

FORM 28 FEB 87 VS

TO 1F-4E-34-1-1

AIRCREW WEAPONS DELIVERY MANUAL (NONNUCLEAR)

USAF SERIES F-4E AIRCRAFT

McDonnell Aircraft
NOw(A)63-0032-I
F42600-86-D-4360

DISTRIBUTION STATEMENT: Distribute Authorized to US Government Agencies And Their Contractors. Administrative Or Operations Use. 15 December 1986. Other Requests For This Document Shall Be Referred to Ogden ALC/MEDT, Hill AFB, UT 84056-5609.

HANDLING AND DESTRUCTION NOTICE: Follow Procedures In Chapter IV of DOD 5400.7-R, DOD Freedom Of Information Act Program.

This manual is incomplete without TO 1F-4E-34-1-1-1, TO 1F-4C-34-1-1-2 and is augmented by TO 1F-4C-34-1-2 and TO 1F-4C-34-1-2-1.

This manual supersedes TO 1F-4E-34-1-1S-25.

Commanders are responsible for bringing this manual to the attention of all affected personnel.

Published under authority of the Secretary of the Air Force.

4E-34 1-1-12661

AIR FORCE 13 FEB 87-3200

B 15 APRIL 1979
CHANGE 20 - 15 DECEMBER 1986

CURRENT FLIGHT CREW CHECKLIST

TO 1F-4E-34-1-1CL-1

15 December 1986

Change 18

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line in the outer margin of the page.

Dates of issue for original and changed pages:

Original.....0..... 15 Apr 79	Change.....6..... 1 May 81	Change.....11..... 15 Oct 82	Change.....16..... 15 Jan 84
Change.....1..... 1 Sep 79	Change.....7..... 1 Jul 81	Change.....12..... 1 Feb 83	Change.....17..... 15 Sep 84
Change.....2..... 15 Nov 79	Change.....8..... 15 Sep 81	Change.....13..... 15 Mar 83	Change.....18..... 15 Apr 85
Change.....3..... 1 Mar 80	Change.....9..... 15 Apr 82	Change.....14..... 15 Jun 83	Change.....19..... 15 Dec 85
Change.....4..... 15 Oct 80	Change.....10..... 15 Jul 82	Change.....15..... 15 Sep 83	Change.....20..... 15 Dec 86
Change.....5..... 1 Feb 81			

Total number of pages in this publication is 312 consisting of the following:

Page No.	#Change No.	Page No.	#Change No.	Page No.	#Change No.	Page No.	#Change No.
Title.....	20	1-22.....	0	1-51.....	17	1-80.....	19
A.....	20	1-23.....	9	1-52.....	0	1-81.....	20
B.....	20	1-24.....	0	1-53.....	0	1-82.....	20
C.....	20	1-25.....	0	1-54.....	17	1-83.....	20
i.....	4	1-26.....	17	1-55.....	0	1-84.....	19
ii.....	20	1-27.....	0	1-56.....	0	1-84A.....	19
iii.....	4	1-28.....	3	1-57.....	0	1-84B blank.....	19
iv.....	6	1-29.....	0	1-58.....	0	1-85.....	17
v.....	17	1-30.....	0	1-59.....	17	1-86.....	20
vi.....	17	1-31.....	19	1-60.....	19	1-86A.....	19
vii.....	17	1-32.....	17	1-60A deleted.....	9	1-86B.....	9
viii blank.....	0	1-33.....	3	1-60B deleted.....	9	1-86C.....	19
1-1.....	18	1-34.....	19	1-61.....	19	1-86D.....	4
1-2.....	19	1-34A.....	19	1-62.....	19	1-86E.....	7
1-3.....	17	1-34B blank.....	17	1-62A.....	19	1-86F.....	17
1-4 blank.....	4	1-35.....	19	1-62B blank.....	19	1-86G.....	17
1-5.....	17	1-36.....	17	1-63.....	17	1-86H.....	4
1-6.....	17	1-37.....	19	1-64.....	17	1-86J.....	19
1-7.....	0	1-38.....	19	1-65.....	19	1-86K blank.....	4
1-8.....	0	1-39.....	19	1-66.....	19	1-87.....	4
1-9.....	0	1-40.....	19	1-66A.....	19	1-88.....	17
1-10.....	20	1-41.....	17	1-66B blank.....	19	1-89 blank.....	0
1-11.....	17	1-42.....	17	1-67.....	19	1-90.....	17
1-12.....	19	1-43.....	17	1-68.....	3	1-91.....	17
1-12A.....	17	1-44.....	20	1-69.....	3	1-92.....	0
1-12B blank.....	3	1-45.....	19	1-70.....	19	1-93.....	17
1-13.....	17	1-46.....	19	1-71.....	19	1-94.....	17
1-14.....	6	1-47.....	20	1-72.....	19	1-95.....	17
1-15.....	0	1-48.....	9	1-73.....	17	1-96.....	17
1-16.....	6	1-49.....	20	1-74.....	19	1-97.....	0
1-17.....	0	1-50.....	17	1-75.....	3	1-98.....	17
1-18.....	0	1-50A.....	9	1-76.....	19	1-99.....	17
1-19.....	17	1-50B.....	17	1-77.....	17	1-100.....	17
1-20.....	0	1-50C.....	17	1-78.....	17	1-101.....	6
1-21.....	0	1-50D.....	3	1-79.....	19	1-102.....	17

#Zero in this column indicates an original page.

Page No.	#Change No.	Page No.	#Change No.	Page No.	#Change No.	Page No.	#Change No.
1-103.....	6	1-157.....	19	1-217 deleted.....	4	1-279 deleted.....	4
1-104.....	17	1-158.....	0	1-218 deleted.....	4	1-280 deleted.....	4
1-105.....	17	1-159.....	9	1-219 deleted.....	4	1-281 deleted.....	4
1-106.....	19	1-160.....	9	1-220 deleted.....	4	1-282 deleted.....	4
1-107.....	17	1-161.....	9	1-221 deleted.....	4	1-283 deleted.....	4
1-108.....	17	1-162.....	0	1-222 deleted.....	4	1-284 deleted.....	4
1-109 deleted.....	17	1-163.....	0	1-223 deleted.....	4	1-285 deleted.....	4
1-110 deleted.....	17	1-164.....	0	1-224 deleted.....	4	1-286 deleted.....	4
1-111 deleted.....	17	1-165.....	18	1-225 deleted.....	4	1-287 deleted.....	4
1-112 deleted.....	17	1-166.....	18	1-226 deleted.....	4	1-288 deleted.....	4
1-113 deleted.....	17	1-167.....	17	1-227 deleted.....	4	1-289 deleted.....	4
1-114 deleted.....	17	1-168.....	2	1-228 deleted.....	4	1-290 deleted.....	4
1-115 blank.....	17	1-169.....	0	1-229 deleted.....	4	1-291 deleted.....	4
1-116.....	17	1-170.....	0	1-230 deleted.....	4	1-292 deleted.....	4
1-117.....	4	1-171.....	10	1-231 deleted.....	4	1-293 deleted.....	4
1-118.....	4	1-172.....	0	1-232 deleted.....	4	1-294 deleted.....	4
1-119.....	7	1-173.....	17	1-233 deleted.....	4	1-295 deleted.....	4
1-120.....	4	1-174.....	17	1-234 deleted.....	4	1-296 deleted.....	4
1-121.....	4	1-174A.....	19	1-235 deleted.....	4	1-297 deleted.....	4
1-122.....	4	1-174B.....	17	1-236 deleted.....	4	1-298 deleted.....	4
1-123.....	9	1-175.....	4	1-237 deleted.....	4	1-299 deleted.....	4
1-124.....	17	1-176 blank.....	4	1-238 deleted.....	4	1-300 deleted.....	4
1-125 deleted.....	9	1-177 deleted.....	4	1-239 deleted.....	4	1-301 deleted.....	4
1-126 deleted.....	9	1-178 deleted.....	4	1-240 deleted.....	4	1-302 deleted.....	4
1-127.....	0	1-179 deleted.....	4	1-241 deleted.....	4	1-303 deleted.....	4
1-128.....	17	1-180 deleted.....	4	1-242 deleted.....	4	1-304 deleted.....	4
1-129.....	0	1-181 deleted.....	4	1-243 deleted.....	4	1-305 deleted.....	4
1-130.....	4	1-182 deleted.....	4	1-244 deleted.....	4	1-306 deleted.....	4
1-130A.....	4	1-183 deleted.....	4	1-245 deleted.....	4	1-307 deleted.....	4
1-130B blank.....	4	1-184 deleted.....	4	1-246 deleted.....	4	1-308 deleted.....	4
1-131.....	0	1-185 deleted.....	4	1-247 deleted.....	4	1-309 deleted.....	4
1-132.....	0	1-186 deleted.....	4	1-248 deleted.....	4	1-310 deleted.....	4
1-133.....	4	1-187 deleted.....	4	1-249 deleted.....	4	1-311 deleted.....	4
1-134.....	0	1-188 deleted.....	4	1-250 deleted.....	4	1-312 deleted.....	4
1-135.....	0	1-189 deleted.....	4	1-251 deleted.....	4	1-313 deleted.....	4
1-136.....	0	1-190 deleted.....	4	1-252 deleted.....	4	1-314 deleted.....	4
1-137.....	0	1-191 deleted.....	4	1-253 deleted.....	4	1-315 deleted.....	4
1-138.....	17	1-192 deleted.....	4	1-254 deleted.....	4	1-316 deleted.....	4
1-139 deleted.....	17	1-193 deleted.....	3	1-255 deleted.....	4	1-317 deleted.....	4
1-140 deleted.....	17	1-194 deleted.....	3	1-256 deleted.....	4	1-318 deleted.....	4
1-140A.....	18	1-195 deleted.....	4	1-257 deleted.....	4	1-319 deleted.....	4
1-140B blank.....	3	1-196 deleted.....	4	1-258 deleted.....	4	1-320 deleted.....	4
1-141.....	9	1-197 deleted.....	4	1-259 deleted.....	4	1-321 deleted.....	4
1-142.....	18	1-198 deleted.....	4	1-260 deleted.....	4	1-322 deleted.....	4
1-143.....	3	1-199 deleted.....	4	1-261 deleted.....	4	1-323 deleted.....	4
1-144.....	17	1-200 deleted.....	4	1-262 deleted.....	4	1-324 deleted.....	4
1-145.....	17	1-201 deleted.....	4	1-263 deleted.....	4	1-325 deleted.....	4
1-146.....	18	1-202 deleted.....	4	1-264 deleted.....	4	1-326 deleted.....	4
1-146A.....	18	1-203 deleted.....	4	1-265 deleted.....	4	1-327 deleted.....	4
1-146B blank.....	18	1-204 deleted.....	4	1-266 deleted.....	4	1-328 deleted.....	4
1-147.....	18	1-205 deleted.....	4	1-267 deleted.....	4	1-329 deleted.....	4
1-148.....	0	1-206 deleted.....	4	1-268 deleted.....	4	1-330 deleted.....	4
1-149.....	9	1-207 deleted.....	4	1-269 deleted.....	4	1-331 deleted.....	4
1-150.....	0	1-208 deleted.....	4	1-270 deleted.....	4	1-332 deleted.....	4
1-151.....	4	1-209 deleted.....	4	1-271 deleted.....	4	1-333 deleted.....	4
1-152.....	14	1-210 deleted.....	4	1-272 deleted.....	4	1-334 deleted.....	4
1-152A.....	14	1-211 deleted.....	4	1-273 deleted.....	4	1-335 deleted.....	4
1-152B.....	17	1-212 deleted.....	4	1-274 deleted.....	4	1-336 deleted.....	4
1-153.....	14	1-213 deleted.....	4	1-275 deleted.....	4	1-337 deleted.....	4
1-154.....	19	1-214 deleted.....	4	1-276 deleted.....	4	1-338 deleted.....	4
1-155 blank.....	19	1-215 deleted.....	4	1-277 deleted.....	4	1-339 deleted.....	4
1-156.....	19	1-216 deleted.....	4	1-278 deleted.....	4	1-340 deleted.....	4

#Zero in this column indicates an original page.

TO 1F-4E-34-1-1

Page No.	#Change No.	Page No.	#Change No.	Page No.	#Change No.	Page No.	#Change No.
1-341 deleted	4	2-27	20	2-79 deleted	9	5-1 deleted	4
1-342 deleted	4	2-28	20	2-80	17	5-2 deleted	4
1-343 deleted	4	2-29	17	2-81	17	5-3 deleted	4
1-344 deleted	4	2-30	17	2-82	17	5-4 deleted	4
1-345 deleted	4	2-31	9	2-83	18	5-5 deleted	4
1-346 deleted	4	2-32	17	2-84	18	5-6 deleted	4
1-347 deleted	4	2-33	19	2-85	18	5-7 deleted	4
1-348 deleted	4	2-34	19	2-86	18	5-8 deleted	4
1-349 deleted	4	2-35	20	2-86A	18	5-9 deleted	4
1-350 deleted	4	2-36	13	2-86B	18	5-10 deleted	4
1-351 deleted	4	2-36A	13	2-87	17	5-11 deleted	4
1-352 deleted	4	2-36B	19	2-88	17	5-12 deleted	4
1-353 deleted	4	2-37 deleted	17	2-89	6	5-13 deleted	4
1-354 deleted	4	2-38 deleted	17	2-90	0	5-14 deleted	4
1-355 deleted	4	2-39 deleted	17	2-91	0	5-15 deleted	4
1-356 deleted	4	2-40 deleted	17	2-92	0	5-16 deleted	4
1-357 deleted	4	2-41 deleted	17	2-93	0	5-17 deleted	4
1-358 deleted	4	2-42 deleted	17	2-94	0	5-18 deleted	4
1-359 deleted	4	2-43 deleted	17	2-95	0	5-19 deleted	4
1-360 deleted	4	2-44 deleted	17	2-96	0	5-20 deleted	4
1-361 deleted	4	2-45 deleted	17	2-97	0	5-21 deleted	4
1-362 deleted	4	2-46 deleted	17	2-98	9	5-22 deleted	4
1-363 deleted	4	2-46A deleted	9	2-98A	9	5-23 deleted	4
1-364 deleted	4	2-46B deleted	9	2-98B	9	5-24 deleted	4
1-365 deleted	4	2-47 deleted	17	2-99	0	5-25 deleted	4
1-366 deleted	4	2-48 deleted	17	2-100	0	5-26 deleted	4
1-367 deleted	4	2-49 deleted	17	2-101	0	5-27 deleted	4
1-368 deleted	4	2-50 deleted	17	2-102	9	5-28 deleted	4
1-369 deleted	4	2-51 blank	17	2-102A	9	5-29 deleted	4
1-370 deleted	4	2-52	17	2-102B	9	5-30 deleted	4
1-371 deleted	4	2-52A deleted	17	2-103	9	6-1	4
1-372 deleted	4	2-52B deleted	17	2-104	9	6-2 blank	4
1-373 deleted	4	2-53	20	2-105	20	Glossary 1	17
1-374 deleted	4	2-54	19	2-106	20	Glossary 2	9
1-375 deleted	4	2-55	20	2-106A deleted	12	Glossary 3	3
1-376 deleted	4	2-56	20	2-106B deleted	12	Glossary 4	3
2-1	20	2-57	19	2-107	12	Index 1	20
2-2	17	2-58	19	2-108	20	Index 2	20
2-3	19	2-58A	19	2-109	20	Index 3	20
2-4 blank	17	2-58B blank	19	2-110 blank	20	Index 4 blank	20
2-5 deleted	17	2-59	20	3-1	19		
2-6 deleted	17	2-60	20	3-2 blank	19		
2-7 deleted	17	2-61	20	3-3 deleted	19		
2-8 deleted	17	2-62	17	3-4 deleted	19		
2-9 deleted	17	2-63	17	3-5	12		
2-10 deleted	17	2-64	17	3-6 blank	12		
2-11 deleted	17	2-65	17	3-7 deleted	12		
2-12 deleted	17	2-66	19	3-8 deleted	12		
2-13 deleted	17	2-67	17	4-1 deleted	4		
2-14 deleted	17	2-68 blank	17	4-2 deleted	4		
2-15 deleted	17	2-69 deleted	17	4-3 deleted	4		
2-16 deleted	17	2-70 deleted	17	4-4 deleted	4		
2-17 deleted	17	2-71	17	4-5 deleted	4		
2-18 deleted	17	2-72	17	4-6 deleted	4		
2-19	20	2-73	20	4-7 deleted	4		
2-20	19	2-74	20	4-8 deleted	4		
2-21	19	2-74A deleted	9	4-9 deleted	4		
2-22	20	2-74B deleted	9	4-10 deleted	4		
2-23	19	2-75	20	4-11 deleted	4		
2-24	17	2-76 deleted	9	4-12 deleted	4		
2-25	17	2-77 deleted	9	4-13 deleted	4		
2-26	20	2-78 deleted	9	4-14 deleted	4		

#Zero in this column indicates an original page.

C Change 20

TABLE OF CONTENTS

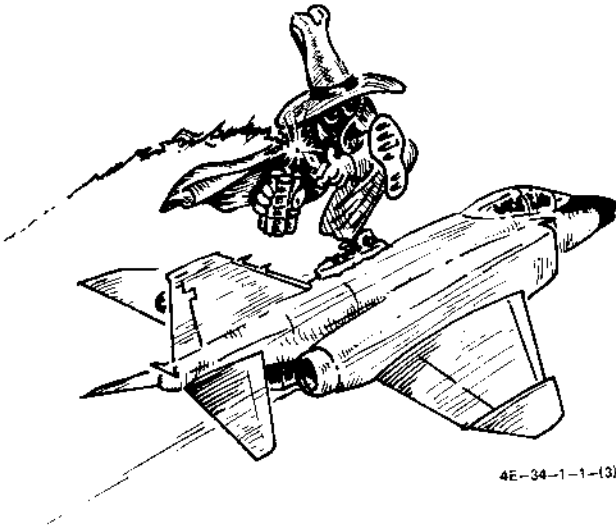
SECTION-I DESCRIPTION	1-1
SECTION-II NORMAL AIRCREW PROCEDURES	2-1
SECTION-III EMERGENCY AIRCREW PROCEDURES	3-1
SECTION-IV SUPPLEMENTARY DATA	*
SECTION-V PLANNING PROCEDURES & SAMPLE PROBLEMS	*
SECTION-VI PLANNING CHARTS & TABLES	*
* Refer to TO 1F-4C-34-1-2	
GLOSSARY	GLOSSARY-1
ALPHABETICAL INDEX	INDEX-1

SAFETY/OPERATIONAL SUPPLEMENT SUMMARY

The following list contains: the previously cancelled or incorporated Safety/Operational Supplements; the outstanding Safety/Operational Supplements, if any; and the Safety/Operational Supplements incorporated in this issue. In addition, space is provided to list those Safety/Operational Supplements received since the latest issue.

NUMBER	SUBJECT OR DISPOSITION
TO 1F-4E-34-1-1S-1 thru 24	Previously cancelled or incorporated.
TO 1F-4E-34-1-1S-25	Tuning Drive Unit Modification, incorporated this issue.

INTRODUCTION



4E-34-1-1-13

SCOPE

This manual contains data to plan and execute an air-to-ground or air-to-air combat attack and/or training mission in the F-4E aircraft employing the nonnuclear weapons. Weapon delivery tactics are not intended or implied in the description of a particular delivery mode or maneuver. For Tactical Fighter Weapons Employment procedures and tactics, refer to TAC/PACAF/USAFE/AAC Manual 3-1 (Secret Noforn).

The following manuals supplement or augment this manual to establish the entire series.

CONFIDENTIAL SUPPLEMENT, TO 1F-4E-34-1-1-1

This manual contains confidential descriptive and procedural data pertaining to the weapon systems and munitions equipment. Some unclassified data remains in the manual to maintain descriptive continuity.

SECRET SUPPLEMENT, TO 1F-4C-34-1-1-2

This manual contains secret data pertaining to aircraft systems and equipment. Some unclassified and confidential data remains in the manual to maintain descriptive continuity.

UNCLASSIFIED SUPPLEMENT, TO 1F-4E-34-1-1-2

This manual contains unclassified data for the AN/ARN-101 Digital Modular Avionics System (DMAS)

and the AN/AVQ-26 Pave Tack Pod. An unclassified checklist, TO 1F-4E-34-1-1-2CL-1 contains the aircrew procedures for DMAS operation.

CHECKLIST, TO 1F-4E-34-1-1CL-1

The unclassified checklist contains abbreviated versions of all aircrew procedures written in these manuals. The checklist contains the numbered and lettered normal procedures and jettison procedures contained in this manual and the classified supplements. Classified terms and data are omitted from the checklist. A complete and separate checklist is provided for each nonnuclear weapon and each item of practice equipment. The format permits the aircrew to reduce the volume of the checklist by removing the portions that apply to the weapons or equipment not associated with the mission being flown or crew duty.

BALLISTICS, TO 1F-4C-34-1-2

This manual contains the following information associated with the F-4C, F-4D, F-4E, and F-4G aircraft:

- a. Weapon and fuze description.
- b. Safe escape and fuze setting data.
- c. Weapon preflight.
- d. Mission planning procedures and sample problems.
- e. Weapon ballistic tables.

CONFIDENTIAL SUPPLEMENT, TO 1F-4C-34-1-2-1

This manual contains the following classified information associated with the F-4C, F-4D, F-4E, and F-4G aircraft:

- a. Weapon and fuze description.
- b. Safe escape and fuze setting data.
- c. Weapon preflight.
- d. Mission planning procedures and sample problems.
- e. Weapon ballistic tables.

ARRANGEMENT, TO 1F-4E-34-1-1

SECTION I, DESCRIPTION. Part 1 of this section contains a description of the air-to-air and air-to-ground weapon systems, the cockpit panels and controls, and the various delivery modes obtainable using these systems. Information previously contained in Part 2 is now contained in TO 1F-4C-34-1-2.

SECTION II, NORMAL AIRCREW PROCEDURES. This section contains the normal aircrew procedures employed in dive bombing, rocket launch, strafing, loft bombing, and

practice bombing using the munitions and systems described in section I.

SECTION III, EMERGENCY AIRCREW PROCEDURES. This section contains the emergency release procedures, the jettison procedures, and the fire fighting and evacuation data. Emergency procedures are identified by black diagonal stripes on three sides of each page.

SECTION IV, SUPPLEMENTARY DATA. All data previously contained in this section is now contained in TO 1F-4C-34-1-2.

SECTION V, PLANNING PROCEDURES AND SAMPLE PROBLEMS. All data previously contained in this section is now contained in TO 1F-4C-34-1-2.

SECTION VI, PLANNING CHARTS AND TABLES. All data previously contained in this section is now contained in TO 1F-4C-34-1-2.

EXTERNAL STORES LIMITATIONS

The Flight Manual, TO 1F-4E-1, provides the limitations associated with carrying, releasing, and jettisoning of the non-nuclear weapons. Only the external stores listed in the Flight Manual can be carried and released.

NOTE

Classified External Store Limitations are located in section IV of TO 1F-4C-34-1-2-1. The load configuration of a store having classified limits is normally unclassified and repeated in the Flight Manual.

RECORD OF TIME COMPLIANCE TECHNICAL DIRECTIVES

The alphanumeric listing provided in subsequent pages contains all current technical directives that have been incorporated in any of these manuals. The directives are repeated in a comparable list in supplement manuals where the data is actually described. When a directive is rescinded, the TO number will be deleted from this table and any reference to the number is deleted from the text.

YOUR RESPONSIBILITY - LET US KNOW

Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. In this regard,

it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual Program are welcomed. These should be forwarded through your Command Headquarters on AF Form 847 in accordance with AFR 60-9, to Headquarters Ogden ALC, Hill Air Force Base, Utah 84056, Attention: MMSRW.

AUTHORIZATION FOR LOCAL REPRODUCTION

Local reproduction of all charts, tables, forms, and any data based on the content of this manual, the classified supplements, and the checklist is authorized.

CHANGE SYMBOL

The change symbol, as illustrated by the black line in the outer margin of this paragraph, indicates significant changes made to the current change or revision.

PUBLICATION DATE

The publication date that appears on the title page represents the currency of the data contained in the manual. When reference to this manual is made, the publication date (which includes the date of the latest change) should be used. The publication date is not the printing or distribution date.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to Warnings, Cautions and Notes found throughout the manual.

WARNING

An operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which, if not strictly observed, could result in damage or destruction to equipment.

NOTE

An operating procedure, condition, etc., which, is essential to highlight.

TECHNICAL ORDER SUMMARY

The Technical Order Summary lists only those technical orders which affect this manual.

Technical Order	ECP	Title	Production Effectivity	Retrofit Effectivity
1F-4E-639C	Mod 2916	Adds AVTR to Pave Spike Aircraft	None	Block 35 thru 45 (Selected aircraft)
1F-4E-643	-	Installs control lens indicator in ARN-101 aircraft	None	Block 48 (71-237) thru 62
1F-4-1245	-	Modifies AVTR	None	Block 35 thru 45 (Selected Aircraft)
1F-4-1424	-	Deactivates AIM-7 pseudo doppler signal	None	Block 31 thru 62
1F-4E-660	Mod 2999	Adds GBU-15 Data Link Control Panel to ARN-101 aircraft	None	Block 48 (71-237) thru 62

BLOCK NUMBERS

AIRCRAFT	BLOCK NUMBER	AIR FORCE SERIAL NUMBER
F-4E (DVST)	-31	66-284 thru 66-297
	-32	66-298 thru 66-338
	-33	66-339 thru 66-382 and 67-208 thru 67-219
	-34	67-220 thru 67-282
	-35	67-283 thru 67-341
F-4E (DSCG)	-36	67-342 thru 67-398
	-37	68-303 thru 68-365
	-38	68-366 thru 68-409
	-39	68-410 thru 68-451
	-40	68-452 thru 68-494
	-41	68-495 thru 68-538
	-42	69-244 69-249 69-256 thru 69-257 69-260 69-262 69-264 69-266 69-268 69-276 69-278 69-282 thru 69-283 69-287 thru 69-291 69-294 thru 69-296 69-298 thru 69-303
	-43	69-305 69-307 69-7203 69-7205 69-7213 69-7221 thru 69-7222 69-7224 thru 69-7227 69-7229 thru 69-7230 69-7237 thru 69-7250 69-7252 69-7255 69-7259
	-44	69-7261 69-7264 thru 69-7269 69-7271 69-7273 69-7292 69-7294 69-7296 thru 69-7297 69-7299 69-7547 thru 69-7549 69-7551 thru 69-7555 69-7557 69-7559

BLOCK NUMBERS (Continued)

AIRCRAFT	BLOCK NUMBER	AIR FORCE SERIAL NUMBER
F-4E (DMAS)	-45	69-7562 thru 69-7565 69-7567 thru 69-7570 69-7573 69-7575 thru 69-7578 69-7584 thru 69-7585 69-7589
	-48	71-224 thru 71-236 71-237 thru 71-247
	-49	71-1070 thru 71-1093
	-50	71-1391 thru 71-1402 and 72-121 thru 72-138
	-51	72-139 thru 72-159
	-52	72-160 thru 72-165
	-53	72-166 thru 72-168 and 72-1407
	-54	72-1476 thru 72-1489
	-55	72-1490 thru 72-1497
	-56	72-1498 thru 72-1499
	-57	73-1157 thru 73-1164
	-58	73-1165 thru 73-1184
	-59	73-1185 thru 73-1204
	-60	74-0643 thru 74-0666 and 74-1038 thru 74-1049
-61	74-1050 thru 74-1061 and 74-1620 thru 74-1637	
-62	74-1638 thru 74-1653	

)

)

)

.

.

)

)

)

)

)

)

SECTION I

DESCRIPTION

TABLE OF CONTENTS

MULTIPLE WEAPONS SYSTEM	
Multiple Weapons Controls	1-2
Aircraft Weapons Release Unit (AWRU) ..	1-7
Stick Grip Controls	1-12A
Throttle Controls	1-12
WEAPONS RELEASE COMPUTER SET (WRCS)	
Computer Control Panel	1-14
Ballistic Computer	1-16
Cursor Control Panel	1-17
Steering Instruments and Indicators (WRCS)	1-17
Weapon Delivery Panel (LABS/Tgt Find Controls)	1-19
ATTITUDE REFERENCE AND BOMBING COMPUTER SET (ARBCS)	
Attitude Director Indicator	1-21
Flight Director Bombing Computer	1-22
Bomb Release Angle Computer	1-22
Bombing Timers	1-22
ARBCS Indicators	1-23
LEAD COMPUTING OPTICAL SIGHT	
Optical Sight Controls	1-23
Reticule Image	1-23
NOSE GUN SYSTEM	
Nose Gun System, M61A1	1-28
Nose Gun Controls	1-30
FIRE CONTROL SYSTEM, RADAR SET	
Radar Set Configurations	1-31
Mission	1-31
FCS Controls and Indicators	1-32
Radar Pulse System	1-50D
CW Transmission	1-50D
Standby Operation	1-51
Transmitting	1-51
Antenna System	1-54
Receiving	1-59
Display System	1-60
Radar Operating Characteristics	1-66
Radar Ground Operation with Engines Operating	1-66
Radar Operation (Air-to-Air)	1-66A
Computer Functions	1-79
Radar Operation (Air-to-Ground)	1-86C
Radar Operation (Beacon Mode)	1-86G
Radar Operation (Visident Mode)	1-86J
TV Display	1-86J

LASER TARGET DESIGNATOR (PAVE SPIKE)AN/ASQ-153(V)-3	
TDS Mission	1-87
Target Designator Pod, AN/AVQ-23A/B..	1-92
TDS Controls and Indicators	1-92
TDS Associated Controls	1-99
WRCS/TDS Integrated Modes	1-100

AN/ALE-40 COUNTERMEASURES EQUIPMENT	
AN/ALE-40 Dispenser Set	1-104
AN/ALE-40 Dispensers	1-105

RADAR WARNING RECEIVER (AN/APR-36 and 37)	
Refer to TO 1F-4E-34-1-1-1	

RADAR WARNING RECEIVER (AN/ALR-46)	
Refer to TO 1F-4E-34-1-1-1	

INTERROGATOR SET, AN/APX-80A	
Refer to TO 1F-4C-34-1-1-2	

RADAR WARNING RECEIVER, AN/ALR-46(V)-3	
Refer to TO 1F-4E-34-1-1-1	

ELECTRONIC COUNTERMEASURES RADAR APPLICATIONS	
Refer to TO 1F-4C-34-1-1-2	

DELIVERY METHODS, AIR-TO-GROUND WEAPONS	
Dive Delivery Considerations	1-116
Dive Toss Delivery	1-119
Dive Laydown	1-122
Level Delivery Considerations	1-122
Laydown Delivery	1-124
Offset Bomb Delivery	1-128
Target Find Mode	1-130A
Loft Bombing	1-133
WRCS/LABS Delivery	1-136
AGM-65 Delivery	1-140A
AGM-45 Delivery	1-147

DELIVERY METHODS, AIR-TO-AIR WEAPONS	
Air-to-Air Gunnery	1-152

Air-to-Air Missiles 1-154

WEAPON SUSPENSION EQUIPMENT

Centerline Station 1-157

Armament Pylons 1-158

Multiple Ejector Rack (MER) 1-164

Triple Ejector Rack (TER) 1-164

Air-To-Ground Missile Launchers 1-165

Air-To-Air Missile Launchers 1-165

Radar Scope Camera System 1-170

Optical Sight Camera, KB-25A 1-173

Airborne Video Tape Recorder 1-174A

TRANSPONDER EQUIPMENT

Radar Transponder SST-181X 1-175

CAMERA SYSTEMS AND RECORDING EQUIPMENT

KB-18A Strike Camera System 1-168

Combat Documentation Motion Picture System 1-170

ELECTRONIC COUNTERMEASURES (ECM) PODS

Refer to TO 1F-4E-34-1-1-1

MULTIPLE WEAPONS SYSTEM

Weapons systems avionics equipment installed in the aircraft provide both the air-to-air and air-to-ground mission capabilities. The air-to-ground systems enable the deployment of several types of high or low drag bomb munitions, guided bombs, rockets, CBU (Cluster Bomb Unit) dispensers, gun pod weapons, nose gun, and various combat support equipment. The pilot may select and use either a manual (DIRECT) delivery method, or select one of several automatic delivery modes provided by computing avionics equipment. The AN/APQ-120 Radar Set provides air-to-ground range data for the primary automatic release modes.

The air-to-air weapons include the nose gun and/or gun pod weapons, AIM-7 radar guided and AIM-9 heat seeking missiles. The radar set provides target range, angles, and rate data for missile launch solutions, and range data for the Lead Computing Optical Sight during gun operations.

The following description considers the cockpit equipment and controls which the aircrew will use for nearly all nonnuclear weapon delivery operations. Controls for specific avionics sets are described later.

MULTIPLE WEAPONS CONTROLS

The forward cockpit weapons controls are located so that most normal and emergency weapon operations are controlled and monitored in a common area. A/G and A/A weapons are selected, armed, monitored, and launched or jettisoned through the multiple weapons controls. These controls are located on the multiple weapons control panel, the throttles, and the control stick.

DELIVERY MODE KNOB

The delivery mode knob (figure 1-1) selects the manual or automatic delivery avionics which the pilot intends to use to deliver armament. The OFF position disables the weapon release system for all munitions except guns, air-to-air missiles, and special weapons. For all other munitions, one of the modes must be selected to get release/launch voltage. The positions on the knob also influence the operating functions of the optical sight described later in this part. The six LABS (Low Altitude Bombing System) positions include the timed or gyro automatic release modes of the AN/AJB-7 Attitude Reference and Bombing Computer Set (ARBCS). The positions on the right side of the control select the Weapons Release Computer Set (WRCS) methods of target navigation and automatic weapon delivery. The DIRECT position selects the manual release mode. The following positions and corresponding systems may be selected on the control.

ARBCS (AN/AJB-7)	WRCS (AN/ASQ-91)	MANUAL
Timed Level	TGT Find (Nav mode only)	Direct
Timed LADD (Low Angle Drogue Delivery)	Dive Toss	
(Timed) O/S (Over-the- Shoulder)	Dive Laydown	
Inst (Instantaneous) O/S	Laydown	
	Offset Bomb	
	AGM-45	
Loft		

WEAPON SELECTOR KNOB

The pilot positions the weapon selector (figure 1-1) for the type of munition aboard. The BOMBS and RKTS & DISP positions select those munitions respectively and apply operate power to the Aircraft Weapons Release Unit (AWRU). These are the only positions that operate the AWRU. The ARM position selects Anti-Radiation Missile and is applicable to the AGM-45 missile. The TV position is selected for the EO guided weapons. The AGM-12 position is not used.

NOTE

- The ARM and TV positions control the trigger circuits so that guns, radar and heat missiles cannot be fired unless the CAGE signal is present.
- Selecting TV or ARM on the weapon selector knob has no effect on the tuned status of AIM-7 missiles.

The remaining selections on this control are A, B, and C. The C position is open and may be used as an OFF position. Switching into or out of the B position provides the same switching function as pressing the AIR-TO-AIR button in the rear cockpit. Selecting or deselecting B reverses (uncages) the cage signal applied to weapon avionics through the CAGE button on the throttle. The cage and uncage functions are described in later paragraphs. The B position also may be used as an OFF position. The A position applies continuous (nonpulse) voltage to the selected station(s) as long as the bomb button is held. The position may be used for munitions which contain their own intervalometers such as CBUs, rocket packages, or multiple spray containers that are dispensed simultaneously. With A selected, only these munitions can be launched from MER/TER equipment; bomb munitions will not release. With the bomb button signal applied, one dispenser fires completely from each selected station. The bomb button is released and pressed again to fire the next set of dispensers. This is essentially a manual-salvo firing sequence since the mode is comparable to the SALVO mode shown in figure 1-2. The

)

)

)

)

)

)

)

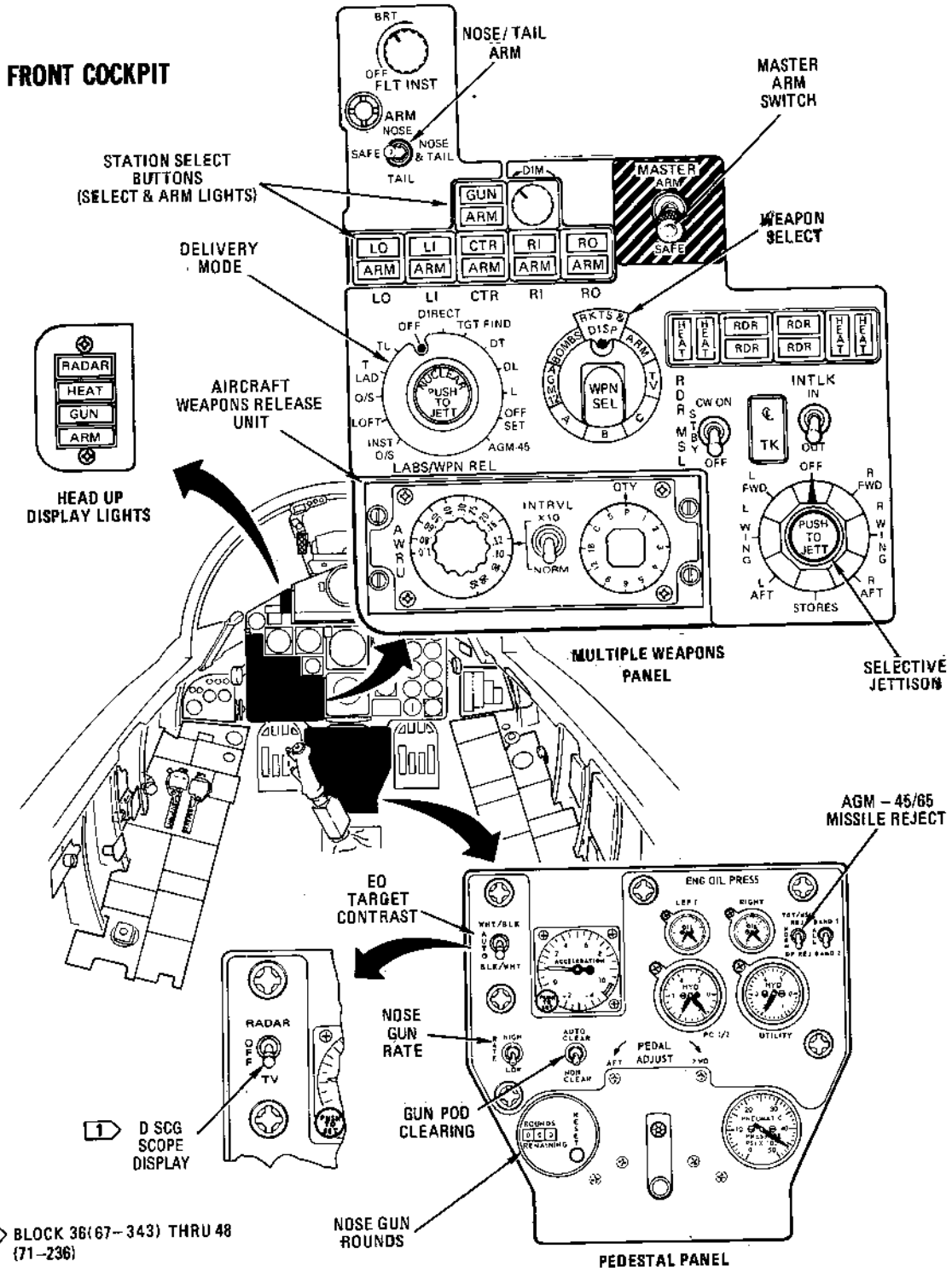
)

)

)

WEAPON SYSTEM CONTROLS & INDICATORS

MULTIPLE WEAPONS AND PEDESTAL PANELS, A/G WEAPONS



1 BLOCK 36(67-343) THRU 48 (71-236)

4E-34-1-1(7)B

Figure 1-1

A method is nonautomatic since the AWRU is bypassed; the MER/TER stepping sequence is accomplished by releasing the bomb button.

STATION SELECT BUTTONS

The required station select buttons (figure 1-1) must be pressed to select and fire/release any air-to-ground conventional weapon. The station select green lights illuminate as soon as the buttons are pressed. The amber ARM lights are fire-ready lights and illuminate to indicate a fire-ready bomb button or trigger circuit. A rheostat knob is provided next to the GUN station button to control the station lights intensity. The station select buttons also provide the selective jettison function for the four wing stations and the CL station (stations 1, 2, 5, 8 and 9). With the STORES method of jettisoning, the required station button(s) must be pressed to jettison any munition (or fuel tank) plus suspension equipment from the corresponding aircraft station. (Refer to Jettison System, this part.)

To obtain the fire-ready (station ARM light ON) indication, the following control conditions must exist.

- a. The delivery mode knob is not in the OFF or TGT FIND position (nose gun station excluded).
- b. The station(s) are selected.
- c. Master arm is in ARM (head-up ARM light ON).
- d. The weapon is selected (on the weapon select knob, or GUNS on the guns/missile switch) and the weapon actually aboard is compatible (in type only) with the weapon selected. For the nose gun, rounds are available and the rounds limiting controls are properly set for gun firing.
- e. The special weapons controls are OFF (See bomb button transfer relay, following paragraphs).
- f. With weapon select in BOMBS, the nose/tail arm switch must be in one of the armed positions to get the station ARM light, and therefore get an armed bomb release. (See nose/tail arm switch.)



In preceding condition (f), an ARM light OFF indication does not mean the release system is SAFE. Bombs will release unarmed if all other controls are set.

The following normal/release conditions deenergize the ARM light.

- a. With BOMBS selected, the amber light goes out when the MER/TER stepper switch has stepped to the OFF position. The amber light illuminates to indicate a hung bomb only after the rehome procedure has been accomplished.
- b. The amber light goes OFF when the armament pylon is empty (contents released or jettisoned).

MASTER ARM SWITCH

The master arm switch (figure 1-1) is a lock-toggle switch with the lock detent in the SAFE position. The switch

performs a true MASTER ARM function for all conventional weapons. The ARM position must be selected to employ guns, heat and radar missiles, and A/G munitions selected through the weapon select knob. Air-to-air missiles or gun (trigger-fired) munitions can be armed for launch simultaneously with BOMBS or RKTS/DISP munitions that are launched through the bomb button. Selecting a TV or ARM weapon, however, will disable trigger-fired A/A weapons.

With ARM selected, the ARM light on the head-up display illuminates (amber). The ARM light illuminates any time the master arm switch is energized, no other control activity is necessary. The head-up ARM light, therefore, is not a fire-ready indicator. It simply announces the position of the master arm switch. If the remaining weapons controls are also energized, then the station ARM light(s) together with the head-up ARM light provide the fire-ready indication.

For air-to-air missiles and the nose gun, the fire-ready indication is provided by the illumination of the head-up ARM light and either the GUN, HEAT, or RADAR lights for those munitions respectively. For the nose gun, the station (amber) ARM light is also ON.

WARNING

If the pullup light comes on under abnormal circumstances, immediately reposition weapon release controls to OFF, SAFE, and NORMAL and cease delivery in that mode to preclude inadvertent weapon release.

NOSE/TAIL ARM SWITCH

This switch (figure 1-1) completes the circuit between the master arm switch and the arming solenoids in the aircraft ejector racks or the MER/TER racks. The energized solenoids retain the arming wire swivel loops and as munitions are ejected, the arming wires are pulled to initiate the fuze arming sequence. In SAFE position, the arming wires are retained by the munition during separation from the aircraft and the associated fuze remains SAFE.

The nose/tail arm switch also provides the selective high/low drag capability for those weapons which may be rigged for either a freefall or retarded drop. In this case, the solenoids are energized to apply the holding force for the lanyards which deploy the retardation device.

WARNING

If this switch is used to select the MK 82 high/low drag release option in flight, the warnings and notes listed for that weapon must be carefully observed.

The switch positions and corresponding solenoids armed are as follows.

Switch Position	Solenoid Armed
SAFE	None
NOSE	Fwd and Ctr
TAIL	Aft
NOSE & TAIL	Fwd, Ctr, and Aft

There is no center solenoid on the MER/TER and BRU-5/A ejector racks.

When a BOMBS mode is selected on the weapons select knob and a MER-10/TER-9 is loaded on the aircraft, the nose/tail arm switch must be in the NOSE or NOSE & TAIL position to apply power through the stores aboard sensing switch to the MER/TER stepper solenoid. Then, with a partial load of bombs aboard, the empty stations are bypassed and the aircraft drops one bomb with each release signal. The TAIL position does not apply this automatic stepping voltage; therefore, an extra release pulse must be delivered to the MER/TER to step through each empty station.

When a RKTS and DISP mode is selected, empty stations are bypassed regardless of the nose/tail arm switch position.

Only loaded MER-10A/TER-9A stations receive a release pulse regardless of nose/tail arm switch or weapon select switch position.

The nose/tail arm switch closes a fuze select-ready relay in the BOMBS/station ARM light circuit. With the weapon selector in BOMBS, the station ARM light will not illuminate unless the nose/tail arm switch is energized. Conversely, the SAFE position of the switch does not inhibit the BOMBS release circuit. Bombs will release (SAFE) if all other release controls are energized and with only the station green light(s) ON. Therefore, the pilot will notice that with BOMBS selected and station green light(s) ON, an ARM-light-OFF indication does not necessarily mean that the bomb button circuit is in a SAFE condition. If the BOMBS position is used to bomb-off rocket or CBU dispensers in a jettison situation, then the nose/tail arm switch should be in one of the (ON) positions to get the proper station ARM light indications (MER/TER stations empty).

AIRCRAFT WEAPONS RELEASE UNIT (AWRU)

The AWRU receives operate power only by the selection of BOMBS or RKTS & DISP on the weapon selector. The control panel contains two INTRVL controls and a quantity (QTY) selector. The interval controls provide the time interval (in seconds) between each weapon release, and therefore determines bomb spread and pattern length. If the INTRVL switch is in NORM, the rotary control provides selectable intervals between 0.05 to 1.0 second. If the INTRVL switch is in X10, the intervals range from 0.5 to 10 seconds.

The AWRU operates in either manual or automatic mode. In manual, the unit develops its output coincident with each pickle signal, and the pickle signal must be interrupted and reapplied to get each subsequent output. In automatic, the unit develops pulsed outputs and the

bomb button must be held pressed to continue the pulse train. The INTRVL setting applies only to the automatic mode and is simply the time duration between the start of a pulse, and the start of the next pulse. The length of time the pulse is ON is 62.5% of the selected NORM interval, and 60% of a X10 interval.

The QTY control selects the singles, pairs, and salvo release sequences, and can be set to yield an exact number of output pulses. The QTY control selections and the sequences obtained may be defined by the following. (Refer to figure 1-2.)

AWRU OPERATION WITH MER/TER

Single-Manual

The QTY position 1 selects a single, AWRU manual release sequence. One weapon is released each time the bomb button is pressed. With multiple stations selected, release occurs in alternate left-right order with the first release signal delivered to the left selected station. Each release signal is retained (ON) until the bomb button is released.

Single-Ripple

The single-ripple sequence is obtained by selecting any one of the QTY numerical positions 2 thru 18. With the release signal held, the total weapons released is equal to the QTY setting; then the release signal is automatically interrupted. The interval between each release pulse is governed by the INTRVL controls. At the completion of the set number of releases, the bomb button may be released then pressed to initiate the sequence again. With multiple stations selected, release is in left-right order. The release signal for the last weapon is retained until the bomb button is released.

Single-Continuous

This mode is the same as single-ripple, except the quantity of weapons released is not automatically limited by the AWRU. With QTY position C selected and the pickle signal held, weapons release in left-right order until the stations empty or the pickle signal is terminated. The time between each weapon is governed by the INTRVL controls.

Pairs-Manual

The QTY position P is selected to get the pairs mode. One set of simultaneous left and right release pulses is generated each time the bomb button signal is applied. Therefore, with any two (or more) stations selected, two weapons are deployed simultaneously with each pickle signal. (With one station selected, the system is in a single-manual mode.)

NORMAL RELEASE SEQUENCE

5 STATIONS LOADED, 5 STATIONS SELECTED. BOMBS OR RKTS/DISP. MUNITIONS

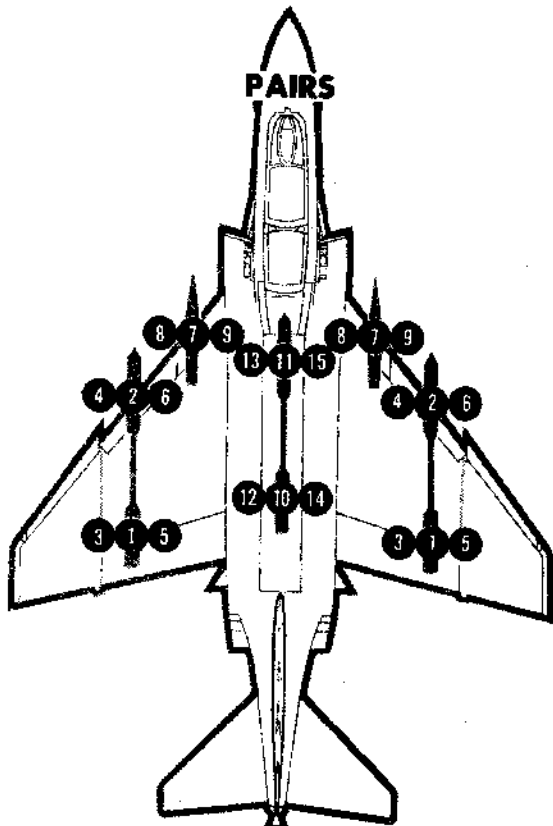
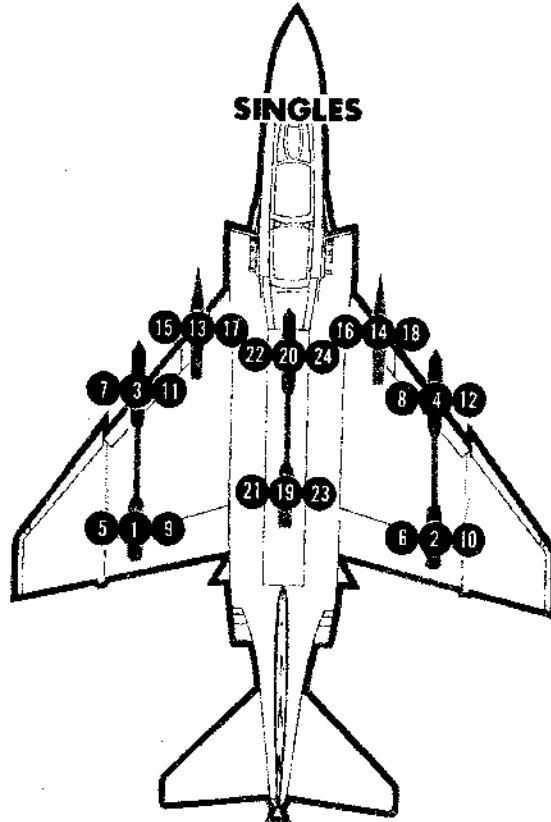
SINGLE-MANUAL (QTY POSITION 1)
ONE WEAPON IS RELEASED WITH EACH BOMB
BUTTON SIGNAL IN ALTERNATE (LEFT/RIGHT)
ORDER.

SINGLE-RIPPLE (QTY POSITION 2 THRU 18)
WITH BOMB BUTTON SIGNAL HELD, WEAPONS
RELEASE ALTERNATELY AT THE SELECTED
RELEASE INTRVL ; THE TOTAL WEAPONS
RELEASED IS EQUAL TO THE QTY SETTING.

SINGLE-CONTINUOUS (QTY POSITION C)
WITH THE BOMB BUTTON SIGNAL HELD, WEAPONS
RELEASE ALTERNATELY AT THE SELECTED RE-
LEASE INTRVL UNTIL THE STATIONS EMPT OR
THE BOMB BUTTON SIGNAL IS TERMINATED.

NOTE

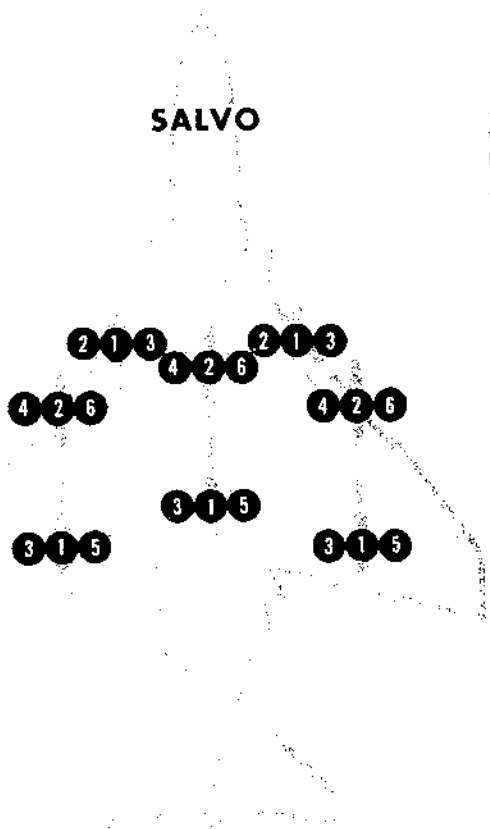
WITH TWO OR MORE STATIONS SELECTED
IN SINGLES MODE, THERE IS NO INDICA-
TION WHICH STATION RECEIVES THE
FIRST RELEASE PULSE, LEFT OR RIGHT.
NORMALLY, THE LEFT STATION
RECEIVES THE FIRST RELEASE PULSE.



PAIRS-MANUAL (QTY POSITION P)
TWO WEAPONS ARE RELEASED SIMULTANEOUSLY
(FROM DIFFERENT STATIONS) EACH TIME THE
BOMB BUTTON IS PRESSED. AT LEAST TWO
(ANY TWO) STATIONS MUST BE SELECTED.

Figure 1-2 (Sheet 1 of 2)

NORMAL RELEASE SEQUENCE (Continued)



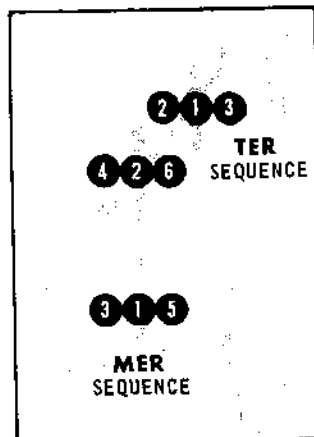
SALVO

SALVO (QTY POSITION S)
 WITH BOMB BUTTON SIGNAL HELD, ONE WEAPON IS RELEASED SIMULTANEOUSLY FROM EACH SELECTED STATION; THE INTERVAL BETWEEN EACH SALVO RELEASE IS EQUAL TO THE INTRVL SETTING

CAUTION

REFER TO T.O. 1F-4E-1 FOR DETAILED INFORMATION CONCERNING THE MINIMUM ALLOWABLE RELEASE INTERVALS THAT MAY BE USED WITH THE AWRU SALVO MODE.

MANUAL-SALVO (WPN SEL POSITION A)
 WITH RKT'S OR DISP ABOARD, ONE WEAPON IS FIRED FROM EACH SELECTED STATION WITH EACH BOMB BUTTON SIGNAL. (THE AWRU IS BYPASSED).



THE MER AND TER RELEASE SEQUENCE ALWAYS REMAINS AS ILLUSTRATED HERE. EMPTY POINTS ARE AUTOMATICALLY STEPPED OVER.

Salvo

The salvo mode is obtained by selecting S on the QTY knob. With the bomb button signal held, continuous release pulses are applied to each selected station. The interval between each release pulse is set by the INTRVL controls. With five stations selected, five weapons salvo followed by another five at the set interval. (With two stations selected, the system is in a pairs-ripple mode.)

AWRU OPERATION WITH MAU-12 (SINGLE CARRIAGE)

When weapons are single-carried on the MAU-12 armament pylons, the aircrew can encounter a situation that would result in a release of more weapons than anticipated.

WARNING

For MAU-12 single carriage, the AWRU release interval and quantity selector should be considered unreliable when more than one station is selected.

To explain the preceding statements, consider the following station transfer differences in aircraft with MER/TER stores aboard, and aircraft with single stores aboard. (Assume that at least two aircraft stations are selected.)

a. With MER/TER carriers, QTY 1 selected: The firing function is transferred to the next station only after termination of the first release pulse by releasing the bomb button.

b. With single carriage, QTY 1 selected: The firing function is transferred to the next station when the bomb-gone switch on the MAU-12 track extends. This may occur before the bomb button signal is released.

When considering item (b), if more than one station is selected, the release function transfers from the first station to a second station by merely releasing the first store. With the bomb button held during transfer, the weapon on the second station releases, even though QTY 1 is selected. The weapons would release at a rate equal to how fast the bomb-gone switch activates. With P (pairs) selected, the same considerations apply except that four weapons would release instead of two (assuming four stations are loaded and selected). If a ripple mode is selected (QTY 2 or more or C) the release interval between bombs cannot be accurately acquired.

The situation can be avoided entirely for the QTY 1 or P (pairs) mode by selecting only that station (or those stations) to be released.

SCOPE DISPLAY SWITCH, DSCG

The display switch (figure 1-1) selects the source of video displayed on the front radar scope; either RADAR, TV (EO

weapon), or OFF. In TISEO aircraft the scope display buttons provide video selection. (Refer to Radar Set.)

TARGET CONTRAST SWITCH

This control is functional in the AGM-65 seeker tracking network. Refer to Delivery Methods, AGM-65 weapons.

MISSILE REJECT SWITCH

This control is functional in both the AGM-45 and AGM-65 missile select circuits (figure 1-1). For the AGM-65, the TGT/MSL REJ (momentary) position is used to deselect the present missile and select the next missile in the launch sequence. The switch is also functional in the AGM-45 missile DF network. (Refer to Delivery Methods, AGM-45 or AGM-65.)

BAND SWITCH

Not used.

GUN RATE SWITCH AND ROUNDS COUNTER

The rate switch and rounds counter (figure 1-1) are functional only in the nose gun weapon system. Refer to nose gun system this section.

GUN CLEAR SWITCH (Gun Pods)

Refer to SUU-16 and -23 gun pods, TO 1F-4C-34-1-2.

AIR-TO-AIR MISSILE CONTROLS

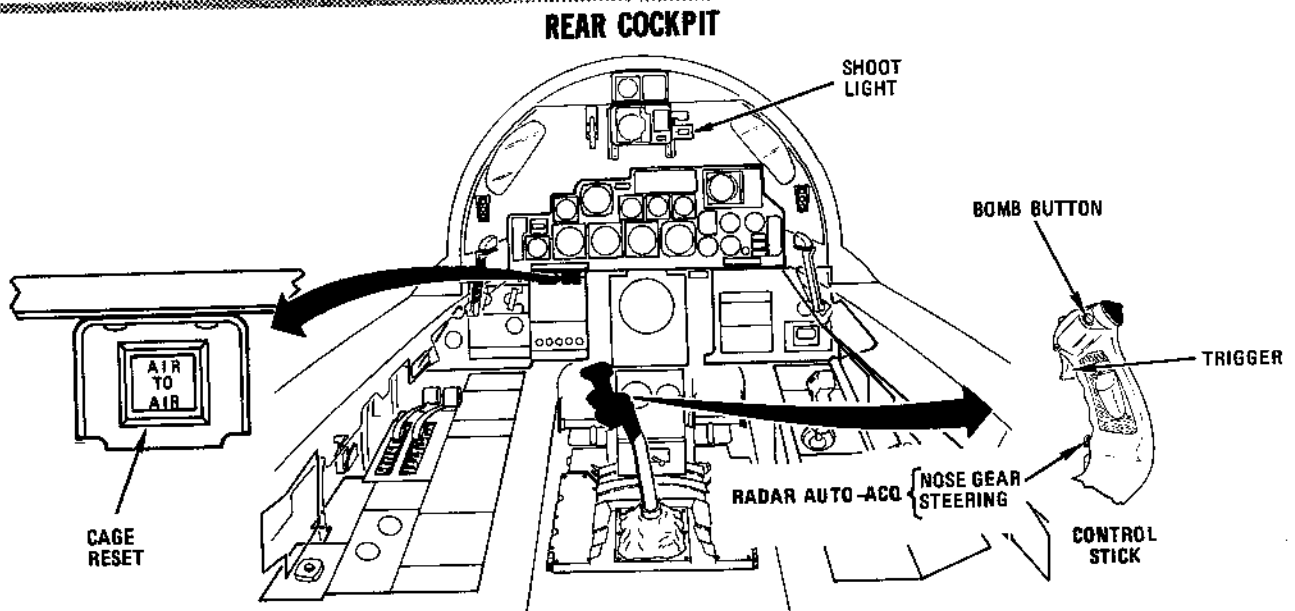
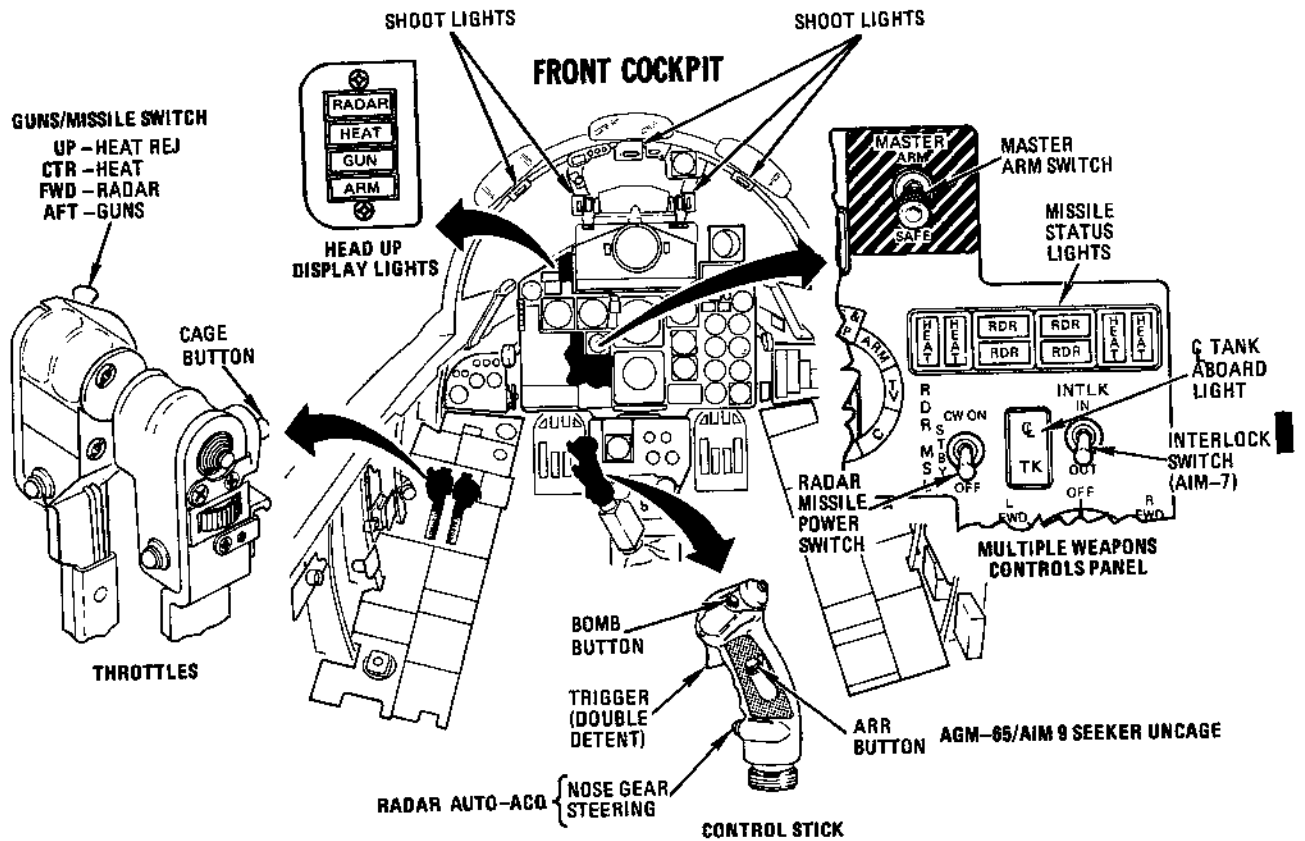
The following multiple weapons controls pertaining to air-to-air missile preparations are shown in figure 1-3. Missile select and launch controls are located on the throttles and control stick.

Radar Missile Power Switch

The missile power switch receives operate power 30 seconds after the radar power knob is positioned out of OFF. The STBY position maintains warmup power on the AIM-7 missile and CW tuning drive unit. The CW ON position energizes the CW transmitter and starts missile tuning. When the missiles tune (RDR status lights ON), the switch may be returned to STBY and the missile tuning motor will hold the position established during tune-up. With CW ON and radar mode knob not in TV, missiles can be tuned and the tuned status continually monitored regardless of the delivery mode or weapon selected. Tuning

WEAPONS SYSTEM CONTROLS & INDICATORS

GUNS & A/A MISSILES, STICK & THROTTLE CONTROLS



4E-34-1-1-19/C

Figure 1-3

operations on the ground should be conducted with the radar power knob in TEST to avoid radiating CW energy in the local area. (Refer to Section II).

Missile Status Lights

These lights (figure 1-3) provide weapon/aircraft electrical integrity and launch status indications. The RDR lights illuminate to show the AIM-7 missile tuned status described in the previous paragraph. If a RDR light does not illuminate, the missile on that station is automatically dropped from the launch circuit. If AIM-7 simulator plugs are installed, RDR lights for loaded stations come ON with the missile power switch in CW ON, simulating tuned missile.

The HEAT lights are AIM-9 station select indicators. With the gear handle in the UP position, a single HEAT light illuminates to indicate which AIM-9 station is selected. The pilot can cycle the guns/missile switch to the heat reject position (figure 1-3) and observe each light illuminate during the station stepping sequence, then return to the first missile to be launched. The tone circuits for each missile may also be checked by this procedure while the master arm switch remains in the SAFE position. (Refer to section II, AIM-9 Missiles.)

Interlock Switch

The INTLK switch controls the selection of AIM-7 missile firing interlocks. With IN selected, the radar missile cannot be launched unless the IN RANGE light is ON; the aim dot is inside the ASE circle; and the radar display knob is not in the VI mode. With OUT selected, the radar missile may be fired any time it is armed; the steering and range interlocks are bypassed and do not inhibit launch. The INTLK switch does not affect AIM-9 missile firing.

Centerline Tank Aboard Light

The CL TK light indicates a launch interlocks exists in the two forward radar missile launch circuits with the following centerline configurations.

Fuel Tank or MER	The CL tank light is ON; forward AIM-7's cannot be launched/jettisoned unless CL equipment is jettisoned.
BRU-5/A with Single Bomb	The CL tank light is ON; however, forward AIM-7's can be launched/jettisoned.
Aero-27/A with Centerline Arming Unit	The CL tank light is ON; forward AIM-7's cannot be launched/jettisoned even after the CL bomb is released/jettisoned.

AIM-7 tuning and status monitoring is not affected by the CL TK interlock.

Shoot/In Range Lights

Five SHOOT lights are located in the front cockpit and one in the rear cockpit (figure 1-3). The lights are clear and contain no legend and in conjunction with the IN RANGE

light, alert the aircrew to missile firing opportunities. The control and test features of these lights are integrated with the flight instrument lights control knob and the warning lights test switch in the front cockpit. When the flight instrument lights control knob is moved from OFF, the SHOOT lights are deactivated and only the IN RANGE light flashes (at reduced intensity) to indicate the target is within missile firing parameters. The flight instrument lights control knob must be OFF to test the SHOOT lights with the warning lights test switch. The SHOOT/IN RANGE lights do not flash when the warning lights test switch is activated.

To avoid on AIM-7 launch in the main beam clutter. The SHOOT lights are inhibited when RADAR is selected, aspect angle is $90^{\circ} \pm 9^{\circ}$, and the elevation angle is lower than 5° above the horizon.

THROTTLE CONTROLS

GUNS/MISSILE SWITCH (PINKY SWITCH)

The guns/missile (pinky switch, figure 1-3) is a four position control which performs the weapon select function for guns, radar and heat missiles, and performs station select functions for the heat missiles. The positions are arranged as follows:

- Forward - Radar missiles
- Center - Heat missiles
- Rear - Guns
- Up - Heat reject (spring loaded)

There is no OFF position on the control. With master arm SAFE, one of the head-up lights illuminate indicating the position of the guns/missile switch, either the HEAT, GUNS, or RADAR light. The pilot can cycle the guns/missile switch through the three positions and watch the three head-up weapon select lights illuminate. (This assumes the landing gear handle is up, or the armament safety override is pressed, and that the weapon selector is not in TV or ARM.) Therefore, when the landing gear handle is raised, one of the lights indicate the guns/missile switch position. If at this point, the master arm switch is placed to ARM (with no further munition preparations) the head-up select light goes OFF and the ARM light comes ON. This indicates that the master ARM signal is present, and that further weapon preparations are necessary. A complete nose gun or missile weapon ready indication is the illumination of both the head-up ARM light and the respective weapon head-up light.

NOTE

The ACM computer computes for the AIM-9N-2/-3/P-2/-3 missiles with HEAT selected and the AIM-7E-3 or AIM-7F (depending on type missile loaded) with RADAR selected.

If gun pods are aboard, the head-up GUN light has no function. Only the head-up ARM light and the station ARM light provide the fire-ready indication.

After OFP P005, the pinky switch will now also control the scan corridor for CAA. When in the rear (GUNS) position the slewable scan will center about 15° azimuth. When in the center (HEAT) position the scan centers about 0° azimuth. When in the forward (RADAR) position the scan centers about 15° right azimuth.

CAGE BUTTON

The basic purpose of the CAGE button (figure 1-3) is to rapidly switch the weapons avionics from an A/G weapon delivery status into an A/A status. When cage is applied, the AIR-TO-AIR light in the rear cockpit comes ON. Depending on the present status of the aircraft, the cage signal effects any or all of the following aircraft systems: the trigger circuit, the optical sight system, and the radar system. The cage signal, as it effects these systems, may be defined as follows:

- a. If the weapon selector knob is in ARM or TV, the cage signal switches the trigger into the launch/fire circuit of whatever munition is selected on the guns/missile switch.
- b. If the sight is being used in an A/G mode, the sight switches into the A/A gun or missile mode depending on the guns/missile switch position. Further operation of the sight (in GUNS mode) depends on whether or not radar lockon exists.
- c. With the radar power knob in any position but OFF or TEST, the cage command switches the radar into BST (transmitter ON) mode, 5-mile range, with auto-acquisition available in each cockpit.
- d. With guns/missile switch in GUNS, pressing the cage button does not break radar lockon. If CAA mode has been selected, pressing the cage button does not terminate CCA mode.

The cage signal does not SAFE the bomb release system for whatever A/G mission was in operation prior to cage. For example, if a TV mission was in progress before cage, the rear cockpit TV display and trigger switch, and both front and rear bomb buttons are still operational in the EO weapon lockon/release network.

Cage Reset

The cage reset capability is available in each cockpit. In the front cockpit, the cage reset signal is applied by momentarily selecting the B position of the weapon select control. In the rear cockpit, the WSO may press the AIR-TO-AIR button (figure 1-3). In either case, the AIR-TO-AIR light goes OFF and the cage reset function returns the aircraft to the mode selected prior to the application of the CAGE signal. If the pilot leaves the WPN SEL in B position, this will not inhibit the radar or LCOSS cage functions, or future cage reset functions of the AIR-TO-AIR button.

STICK GRIP CONTROLS

NOSE GEAR STEERING BUTTON (AUTO ACQUISITION)

The radar auto-acquisition (auto-acq) operation is available on the nose gear steering button in both cockpits. The mode is entered by the cage command. Refer to Computer Automatic Acquisition Mode, this section.

ARR BUTTON (SEEKER UNCAGE)

The air refueling release (ARR) button provides seeker uncage functions for the AIM-9 missile or AGM-65 missile, depending on which munition is in priority. For the AGM-65, the button is held pressed to uncage and enable seeker slew operations, and released to command lockon. For the AIM-9, the button is pressed and held to command seeker uncage and self-track. With both munitions aboard, the button/missile priority can be switched by applying the cage/uncage commands described under Cage Button, this section.

)

)

)

)

)

)

)

)

)

BOMB BUTTON

Bomb button power is supplied through the A/G Weapon Release Control circuit breaker on No. 1 circuit breaker panel. The bomb button (figure 1-3) controls the application of weapon release/launch voltage for all air-to-ground weapons. The sight camera system is also operated through the bomb button.

The bomb button in the rear cockpit will also release armament and operate the cameras. The conditions which must be present to enable the bomb button (station ARM and head-up ARM lights) are described under Station Select Buttons in previous paragraphs. Also, the bomb button transfer relay interlock must be satisfied.

Bomb Button Transfer Relay

The transfer relay performs a switching function in the bomb button circuit. When the relay is energized, the bomb button outputs are applied to the weapons firing and release circuits. The DCU-94/A special weapons controls, however, will take command and deenergize the relay unless any ONE of the following conditions exist.

- a. All DCU-94/A station select switches - AFT
- b. DCU-94/A master release lock switch - AFT
- c. Consent switch -SAFE

TRIGGER

The front cockpit trigger is a two-detent switch. The trigger 1 position operates the optical sight camera without munition expenditure; trigger 2 fires the AIM-7, AIM-9 missile or gun, operates all cameras, and initiates the Snapshot Function for recording fire control parameters. (Refer to Tactical Information Retrieval System (TIRS) for details.) Both the front and rear cockpit trigger will energize AGM-65 weapon video. The rear cockpit trigger, however, will not fire armament nor operate cameras. The following information summarizes the conditions necessary to obtain a launch ready trigger circuit for radar and heat missiles and the nose gun. Trigger voltage is applied through the GUN TRIG circuit breaker on the No. 1 circuit panel.

AIM-7 Trigger Ready

The RADAR missile launch-ready trigger is obtained when the following conditions are satisfied.

- a. The radar power knob must be in the OPR position for optimum success.



The TEST and STBY positions of the radar power knob do not inhibit missile launch. These are not (SAFE) positions in the missile launch circuit when the interlock switch is in the OUT position and all other controls (listed here), are energized.

b. The radar missile (RDR MSL) power switch must be in CW ON.

c. The missile(s) must be tuned (RDR missile status light(s) ON).

d. The interlock (INTLK) switch may be positioned to IN or OUT.

- (1) With IN selected, the computer interlocks (radar range and steering requirements) must be satisfied.

e. The guns/missile switch must be in the radar position.

- (1) Head-up RADAR light - ON

f. The master arm switch must be in ARM.

- Head-up ARM light - ON

NOTE

● The two forward missiles cannot be launched if a MER or fuel tank is aboard the CL station (CL TK light ON). This equipment must be jettisoned to get the forward missiles into the launch circuit.

● (Block 31 thru 40) If the CL TK light is on due to the installation of a centerline arming unit on the Aero 27A bomb rack, the forward missiles cannot be launched or jettisoned, even after release of the single mounted bomb on that station.

For additional radar missile information, refer to Fire Control System, Computer Functions.

AIM-9 Trigger Ready

The HEAT missile launch-ready trigger is obtained as follows.

- a. The guns/missile switch must be in the heat position.
 - (1) Missile status HEAT light - ON (selected station)
 - (2) Head-up HEAT light - ON
- b. The master arm switch must be in ARM.
 - (1) Head-up ARM light - ON

Nose Gun Trigger Ready

The gun trigger-ready condition is obtained as follows.

- a. The guns/missile switch must be in the guns position.
 - (1) Head-up GUN light - ON
- b. The gun station button must be ON.
 - (1) Gun (green) light - ON
- c. The master arm switch must be in ARM.
 - (1) Gun station ARM light - ON
 - (2) Head-up ARM light - ON

WEAPONS RELEASE COMPUTER SET (WRCS)

The WRCS (AN/ASQ-91) provides several delivery modes in support of both the level and dive delivery maneuvers. The weapon release signal is generated automatically by the computing system using inputs of INS velocities, radar target range, and manual inputs through controls in the cockpit. The basic system consists of the ballistics computer in access door 119, and the WRCS control panels in the cockpit (figure 1-4). A simplified flow diagram is provided at the end of this description to show all other aircraft avionics systems that are used in support of the WRCS equipment and associated delivery modes.

The available delivery modes are selected on the delivery mode knob. The level delivery modes are the LAYDOWN, DIVE LAYDOWN and OFFSET BOMB selections; the dive delivery modes are obtained by selecting DIVE TOSS. The TGT FIND position selects a navigational mode in which a release signal cannot be obtained. Therefore, the TGT FIND selection is a SAFE (or OFF) position of the control (as far as weapon deployment is concerned) for any weapon except guns. The AGM-45 position is a WRCS missile mode and the system provides the automatic launch signal in either a dive, level, or pullup maneuver (see Delivery Modes, Air-to-Ground). Each delivery mode is described later in this section.

NOTE

On aircraft with a Pave Spike pod loaded and pod POWER ON selected, the slant range indicator mode knob must be in the WRCS position to obtain weapon release with the delivery mode knob in any WRCS mode.

COMPUTER CONTROL PANEL

The WRCS computer control panel has three TARGET input controls, two RELEASE input controls, and a bomb DRAG COEFFICIENT input control. The panel also has a BIT control knob that is used to select and test the go/no-go status of the WRCS. Figure 1-5, WRCS manual inputs, shows the required panel controls that must be set with some value for each WRCS operating mode.

TARGET RANGE CONTROLS

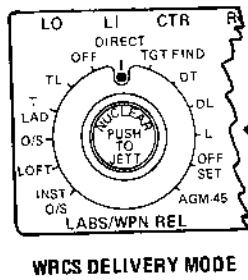
The three target inputs are used for the target find and offset bomb mode. The distance between the IP (identification point) and the target is placed on the two distance readout displays by rotating the adjacent control knobs. The distance readout is in hundreds-of-feet. The top target distance control receives the north or south distance, the lower target distance control receives the east or west target distance. For the offset bomb and target find mode, the altitude value placed in the ALT RANGE control should be either (1) the target or RIP elevation (MSL) for the planned run-in altitude or (2) the target or RIP pressure altitude. For the laydown bombing mode, the ALT RANGE control receives the range from the IP to target in hundreds-of-feet. Either the ALT or RANGE placard is illuminated under the panel, depending on the delivery mode selected. The maximum setting on the target controls is 999×100 feet (99,900 feet). Tick marks are provided on the 100-foot dial to permit intermediate settings. The dual purpose ALT RANGE control has the following maximum settings: the maximum ALT settings is 100×100 feet (10,000 feet); the maximum RANGE setting is 249×100 feet (24,900 feet). The maximum setting on the N-S and E-W DISTANCE controls is 999×100 feet (99,900 feet).

CAUTION

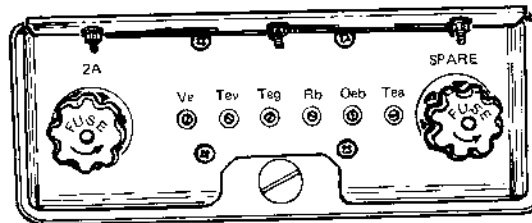
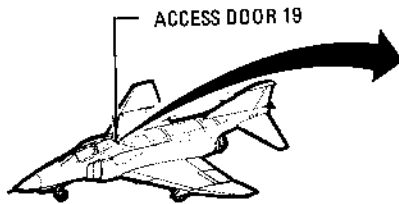
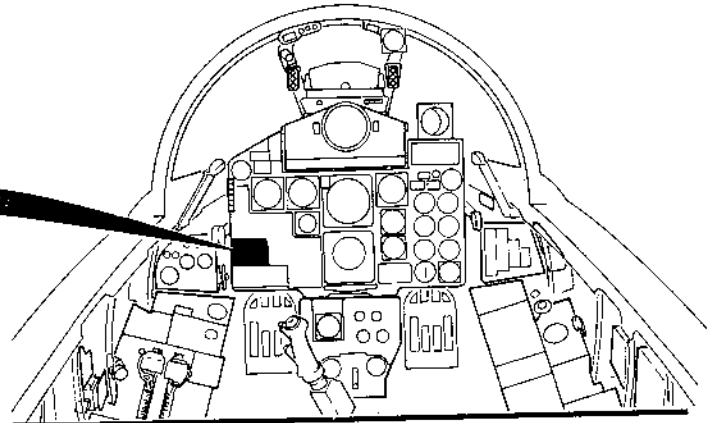
When a value is inserted in the target ALT RANGE counter other than 000, do not select the target find or offset bomb mode unless the aircraft altitude MSL is greater than the value (times 100); or unless the WSO is performing the target find/offset bomb WRCS BIT check as presented in section II. This is necessary to prevent possible damage to the pitch servo in the WRCS computer.

WRCS CONTROLS

FRONT COCKPIT



WRCS DELIVERY MODE

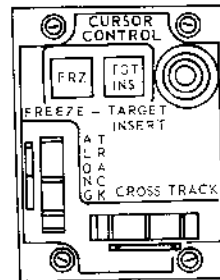


BALLISTIC COMPUTER ADJUSTMENTS

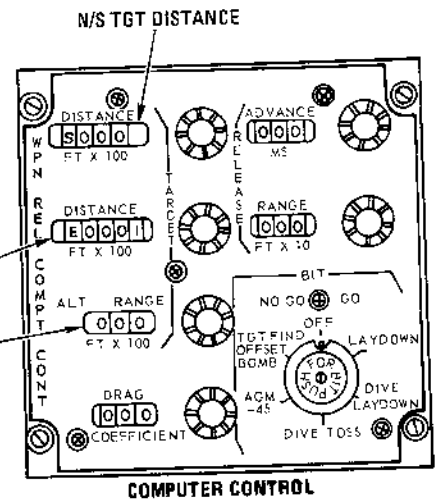
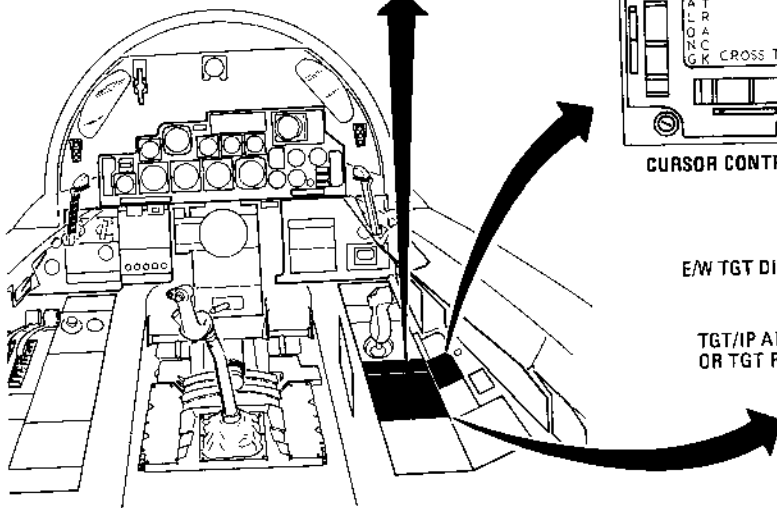
REAR COCKPIT



LABS/TGT FIND CONTROL



CURSOR CONTROL



COMPUTER CONTROL

4E-34-1-1-110A

Figure 1-4

WRCS MANUAL INPUTS

DELIVERY MODE	TARGET - FT X100				DRAG COEF - FICIENT	RELEASE	
	N/S DIST	E/W DIST	ALT	RANGE		ADVANCE MILLI-SECOND	RANGE FT x 10 FT x 100
MAX SET	999	999	100	249	9.99	999	999
DIVE TOSS					X	X	
DIVE LAY						X	X
LAYDOWN				X		X	X
OFFSET BOMB	X	X	X			X	X
TGT FIND	X	X	X				
AGM-45			X			X	
TGT FIND/LABS	X	X	X			X	X

4E-34-1-1-111)

Figure 1-5

RELEASE RANGE CONTROL

The release range (R_R) control knob is used to manually set the bomb range in tens-of-feet on the digital readout. This control is used for the laydown, dive laydown, and offset bombing modes. The maximum setting is 999×10 feet (9,990 feet).

NOTE

- As described later, the (R_R) setting may be as great as 99,900 feet for WRCS/AJB-7 integrated deliveries.
- Do not set the target range control and release range control on equal values, allow at least 0.25 second time/distance between settings to allow for the maximum possible bomb rack time delay. If the values are equal, the bomb may not release or release late.

RELEASE ADVANCE CONTROL

The release advance control is operative in all WRCS bomb release modes and in the WRCS/LABS integrate mode. The release advance control can be used in conjunction with the AWRU to advance the release signal in milliseconds. For example, if single-ripple (QTY 3) is selected on the AWRU with a release interval of 100 milliseconds, the release advance control can be used to place the second bomb on target. Setting 100 milliseconds on the digital readout causes the first bomb to hit short of the target and the third bomb to hit long of the target. The counter has a maximum setting of 999 milliseconds. The release advance setting that will place the middle bomb on target can be determined by the following method.

$$RA = I_R (N_{Tgt} - 1);$$

where:

RA - Release Advance Setting, milliseconds;

I_R - Release Intervalometer setting, milliseconds;

N_{Tgt} = Impact sequence number of bomb desired on target.

Example:

To place the third bomb impact of the ripple release string on target, use $N_{Tgt} = 3$. Then if $I_R = 100$ msec., $RA = 100 (3 - 1)$; or, $RA = 200$ msec.

DRAG COEFFICIENT CONTROL

The drag coefficient control is used only during the dive toss mode. The maximum setting is 9.99. The drag coefficient (C_D) is a bias factor that is analytically established to equate the computer bomb trajectory to the actual bomb trajectory. This drag coefficient value is not the mathematical drag coefficient of the bomb. The ground crew must set the Ballistic Computer with a related V_e value. When V_e is changed, the drag coefficient will change (see Ballistic Computer).

BUILT-IN-TEST (BIT)

The built-in-test (BIT) control is used to establish the go/no-go status of the WRCS. The BIT selector knob is not a mode selector switch for computer operation. The BIT is initiated by rotating the knob to the bombing mode to be tested and pressing the button in the center of the selector knob, placarded PUSH FOR BIT, wait 5 seconds and then press the FREEZE button while holding the BIT button pressed. Upon receiving either a GO or NO-GO indication, the BIT is discontinued by releasing the button. The NO-GO and GO lights are located under the panel to illuminate the applicable placard. Illumination of the NO-GO indicator at times other than the BIT checks indicates an inertial navigation system malfunction. A NO-GO indication will result if the BIT parameter (listed in the checklist) are not used. If a NO-GO indication is received as the BIT button is released, the indication can be disregarded if a GO indication was previously obtained. Refer to section II, WRCS BIT check procedures.

BALLISTIC COMPUTER

The ballistic computer contains all of the analog circuitry required to solve the bombing problem for each WRCS delivery mode. Built-in-test (BIT) features are incorporated to facilitate a go/no-go check of the WRCS.

The computer has several screwdriver adjustments (figure 1-7) that are made by the ground crew. These adjustments are bias factors and should not be confused with the actual parameter. For example: V_e IS NOT the ejection velocity of the bomb in feet per second; V_e is the ejection velocity bias factor that is selected and applied to the computer. The drag coefficient value (C_D which is dialed into the computer by the WSO) is also a bias factor that varies with

the type of bomb and is related to specific V_e bias setting. When V_e is changed, the drag coefficient must be changed.

CURSOR CONTROL PANEL

The cursor controls panel (figure 1-4) contains the additional control required to perform the target-finding mode and the offset bombing mode.

CURSOR CONTROLS

The cursor control panel has two thumbwheel controls (or slew controls) placarded **ALONG TRACK** and **CROSS TRACK**. These controls are used to position the cursors that appear on the radar scopes when the radar set is operated in the MAP-PPI mode. The controls are spring-loaded to return to the center position after each operation of the control; this return motion of the control does not affect the position of the radar cursors. The along track control contains a microswitch that activates a relay to enable the cursor control commands to be received by the WRCS computer. Therefore, the along track control must be moved first, and then the cross track control. Until the along track control is moved or the freeze button is pressed, the velocity integrators in the WRCS computer are maintained at zero distance traveled. The along track control positions the range cursor over or below the RIP radar return. The cross track control positions the vertical offset cursor over the RIP radar return. The intensity of the cursors on the scopes can be controlled by the controls located on the scope panel in the rear cockpit. If the cursors appear to be erratic in track or control, push the reset button and resume operation.

NOTE

Do not position the range cursor below zero range. If the range cursor is moved below zero range and positioned over the IP, the steering information will be in error by 180 degrees and the cursor will respond opposite to along track cursor control movements.

FREEZE BUTTON

When the freeze button is pressed, the velocity integrators in the WRCS computer begin to calculate the distance traveled from zero, and the cursors begin tracking the ground position indicated on the radar scopes by the intersection of the two cursors. The freeze button remains illuminated until the reset button is pressed, or until a different delivery mode is selected. The freeze button is used also during the BIT check to initiate the test problem for all bombing modes.

TARGET INSERT BUTTON

When the **TARGET INSERT** button is pressed, the north-south and east-west distances (entered in the WRCS panel controls) are inserted into the WRCS computer. This causes the cursors to move from the RIP to the target and begin tracking the target location on the radar scope. Only at this point is target steering information supplied to the various display instruments.

The target insert button remains illuminated until the reset button is pressed, or until a different delivery mode is selected.

RESET BUTTON

The reset button is a momentary pushbutton switch spring-loaded to ON. Pressing the button deenergizes the tracking relays and causes the velocity integrators to return to zero distance traveled; the freeze button light and the target insert button light go OFF; the offset cursor on the radar scope moves to the center of the scope; and the range cursor disappears. The purpose of the reset button is to permit the aircrew to cancel all previous inputs and start over. This might be desirable when the RIP can be visually located and a flyover fix on the RIP accomplished. When the aircraft is directly over the RIP, the WSO presses the freeze button to press the velocity integrators. If immediate steering information is required, the WSO should press the target insert button as soon as possible after pressing the freeze button.

STEERING INSTRUMENTS AND INDICATORS (WRCS)

During WRCS bombing, navigational, and AGM-45 missile modes, the aircrew is provided with target steering, range and bearing information displayed on the ADI, HSI, optical sight reticle and the BDHI. AGM-45 maneuver command indications are provided on the angle of attack indexers in each cockpit. Refer to the WRCS signal flow diagram, figure 1-6.

ATTITUDE DIRECTOR INDICATOR (ADI)

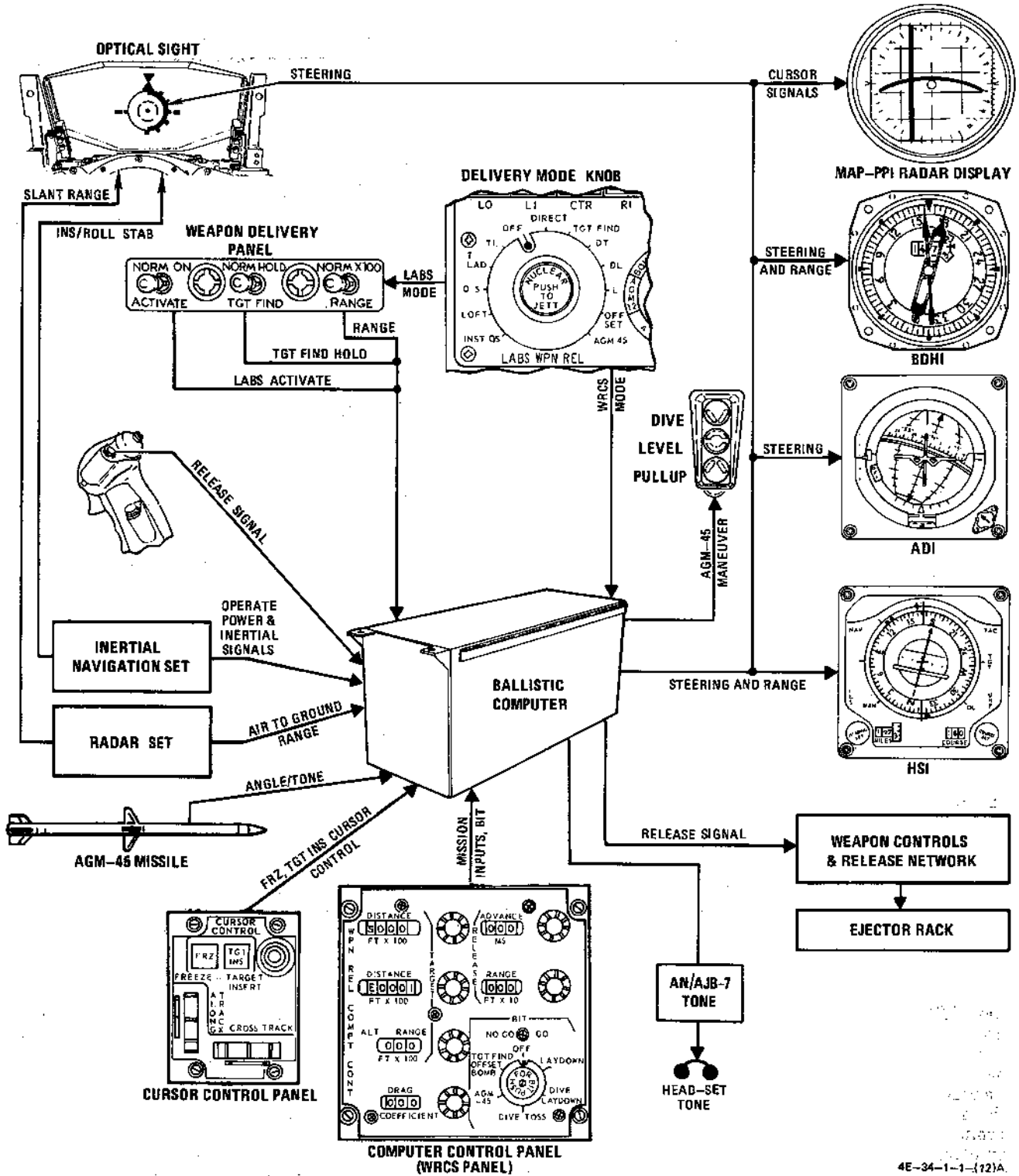
The ADI provides steering information during the offset bombing, target finding and AGM-45 modes as follows.

- a. During the offset bombing and target find modes, when target insert is initiated and positive cursor tracking is established, the vertical pointer provides azimuth steering information to acquire an inbound track to the target.
- b. During the AGM-45 missile mode, the vertical and horizontal pointers indicate elevation and azimuth missile look angles. Refer to AGM-45 Delivery, this part.

HORIZONTAL SITUATION INDICATOR (HSI) AND BEARING DISTANCE HEADING INDICATOR (BDHI)

The HSI (front cockpit) and BDHI (rear cockpit) provide command steering information to the target during offset bomb or target find modes. The operating controls for these instruments are maintained in the NAV/COMP position to get the target steering data. The HSI relates magnetic bearing, magnetic heading, and magnetic course to target with a distance read-out in nautical miles. Only a portion of this information is displayed on the BDHI in the rear cockpit. Refer to Delivery Modes, Air-to-Ground.

WEAPONS RELEASE COMPUTER SIGNAL FLOW



4E-34-1-1 (12)A

Figure 1-6

OPTICAL SIGHT RETICLE

The sight reticle is used in conjunction with the WRCS delivery modes as follows (see Lead Computing Optical Sight).

- a. In the laydown mode the depressed reticle is used to establish a target position fix and indicate aircraft drift throughout the bombing run.
- b. In the dive toss or dive laydown mode, the reticle is caged at RBL (35 mils) and drift stabilized. With radar lockon, the pilot tracks the target and when the pipper and target are superimposed, a target fix (range input) is established. With lockon, the range bar indicates present slant range.
- c. In the target find or offset bomb mode when target insert is initiated, the roll tabs provide a head-up display of the steering information presented on the ADI vertical pointer.

ANGLE OF ATTACK INDEXERS

The angle of attack (AOA) indexers are functional only in the AGM-45 missile mode for level, dive or climb maneuver command indications. Refer to AGM-45 Delivery, this part.

WRCS TONE

An audio tone is present in the headset for all WRCS modes except AGM-45 when the bomb button is pressed and continues until a bomb release signal is generated. The tone is generated by the AN/AJB-7 audio tone generator and is transmitted for training purposes unless the pullup tone switch is in the OFF position. (See Pullup Tone Switch, ARBCS system.)

WEAPON DELIVERY PANEL (LABS/TARGET FIND CONTROLS)

The controls on this panel (figure 1-6) enable the selection of a delivery mode using combined avionics equipment.

The aircrew may select and use the target navigation features of the TGT FIND (WRCS) mode, and deliver a weapon using any of the LABS (ARBCS) modes on the delivery mode selector. Refer to Delivery Methods, Air-to-Ground, this section.

TGT FIND SWITCH

The selective functions of the target find switch and the TGT FIND mode on the delivery mode knob are identical. If the pilot selects a WRCS mode on the delivery mode knob, the target find switch has no function and should remain in NORM. The HOLD position energizes the target find circuits along with any LABS or DIRECT mode (including OFF) that the pilot selects.

NOTE

WSO target find steering is disabled if the pilot selects any WRCS mode (except TGT FIND) in the forward cockpit.

RANGE SWITCH

The range switch is functional in any WRCS mode that requires an R_R setting. The (X 100) position applies a multiplier of 100 to whatever digit the WSO places in the R_R counter. In NORM, a factor of 10 is applied to the R_R setting.

ACTIVATE SWITCH

Voltage is available for the activate switch when the target insert button is pressed. Placing the activate switch to ON provides continuity to activate circuits in the weapon release computer. These circuits close only when the aircraft range from target becomes equivalent to the set R_R range. This applies the activate signal to the selected LABS circuits and the associated indicators. To avoid premature activation, select the ON position only after target insert, and only after the range and steering devices have transitioned to the target. If the activate switch is left in NORM, the system is operating in a target find mode where an R_R setting has no meaning.

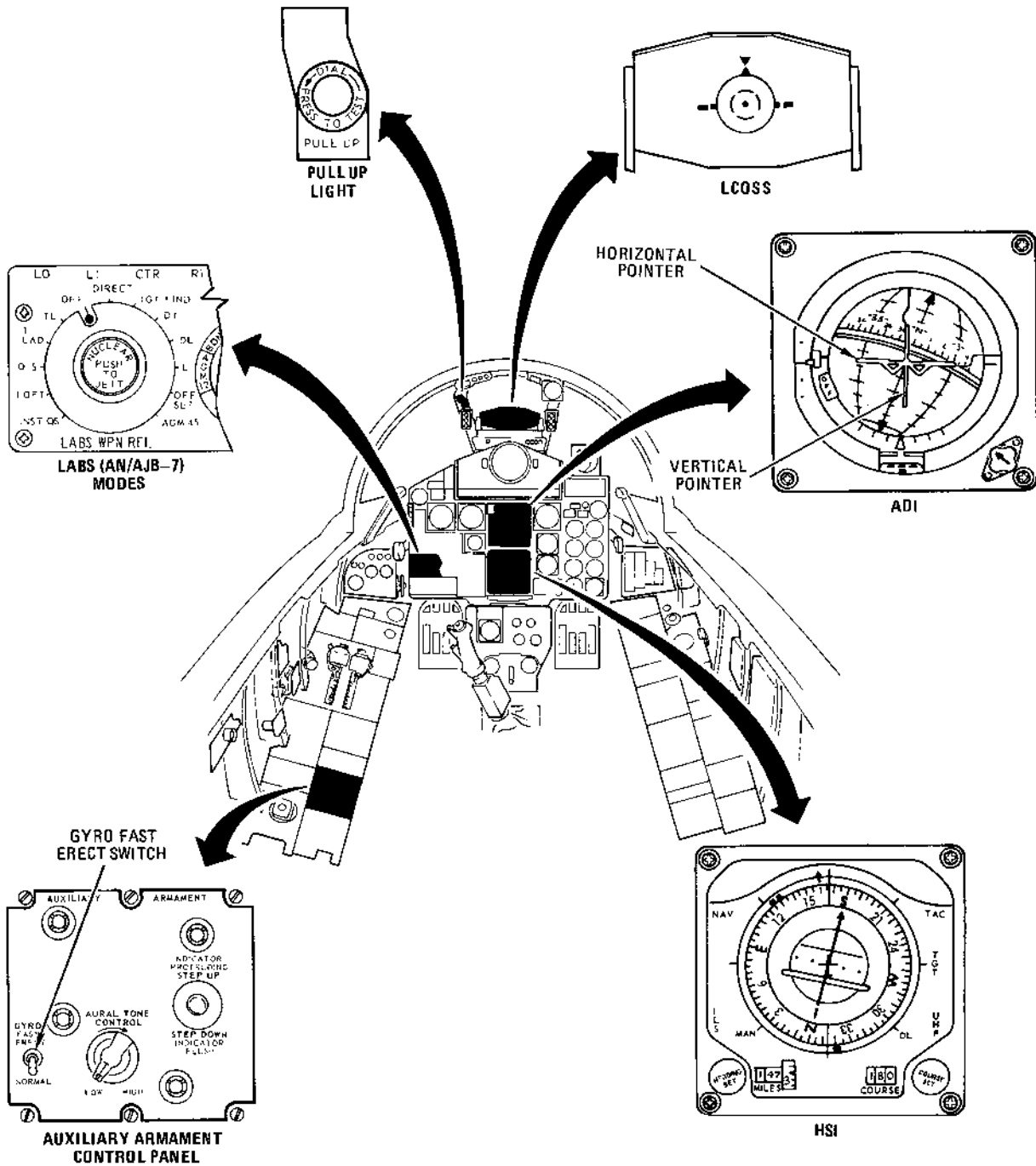
ATTITUDE REFERENCE AND BOMBING COMPUTER SET (ARBCS)

The ARBCS equipment (figure 1-7) is considered primarily for the LOFT (or pullup) maneuvering capabilities of the automatic release system. The system may be used directly with multiple weapons controls on the pedestal panel and bomb, laser, or AGM-45 munitions. The system delivers the weapon release signal at the termination of a release time setting or at a planned pitch (gyro) angle setting. The high angle gyro (O/S) modes are not considered.

The left (or LABS) side of the delivery mode knob selects the ARBCS release modes. The LOFT and T LAD modes provide weapon release in the pullup flight path environment. The LOFT position selects a 4.0-G pullup schedule, and release occurs when the aircraft pitch angle reaches the value set on the low angle gyro switch. The T LAD position selects a 3.5-G pullup schedule and release occurs at the completion of the release timer. Ballistic tables are provided for both methods.

ARBCS CONTROLS AND INDICATORS

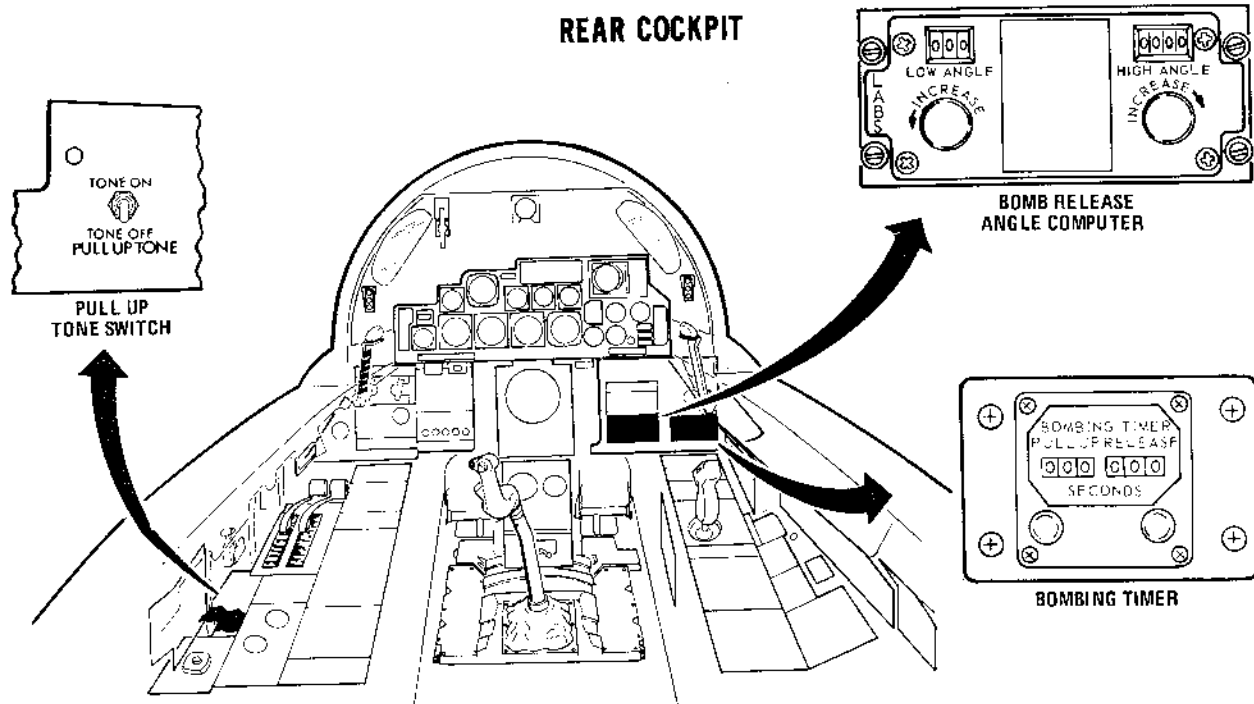
FRONT COCKPIT



4E-34-1-1 (13-11A)

Figure 1-7 (Sheet 1 of 2)

ARBCS CONTROLS & INDICATORS (Continued)



4E-34-1-1-(12-2)A

Figure 1-7 (Sheet 2 of 2)

ATTITUDE DIRECTOR INDICATOR (ADI)

For bombing operations, the ADI aids the pilot in establishing and maintaining a constant G pullup maneuver. The vertical and horizontal pointers are programmed to move out of center when the aircraft is not following the programmed pullup profile (4.0 G obtained in 2 seconds and maintained thereafter). During the loft bomb run, the vertical and horizontal pointers indicate yaw/roll and acceleration flight path errors. Prior to actuating the bomb button, the vertical needle is either deflected out of view or is being used navigationally, depending on the position of the navigation mode knob. When the bomb button is depressed, the AN/AJB-7 assumes command and the vertical pointer centers - presenting the roll signal and indicating flight path deviations while the pullup timer is operating. At pullup, when the pullup timer is complete, the resolved yaw/roll signal is presented on the vertical pointer. If the pointer deflects to the right during the pullup, the pilot rolls to the right - correcting into the pointer. The vertical director warning flag appears or disappears to indicate the degree of TACAN signal strength. Therefore, the appearance of the flag has no meaning with respect to the vertical pointer in a bombing mode.

NOTE

For vertical pointer functions during LOFT/AGM-45 operations, refer to AGM-45 Delivery, this part.

The horizontal pointer is always deflected out of view unless the loft bomb run is in progress (bomb button pressed). The pointer indicates deviations in the 1.0 G flight path during the low level approach to the pullup point. When the pullup timer is complete, horizontal pointer movement represents error between the desired pullup G program and actual load factor which is measured by the accelerometer. The system actually programs the proper G buildup rate, which means that if the pilot increases G loading at the proper rate, the pointer will NOT move from the center of the sphere. The pointer continues showing error in the constant 4.0 G flight path until the pilot releases the bomb button after final bomb release.

The ADI OFF flag comes into view if: (1) a system ac or dc power failure occurs; (2) there is excessive error in the roll and pitch signal sources of the gyroscope assembly; (3) an ADI failure, or an internal dc failure within the ADI occurs. The OFF flag indicates malfunctions of the ARBCS only, regardless of the mode the pilot has selected (PRIM or STBY) on the compass control panel. If the gyro system fails in some manner (conditions 1 and 2), the aircrew cannot expect to obtain an accurate bomb release angle since release occurs through the ARBCS pitch-following system.

NOTE

For LOFT (bombing) mode, the pedestal panel REJECT switch should be in DF REJ, or else the weapon selector must not be in the AGM-45

mode. This is necessary to get the ADI vertical pointer into the LOFT yaw/roll network.

FLIGHT DIRECTOR BOMBING COMPUTER

The unit is not visible to the aircrew. The computer develops dc voltages proportional to yaw/roll and G error for ADI steering indications in the loft bombing maneuvers. The computer also contains the tone generator which provides the warning and pullup tone in the headset. By removing a cover plate, controls are available to set tone level, roll sensitivity, yaw sensitivity, and pitch and G error sensitivity. The sensitivity controls govern the ADI horizontal and vertical pointer rate of deflection with respect to yaw/roll and G error signals. There is no AN/AJB-7 tone volume control in the cockpit.

The flight director computer contains a roll cancel relay which is energized if roll error (yaw/heading change) exceeds 30° during the pullup flight path. With the roll cancel circuit energized, the release circuit cannot be energized and the bomb run is cancelled. To ready the system for another run, momentarily position the bomb mode switch out of the selected function then back to LOFT.

PULLUP TONE SWITCH

The pullup tone switch (figure 1-7, sheet 2) is used primarily for training purposes. The TONE ON position allows the tone signal to be broadcast by the UHF transmitter. The TONE OFF position (or selecting STBY on the communication control panel) inhibits tone transmission. In either case, the aircrew hears the tone and all tone functions remain the same.

BOMB RELEASE ANGLE COMPUTER

The release angle computer (figure 1-7, sheet 2) contains the high and low angle release switches, the drum shaft and yaw/roll resolver, and the drogue switch. The pitch inputs drive the drum shaft which actuates the high and low angle release switches. The yaw and roll inputs are resolved, as a function of pitch, and transmitted to the flight director bombing computer for use in the vertical director pointer network. The controls on the front of the computer are used to establish the release angle. The low angle control may be set from 0° to 89.9°, and the high angle control may be set from 70° to 179.9°. Only the low angle control is used for loft bombing.

WARNING

When the LABS high angle switch is set greater than 169.0°, bomb release may occur at the pullup point when the bomb button is pressed (INST O/S) or at the completion of the pullup bombing timer (TIMED O/S).

GYRO ERECT SWITCH

During aircraft maneuvers, the fluid in the displacement gyro electrolytic switches may be driven to a false gravity-level position by acceleration forces. On turns of 15°/minute or more and during a bomb mode pull-up, slaving and erection are cut out to minimize the effect of acceleration, but no cutout is provided for other maneuvers. When the aircraft resumes a straight and level attitude, erection errors may be reduced at a fast rate (15°/minute) by placing and holding the gyro switch to FAST ERECT (figure 1-7, sheet 1). The switch must not be held in FAST ERECT for more than 60 seconds or damage to the displacement gyro may result. If fast erect capability is not exercised, normal erection reduces the error at a rate of 1° to 2°/minute. The gyro switch is spring-loaded to the normal position.

BOMBING TIMERS

The timer controls include the pullup and release timer controls in the rear cockpit (figure 1-7, sheet 2). The pullup timer may be set from 0 to 60 seconds and the release timer may be set from 0 to 30 seconds. Both timers can be set in increments of 0 seconds, with 0.1 second as the minimum numerical setting. The setting references in the window do not move during the application of operate voltage in the bomb run. Completion of the pullup timer energizes relays which provide the various pullup signals and the pullup flight program. The timers are either motor driven (sequential) or solid state (dual timer). The motor driven timer receives 115 volt ac power; the solid state timer receives 28 volt dc. Timer excitation voltage is applied when the pilot selects any LABS mode except DIRECT. Timer initiate (operate) voltage is applied, however, as a function of the specific mode selected. To demonstrate, the following list summarizes the timer operated versus the mode selected. (Operate voltage is applied by actuating the bomb button.)

a. LOFT (and TIMED O/S) - Operate voltage is applied only to the PULLUP timer, provided the timer is set to some value other than zero. The PULLUP timer must be set to some value to energize the ADI pullup flight path program.

b. TIMED LADD (and TIMED LEVEL) - Operate voltage is applied to the PULLUP timer; then to RELEASE timer at the termination of the PULLUP timer countdown. For the LADD mode, the PULLUP timer must be set on some value to get the ADI pullup schedule; the RELEASE timer must be set to develop a bomb release signal.

c. Pullup Warning Tone -

(1) Motor Driven Timer: For all modes in which the PULLUP timer is set, a 0.25 second warning tone pulse is initiated 1 second prior to PULLUP timer completion.

(2) Solid State Timer: A warning tone pulse is not provided.

For LABS/WRCS modes of operation, the above information remains the same except that the timer operate signal is applied by a signal from the WRCS ACTIVATE circuits, rather than the bomb button. In all LABS/WRCS combined modes, a 0.375 second activate tone is applied at the ACTIVATE point.

ARBCS INDICATORS

The pilot has various visual/and audio indicators that signal the progress of the particular ARBCS delivery mode. These include the tone signal, pullup light, and the optical sight reticle provided the sight is illuminated. For example, during the LOFT mode, the indicators function as follows (figure 1-7, sheet 1).

a. When the pilot applies bomb button voltage to start the pullup timer: pullup light - ON.

- b. At pullup timer complete: pullup light and reticle light - OFF, steady tone - ON. (The motor driven timer initiates a 0.25 second warning tone prior to the steady tone.)
- c. As the aircraft reaches the release pitch attitude: pullup light, reticle light - ON, tone - OFF.
- d. When bomb button signal is removed: pullup light - OFF.

These indicators function in this manner whether or not an actual bomb release occurs; the weapon release system may remain in a SAFE state.

LEAD COMPUTING OPTICAL SIGHT SYSTEM

OPTICAL SIGHT CONTROLS

The lead computing optical sight system (LCOSS, figure 1-8) is used to establish a visual sight reference to air-to-air and air-to-ground weapons delivery. A red reticle image is projected on a combining glass. Power is applied to LCOSS components when the sight mode selector knob is in any position except OFF.

SIGHT MODE KNOB

The sight mode knob selects the mode of operation:

- a. OFF: Denergizes the sight system.
- b. STBY: Energizes the sight system for warm-up. The reticle is not displayed.

CAGE	Reticle is displayed and caged at the radar boresight line (RBL).
A/G	Selects air-to-ground mode; the reticle is depressable from zero mils to 245 mils below fuselage reference line (FRL).
A/A	Selects air-to-air lead compute mode. The reticle position is governed by the sight gyro, radar range, the CADC Sensor, and the cage button.
BIT 1 and BIT 2	Energizes lead computing amplifier relays so that fixed voltages are applied to the sight system for self test of system performance.

RETICLE DEPRESSION CONTROL

The reticle is depressed by rotating the reticle depression knob until the digital readout (in one-mil increments) corresponds to the desired sight setting. The sight cannot be manually positioned in azimuth.

RETICLE INTENSITY CONTROL

Rotating the reticle intensity control knob permits the pilot to vary the reticle brightness level.

SHUTTER (LEVER) CONTROL

The shutter control is a two position lever with positions of CL (closed) and OPEN. The CL position places a shutter between optical light sources and the combining glass, thus preventing damage to the optics from bright sun light. The OPEN position allows the reticle to be displayed.

NOTE

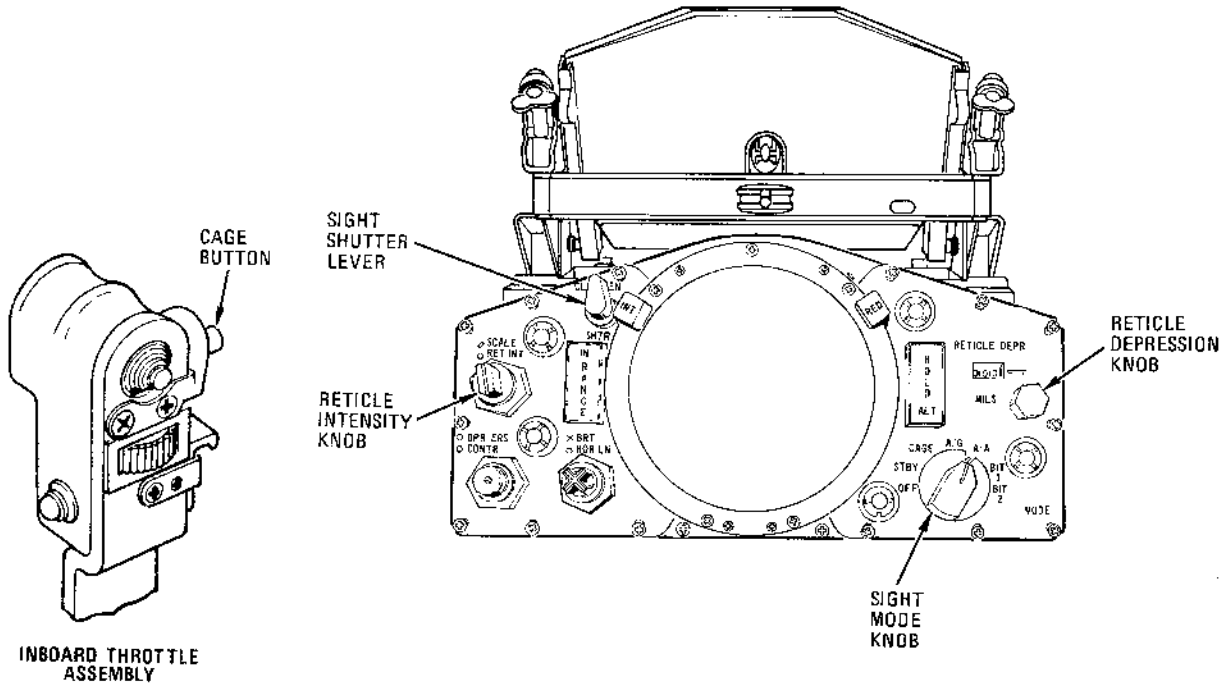
For optical sight lead computing operations, refer to Air-to-Air Gunnery, this section.

RETICLE IMAGE

The reticle image that is projected on the combining glass is composed of a fixed reticle, roll reference tabs, and a range bar (figure 1-9). The fixed reticle consists of a 2-mil diameter pipper located in the center of a 25-mil diameter segmented circle, and a 50-mil diameter complete circle. The 50-mil circle has three index tabs located on the outer edge at the top, and left and right of the pipper.

The roll reference tabs rotate about the 50-mil circle. The roll reference tabs have two separate functions. During the offset bombing mode and the target finding mode, the roll tabs provide steering information supplied by the WRCS. The position of the roll tabs, with respect to the fixed index tabs, indicates the angle between the ground track and course to the target. During all other modes of operation, the roll tabs indicate the aircraft roll attitude which is supplied by the INS.

LEAD COMPUTING OPTICAL SIGHT

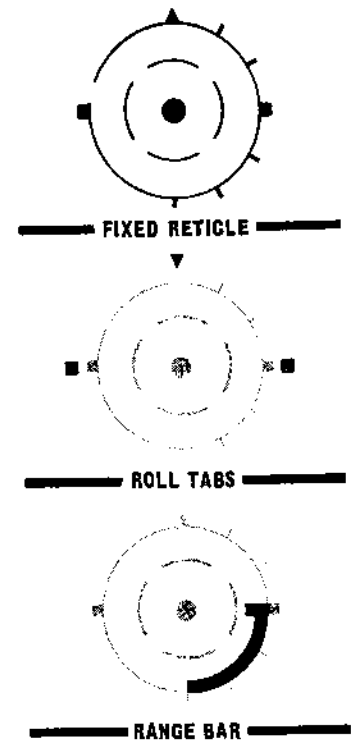
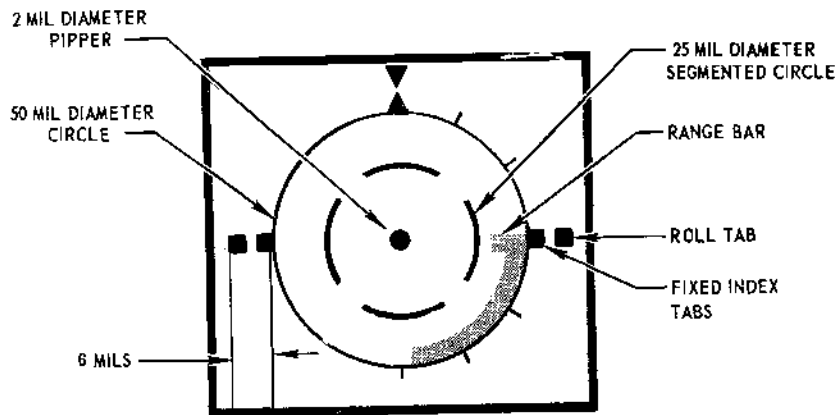


OPTICAL SIGHT A/A MODES VS THROTTLE CAGE BUTTON

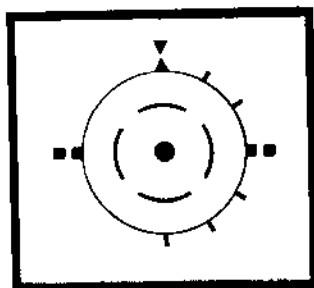
THROTTLE WEAPON SWITCH	WITH RADAR LOCKON		WITHOUT RADAR LOCKON	
	CAGE BUTTON		CAGE BUTTON	
	PRESSED	RELEASED	PRESSED	RELEASED
GUNS	1000 Ft. Lead Compute	Radar Range Lead Compute	RBL	1000 Ft. Lead Compute
MISSILES	RBL	RBL	RBL	RBL

Figure 1-8

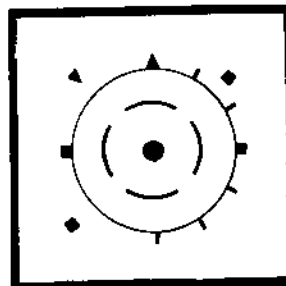
OPTICAL SIGHT RETICLES



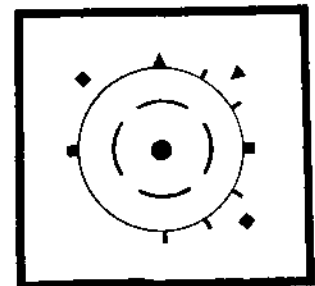
ROLL TAB FUNCTION



1 WINGS LEVEL
2 (OR ON COURSE)



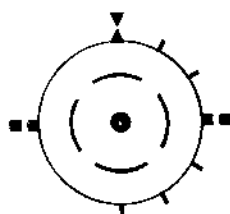
1 RIGHT ROLL
2 (OR STEER LEFT)



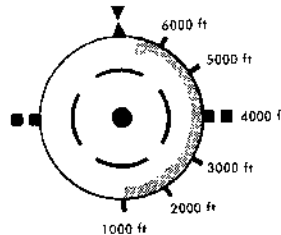
1 LEFT ROLL
2 (OR STEER RIGHT)

1 AIRCRAFT ATTITUDE
2 STEERING COMMANDS FOR TARGET FINDING OR OFFSET BOMBING MODES

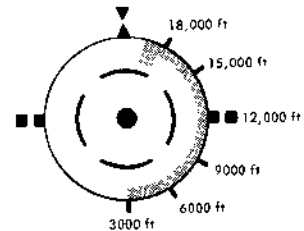
RANGE BAR FUNCTION



BEFORE RADAR LOCK-ON



AFTER RADAR LOCK-ON
Max range 6,667 FT
with guns selected.



AFTER RADAR LOCK-ON
Max range 20,000 FT
without guns selected.

Figure 1-9

The range bar is semi-circular and appears on the inside of the 50-mil circle only when a target has been acquired by radar lockon. The instantaneous length of the range bar, and the rate at which the length is changing indicates the actual radar slant range and the range rate between the aircraft and the target. The minimum length of the range bar (and minimum range indication) exists at the 6 o'clock position. With gun selected and the inside tab of the range bar at 6 o'clock, the actual radar range is 1000 feet. When the range bar tab is at 5 o'clock, the range is 2000 feet. The range indication is linear; i.e., 1000 feet per each tab on the 50-mil circle. When the range bar reaches its maximum length, (near 12 o'clock), the radar range is 6667 feet. If the range is greater than 6667 feet, the range bar will remain at the maximum position. (Refer to Range Bar Ranging.)

- a. With the mode knob in A/A, the range bar appears when radar lockon is accomplished in any of the radar modes and indicates slant range to the target for air-to-air gunnery or missile attack.
- b. With the mode knob in A/G and the DIVE TOSS or DIVE LAY mode selected on the delivery mode knob, the range bar will appear to indicate radar lockon has been accomplished in any of the radar modes and will indicate slant range from the aircraft to the position of the piper on the ground.

RANGE BAR RANGING

Interpretation of the slant range displayed by the position (or length) of the range bar is affected only when guns is selected. With GUNS selected, the minimum length of the range bar represents 1000 feet and the maximum length represents 6667 feet (approximately 6700 feet). When any other weapon or delivery mode is selected, the minimum length of the range bar represents 3000 feet and the maximum length represents 20,000 feet (figure 1-9).

WARNING

Do not attempt air-to-ground deliveries using the optical sight range bar with the sight operating in the A/A mode. Operating the sight in the A/A mode with a radar lockon in the A/G mode will result in dangerously misleading range bar indications.

RETICLE LIGHT FLASHER

The reticle flashes at approximately 20 Hz to alert the pilot that the following conditions may exist.

- a. INS failure with a WRCS bombing mode selected.
- b. Premature release of the bomb button during ARBCS timed bombing mode.
- c. Loss of bomb button power (i.e., armament bus power).
- d. Loss of pitch stab during an ARBCS bombing mode.

Any of the preceding conditions will energize the reticle flasher relay. The pilot can momentarily recycle the delivery mode knob out of its present position and deenergize the flasher relay.

RETICLE CAGE

The reticle cage function is applied through the cage button on the inboard throttle. With the sight operating in the (GUNS) A/A mode and with CAGE pressed (no radar lockon) the reticle is caged at RBL. When CAGE is released, a pseudo range of 1000 feet is supplied to the computer; the range bar is not displayed. With radar lockon, the stiffening function is applied as long as CAGE is pressed; the lead angle computer receives the 1000-foot range signal. The range bar continues to indicate the actual radar range or the maximum displayable range of 6700 feet. When CAGE is released, the reticle moves in AZ-EL to display the lead required to a maximum of 4000 feet. (See figure 1-8.)

With guns/missile switch in GUNS, pressing the cage button does not break a radar lockon. If CAA mode has been selected, pressing the cage button does not terminate CAA mode.

If the sight is being operated in the A/G mode, the CAGE signal immediately switches the sight to the A/A mode and into the operating functions shown in figure 1-8.

RETICLE FUNCTIONS VS DELIVERY MODE

The basic modes of sight operation (A/A or A/G) are influenced by the delivery mode selected, and in some cases by the weapon selected. The table provided in figure 1-10 show the effect of these controls on sight functions.

OPTICAL SIGHT FUNCTIONS

DELIVERY/ MUNITION SELECTED	WPN SEL POSITION	DELIVERY MODE SELECTOR	OPTICAL SIGHT MODE	OPTICAL SIGHT RETICLE			
				ELEVATION	AZIMUTH	ROLL TABS	RANGE BAR
GUNS	Any except TV/ARM	NA	1 A/A	Lead Compute	Lead Compute	Roll	Max Range 6700 ft
		OFF or DIRECT	2 A/G	Manual Dep. from FRL	Caged at 0°		
Heat or Radar Missiles	Any except TV/ARM	NA	A/A	Caged at RBL		Caged at 0°	Roll
Rockets, GP Bombs,	BOMBS, RKTS & DISP, A	DIRECT	3 AG	Manual Dep. from FRL			
Target Find	NA	TGT FIND		Caged at RBL	Caged at 0°	4	
Offset Bomb	BOMBS, RKTS & DISP or A	OFFSET	3 AG	Caged at RBL	Drift	Roll	
Dive Toss, Dive Laydown, Laydown	BOMBS, RKTS & DISP or A	DT DL L		5			
Timed or AN/AJB-7	BOMBS, RKTS & DISP or A	TL T LAD O/S LOFT INST O/S	3 AG	5	Caged at 0°	Roll	
AGM-45	6 ARM	AGM-45		Caged at RBL			
EO MISSILE	6 TV	DIRECT	3 AG	Manual Dep. from FRL	Caged at 0°	Roll	

- 1 With lockon, the CAGE signal (held in) applies the reticle cage, 1000 ft. fixed range, lead compute mode. Without lockon, the CAGE signal (held in) places the reticle at RBL.
- 2 A momentary CAGE signal switches the sight to A/A lead compute mode, either 1000 ft. range or at RDR range if lockon is present (switching occurs as the CAGE button is released).
- 3 A momentary CAGE signal switches the sight to the A/A mode: either caged at RBL with HEAT/RDR missiles selected; or lead compute with GUNS selected.
- 4 Roll displayed until target insert, then steering to target.
- 5 The sight reticle is pitch stabilized; manual depression is from the level plane. If INS fails (reticle flashes*), the AN/AJB-7 reference system must be used; switch the attitude reference system selector knob to STBY for reliable sight depression.
- 6 The CAGE signal places trigger circuit into either GUNS or HEAT/RDR missile fire network; the sight functions as stated in note 3.

* The sight reticle flashes if INS fails; at AN/AJB-7 or WRCS mission abort, or with bomb button power loss. The CAGE signal deenergizes the reticle flasher.

NOSE GUN SYSTEM

GUN SYSTEM, M61A1

The internal gun system (figure 1-11) is an electrically controlled, hydraulically powered, forward firing 20mm gun. The weapon is a complete palletized package installed in the forward fuselage which may be down-loaded for maintenance. The system is interchangeable in all nose gun aircraft. The package is 84 inches long, 22 inches wide, 46 inches high and weighs 1100 pounds fully loaded and 672 pounds empty. The total ammunition capacity is 639 rounds with firing rates of 6000 SPM (shots per minute) or 4000 SPM. The pilot operates the gun system through the throttle guns/missile switch, gun station button, and master arm switch. Gun master arm voltage is available only if the landing gear handle is UP. The following paragraphs described the major components of the gun system.

CAUTION

To reduce possible gun damage and prolong gun life, a single burst should not exceed three seconds.

NOTE

The minimum time between bursts is approximately one second. The trigger is automatically disabled during this period. Refer to Gun Electric's Controls.

AMMUNITION DRUM AND CONVEYOR SYSTEM

The drum assembly (figure 1-11) provides the storage area for the 20mm ammunition and is directly linked to the ammunition feed conveyor system and the return conveyor system. Each conveyor system is identical and contains an exit unit for removing ammunition from the drum, and an entrance unit for returning spent round cases into the drum. The inner drum assembly, which is mechanically driven, rotates and drives ammunition along drum partitions and into the exit unit. The exit unit removes the rounds from the drum partitions and passes them to the conveyor and to the gun feed assembly. After firing, the conveyor system directs spent cases (and cleared rounds) to the drum entrance unit. The entrance unit returns the rounds into the drum partitions. The complete ammunition cycle forms a closed loop.

The drum exit unit contains a last round sensing switch. When empty rounds appear in the path of the exit unit, the switch opens and automatically deenergizes the trigger fire circuit to stop gun operation. This also deenergizes the nose gun station select amber light.

HYDRAULIC DRIVE ASSEMBLIES

The utility hydraulic system supplies the power to operate the gun system at firing rates of 4000 or 6000 SPM. The rate of fire is controlled by a two-speed hydraulic flow control valve in the aircraft, which in turn is controlled by the rate switch on the pedestal panel. The application of the trigger signal opens the gun control valve, applying power to drive the gun system through the hydraulic motor and gearbox.

SCAVENGE SYSTEM

The gun compartment scavenge system includes a scavenge door on the upper surface of the aircraft nose section and the associated valve and linkages that apply utility hydraulic system pressure to the door operating valve. The door is held closed by hydraulic pressure. The trigger signal removes the hydraulic lock and the door opens by spring force. The door remains open during gun firing and for approximately 30 seconds after trigger release. If the pilot deenergizes the gun select/arm controls during the 30 second period, the door will close. With the door open, the atmosphere within the nose section completely changes at a rate of 1.0 to 2.0 times per second depending on airspeed.

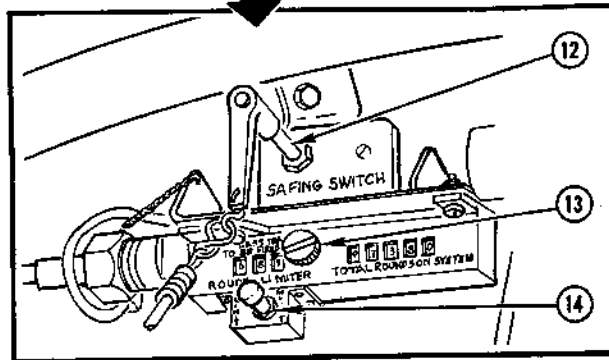
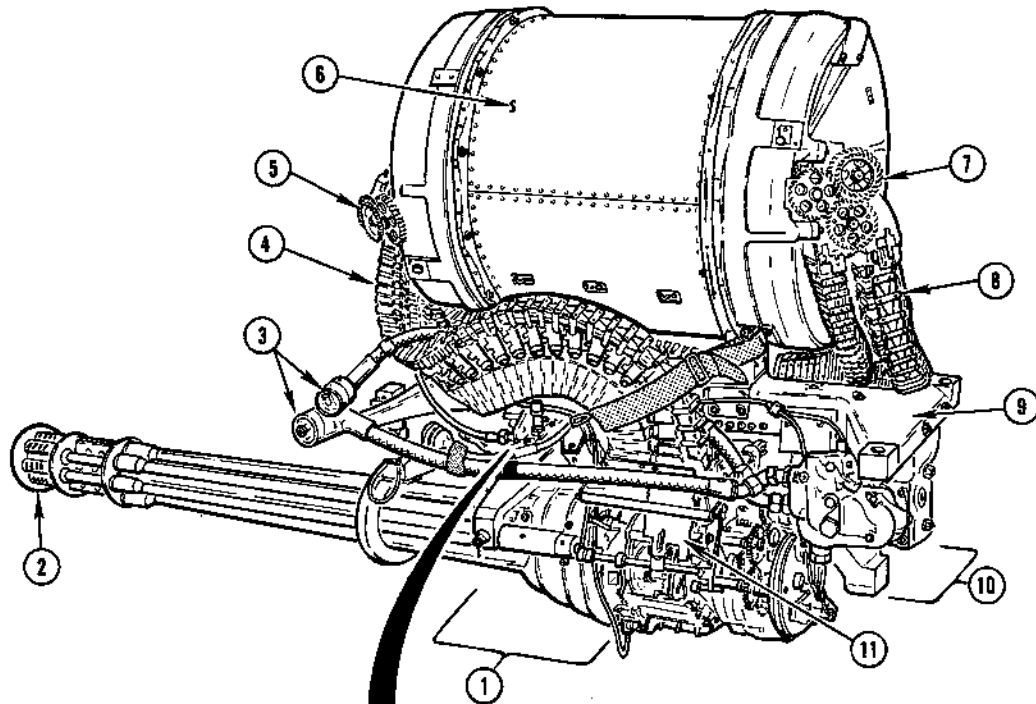
GUN PURGE SYSTEM

The gun purge system operation is coincident with the scavenge system operation. The electrically operated valve in this system controls the application of engine bleed (rain removal) air to a jet pump in the gun gas discharge line. If electrical power is lost at the valve, the valve fails in the open (safe) position so that the purge system continues to function. If the pilot must dump cockpit pressure for any reason, then purge system air is lost. In this situation, the scavenge system continues to function and there is no danger of explosion or fire due to gases collecting in the nose gun area.

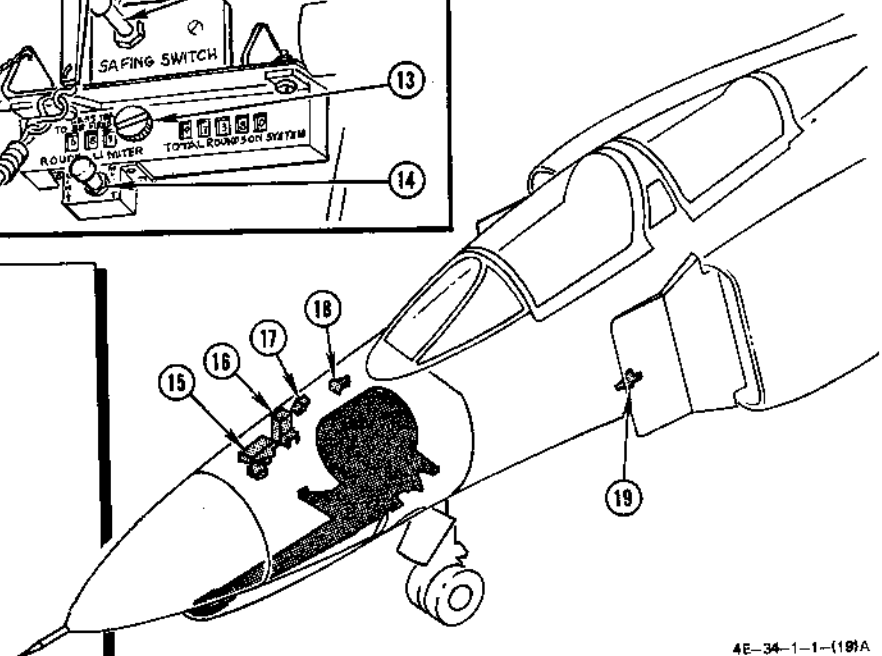
GUN ELECTRICAL CONTROL

The electrical requirements for gun operation are supplied by the aircraft main bus system and dispersed by the gun control unit. The trigger signal applies voltage to the hydraulic motor solenoid that initiates the hydraulic gun drive force. The trigger also closes relays in the gun control unit that apply 330 \pm 50 volt dc (rectified 115 volt ac) into the round firing circuit. Other control unit circuits includes those that control speed sensing, rounds limiter, and automatic gun clearing.

NOSE GUN SYSTEM



1. M61A1 GUN
2. GAS DIFFUSER
3. HYDRAULIC QUICK DISCONNECTS
4. GUN FEED CHUTE
5. DRUM EXIT UNIT
6. AMMUNITION (OUTER) DRUM
7. DRUM ENTRANCE UNIT
8. RETURN CHUTE
9. PALLET ASSEMBLY
10. HYDRAULIC DRIVE ASSEMBLY
11. GUN FEED UNIT
12. GUN FIRING CIRCUIT SAFETY PIN
13. ROUNDS LIMITER AND SET KNOB
14. ROUNDS LIMIT SWITCH
15. GUN COMPARTMENT SCAVENGE DOOR
16. GUN CONTROL UNIT
17. CLEARING SIGNAL UNIT
18. GUN GAS PURGE VALVE
19. HYDRAULIC TWO-LEVEL FLOW VALVE



4E-34-1-1-(18)A

Figure 1-11

The gun always operates in an auto-clear mode. (The auto-clear switch on the pedestal has no function in nose gun operations.) During gun firing, the clearing device receives a signal from the speed sensing circuits at a frequency which is directly proportional to the rate of weapon fire. When the pilot releases the trigger, the clearing signal device prevents the gun from going into the clearing mode until the firing rate has decelerated below 4000 SPM. Round firing voltage is held on the gun during the clearing cycle so that any rounds chambered before the bolts retract are fired. The delay between trigger release and the point at which all the bolts are cleared is such that approximately 5 to 11 rounds will fire after the trigger is released. This depends on the initial firing rate. The time period between the last round fired and complete gun stop results in live rounds (4 to 9) clearing the gun and returning to the drum. The total time period between trigger release and gun full stop is slightly less than 1 second. During this period, the trigger is disabled and the pilot must delay at least this long between bursts.

ROUNDS LIMITER

The rounds limiter (figure 1-11) may be adjusted by armament crew personnel when it is necessary to limit the quantity of rounds to be fired during one flight. The device has a counter unit which is set to actuate a rounds limiter switch and stop gun operation after the determined number of rounds have been fired. Actuation of the rounds limiter switch will deenergize the ARM light in the nose station select button and the head-up GUN light.

Set Knob and Limit Switch

The set knob is used to insert the limit number of rounds to be fired. The number of rounds to be fired is registered on the 3-place counter located adjacent to the set knob. The rounds limit toggle switch must be in the LIMIT position for this mode of operation.

NOSE GUN CONTROLS

GUN SELECT

The guns select functions are provided by the guns/missiles switch on the left throttle. The rear-most position of the switch selects the nose gun and illuminates the head-up GUN light. Further gun arming functions are provided by the controls below.

GUN STATION SELECT

The nose gun station button is pressed to select the nose gun station. The GUN (green) light in the button housing comes ON.

MASTER ARM SWITCH

Selecting the arm position on the master arm switch energizes all gun select circuits and arms the trigger switch. The station ARM amber light illuminates to show the ready condition. The station ARM light is electrically located in the last rounds switch and rounds limiter circuits. Therefore, the light goes OFF when all expendable rounds or the limited number of rounds have been fired.

RATE SWITCH

With the master arm switch in ARM, power is available for the rate switch. The rate switch LOW position applies power to the two-speed hydraulic flow valve and the gun fire rate is 4000 SPM. In HIGH position, the valve circuit is open and the gun fires at 6000 SPM.

ROUNDS COUNTER

The clearing signal device, which supplies signals proportional to rate of fire, is also used to operate the remote rounds counter on the pedestal panel. The counter system is triggered once for every 10th round cycled through the ammunition feed system.

TRIGGER SWITCHING

Consider the situation when the mission involves the use of BOMBS or RKTS and DISP munitions deployed through the bomb button. With master arm energized, the trigger switch is HOT in the air-to-air weapon launch circuit selected on the guns/missile switch. With GUNS selected for example, the only way to SAFE the nose gun is to deselect the nose gun station. If HEAT missiles are aboard and with HEAT selected, there is no way to safe the trigger circuit except to deselect the HEAT position. With radar missiles selected and tuned (CW ON), the only way to prevent the immediate trigger-launch of radar missiles is to select interlocks IN. Therefore, when all three air-to-air munitions are aboard with master arm energized, the trigger can be rendered SAFE by selecting the gun weapon on the throttle and by maintaining the gun station button deenergized.

There is one situation which the pilot must consider during combat conditions. If it becomes necessary to rapidly switch from one air-to-air weapon to another - say from radar to guns - the pilot must not become misoriented and hold the trigger signal while the guns/missile switch is being positioned. This would result in the accidental expenditure of needed munitions, and possible munition collisions in front of the aircraft.

FIRE CONTROL SYSTEM, RADAR SET

RADAR SET CONFIGURATIONS

Three radar set configurations and three display groups are currently employed in these aircraft.

AN/APQ-120D(V)

The basic radar set using Direct View Storage Tube (DVST) display equipment.

AN/APQ-120F(V)

Same basic radar set with TISEO installed beginning at Block 48 (71-237). TISEO aircraft use the DSCG. At block 60, the Digital Scan Converter Group (DSCG) display is installed. These display sets are TV capable and the radar antenna hand control is modified to provide TISEO/AGM-65 seeker AZ/EL drive commands.

AN/APQ-120(V)-10 and -11

The computer automatic acquisition (CAA) modification provides a faster automatic acquisition mode with a corridor scan and suppresses altitude line returns to reduce spurious lock-ons. Target information is provided by a computer controlled digital target detector.

The ground programmable digital fire control computer provides accurate missile launch envelopes for AIM-7E, AIM-7F, and AIM-9P-2/-3/N-2/-3 missiles. Before OFP P005, two modes of operation are provided: long range intercept (LRI) and air combat maneuvering (ACM).

This description (and Section II procedures) differentiates between radar sets by referring to the display equipment, i.e., DSCG aircraft.

MISSION

The purpose of the Fire Control System (FCS) is to detect and track airborne targets and to provide control and

guidance for the firing of missiles. The FCS consists of three major subsystems and related equipment. These are:

- a. Radar Set, AN/APQ-120()
- b. Missile Auxiliary Group.
- c. Missile Launching Circuits.

The FCS is a multi-mission system used in both air-to-air and air-to-ground operation. The radar set searches for and tracks targets at the discretion of the WSO and provides information to assist the pilot in firing weapons. The FCS is used as a ranging radar for firing guns or visual bombing and as a mapping radar for navigation and radar bombing. Capabilities for using TV and beacon are also included. The following major operations are performed:

- a. Detection of airborne and ground targets.
- b. Automatic or manual acquisition and automatic tracking of selected target.
- c. Display of target range, angle, range rate, altitude, and aspect angle information.
- d. Display of steering information to achieve an optimum missile launch position.
- e. Preparation and check of necessary parameters to launch missiles.
- f. Illumination of target with modulated CW rf energy required for AIM-7 missile guidance.
- g. Display of launch parameters for AIM-7E/F and AIM-9P-2/-3 missiles.
- h. Display of TV video provided by TISEO or TV weapon.
- i. Range information computed and supplied to WRCS and LCOSS.
- j. Mapping capability with choice of B or PPI display.
- k. Beacon capability.

Airborne Fire Control Radar Set

The radar set is the major component of the FCS and consists of 23 separate units which are located in the radar package in the nose of the aircraft and in the cockpits. The radar set is employed to search for and track airborne targets, compute and present the AIM-7 or AIM-9 attack display, and illuminate targets with CW energy for AIM-7

missile guidance.

Two transmitters, receiving circuits, signal processing and display circuits, and computing and control circuits are included. The operation of these circuits depends on the position of various operating controls which are set to meet the requirements of a mission.

Missile Auxiliary Group (AIM-7)

The missile auxiliary group consists of the tuning drive and the rf hardware which distributes the pseudo and rear signals to the AIM-7 missiles. After TO 1F-4-1424, the pseudo doppler signal is removed. The four-channel tuning drive controls the tuning of the klystron in each AIM-7 missile. The tuning drive applies suitable modification signals to the missile control circuits so that the missile speedgate will lock on the simulated target frequency. The auxiliary group also provides roll command signals to the missile.

Missile Launching Circuits

The missile launching circuits contain the necessary avionics and cockpit controls to launch the air-to-air missiles. The radar must be in operation for optimum employment of AIM-7 missiles; AIM-9 operations do not require the radar unless the pilot chooses to employ the attack steering display. Missile launch controls and indicators are described in previous pages.

FCS CONTROLS AND INDICATORS

The FCS controls and indicators are located on the radar set control, the antenna hand control, the control monitor panel, and each radar scope.

NOTE

Refer to TO 1F-4C-34-1-1-2 for special ECCM applications of the radar controls.

RADAR SET CONTROL PANEL

Radar Power Knob

The radar power knob (figure 1-12) is used to control power application to the entire fire control system. Anytime the power knob is positioned out of OFF to TEST or STBY, -250vdc is indicated on the control monitor meter approximately 30 seconds after initial turn on. After approximately 3 minutes (2.5 minutes plus 30 seconds) from turn on, the radar may be tested or placed into full operation according to the following paragraphs.

TEST

With TEST selected, voltage is applied to the TEST knob on the control monitor and the system may be operationally checked in TEST positions 1 thru 6. Positions 7 and 8 are not used except for ground testing by

maintenance personnel. The antenna is automatically coupled to a dummy load to prevent rf transmission. This position also inhibits the throttle CAGE mode.

STANDBY

With STBY selected, the radar system is maintained in a ready condition. Warm up voltages are applied so that the radar is operational in a minimum amount of time when switched to OPR.

OPERATE

When OPR is selected, the system is fully operational; the radar transmitter, waveguide, and antenna are coupled together which permits rf energy to be transmitted.

WARNING

During ground operation, the OPR position should not be used unless the area is clear of personnel, electro-explosive devices (EED), or when ground fueling is in progress within a 100 foot radius. In addition, check that there are no surfaces within 50 feet of aircraft which can reflect rf energy back into antenna and cause damage.

EMERGENCY

When EMER is selected, the 2.5 minute time delay, pressure, and temperature interlocks are bypassed. These interlocks are provided to inhibit operation under abnormal operating conditions. Once EMER is selected, a red flag comes into view behind the power knob and cannot be reset without removing the knob.

CAUTION

The EMER position should not be used unless conditions dictate radar operation regardless of possible damage.

Polar Switch

The polar switch (detented out of the CIR 2 position) is used to control the polarization of the transmitted rf energy from the antenna. Control of the polarization is accomplished by positioning the quarter wave plate in the antenna feedhorn. RF energy is a combination of pulsating electrostatic and magnetic fields. The following paragraphs describe the polar switch positions and their effect on the radiated rf energy.

LIN (LINEAR)

The LIN position is the normal operating position since most electromagnetic energy is linearly polarized. In this position, the rf energy is vertically polarized. AIM-7 missiles are normally fired in this position.

FCS CONTROLS & INDICATORS

RADAR SET CONTROL PANEL

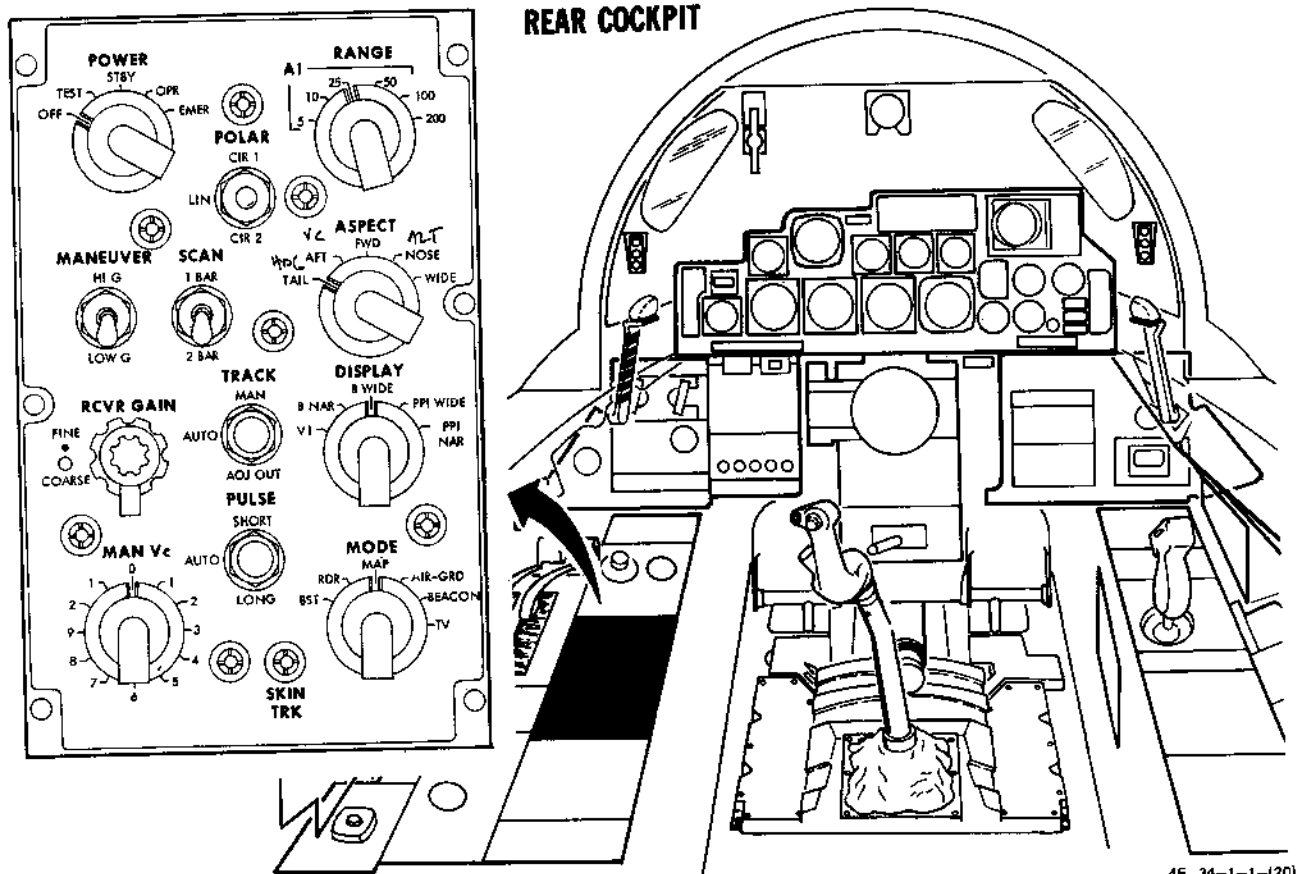


Figure 1-12

CIR 1

When CIR 1 is selected, the rf energy is rotated in a clockwise direction from the vertical plane. AIM-7 missiles may be fired in this position.

CIR 2

In the CIR 2 position, the rf energy is rotated in a counter-clockwise direction from the vertical plane. Circular 2 polarization is automatically commanded in the BEACON mode, regardless of the position of the polar switch. This polarization is not compatible with the AIM-7 missile and must not be used when firing the missile. An AIM-7 missile will not guide if launched with CIR 2 selected. The cw energy transmitted is 90° out of phase with the AIM-7 missile rear antenna.

Circular polarization tends to minimize clutter from fog or rain while permitting a target return to be received at usable strength. These modes can be selected in an attempt to clear up the scope presentation. However, it is unlikely that any significant indications will be observed

during ground operation.

NOTE

The feedhorn must be nutating to change polarization.

Radar Range Knob

The range knob is used to select a range sweep of 5, 10, 25, 50, 100 and 200 mile ranges on both scopes. The first four positions are the AI (air intercept) positions and when selected, activate a corresponding range light on the range lights panel. The remaining positions select a range sweep of 100 or 200 miles for search or mapping and disables the lockon capability.

On DSCG aircraft all range selections are digitally displayed in the upper left corner on both scopes.

Maneuver Switch

The maneuver switch is used to limit acceleration responses which tend to drive the tracking loop off in range and to remove the limit during air-to-air combat. The LOW G position is used to limit acceleration responses produced by countermeasures and clutter and is the normal operating position. The HI G position removes the LOW G limit function and allows the range track loop to respond to high acceleration rates that may occur during air-to-air combat. During CAA, the HI G function is automatically selected.

Scan Switch

The SCAN switch selects the following antenna elevation scan pattern. In 1 bar scan, the antenna search pattern is unique to one elevation plane and is manually controlled by the elevation thumbwheel (refer to antenna hand control this section). With 2 bar selected, the antenna search pattern is discrete in two elevation planes separated by 3.75° on each successive scan. In boresight, air-to-ground or map modes, 1 bar scan is automatically commanded.

Aspect Knob

The aspect knob is used to provide the AIM-7 missile with a predetermined simulated doppler instead of actual doppler inputs. The positions of this control enable the WSO to approximate the correct missile speedgate location when radar range is not available. After the missile is tuned, the NOSE, TAIL, FWD or AFT positions may be used (as a function of aspect angle) to lock the missile speedgate in the region of the target doppler. After launch, the speedgate unlocks and sweeps a narrow band centered about the simulated doppler frequency. When WIDE is selected, the speedgate begins searching the entire actual doppler spectrum and other doppler inputs are overridden.

NOTE

The aspect knob supplies Vc to the Intercept computer only in BST mode without radar lockon. The WIDE position overrides all other switch settings and locks the missile speedgate in wide sweep even with a full system lockon.

On DSCG aircraft before OFP P005; when NOSE is selected on the aspect knob, target aspect angle (fighter position from target tail) and altitude are displayed in place of the range rate readout. Target altitude is displayed first for 2 seconds, then aspect angle for 4 seconds. Right aspect angles of 0° thru 180° are displayed as 000 thru 180; left aspect angles are displayed as -000 thru -180. Target altitude to the nearest 1000 feet is displayed in hundreds of feet with the last digit always zero; target altitude of 20,000 feet is displayed 200.

NOTE

On aircraft with DVST before OFP P005; with the radar locked on to a target, do not select the NOSE position; erroneous Vc gap readings will result.

On DSCG aircraft after OFP P005; when NOSE, FWD, or TAIL is selected on the aspect knob, target aspect angle (fighter position angle from target tail), target altitude, and target heading is displayed in the upper right corner of the DSCG scopes replacing the range rate readout. Aspect angle readout is selected by positioning the aspect knob to FWD. Target altitude readout is selected by positioning the aspect knob to NOSE. Display of right aspect angles (0° to 180°) is 000 through 180. Display of left aspect angles (0° to -180°) is 000 through -180. Displayed target altitude changes in 1000 foot increments, but is displayed in hundreds of feet (last digit is always 0). For example, a target altitude of 20,000 MSL would be displayed as 200. Target heading is selected by positioning the aspect knob to TAIL. Display is an approximate heading of the target in degrees from 0 to 360. For heading information to be most accurate, aircraft heading must be initialized by radar preflight procedures (BIT 5).

NOTE

On DVST aircraft after OFP P005; the LRU-1 must be notified that the aircraft has a DVST using the procedures under Radar Turnon in section II. If these procedures are not used the NOSE, FWD, and TAIL positions of the aspect knob will give erroneous Vc indications.

Receiver Gain Knobs

The receiver gain FINE and COARSE controls are used to adjust the gain of the radar receiver during search operation. During MAP PPI operation, BEACON PPI, and AIR-GRD they control the STC circuits which determine the extent to which receiver gain is modified as a function of range. They are automatically switched out of the circuit when the system is tracking a target. These controls should be adjusted for best video return (best target display) on the scope during search operation or to control the intensity at the lower part of the scope during MAP-PPI operation.

Track Switch

This switch enables the WSO to perform radar tracking operations manually during heavy clutter environments, or automatically as described below.

MANUAL

When the MAN position is selected, the WSO initiates manual tracking operation when full-action is initiated. In this operation, the target is bracketed with the acquisition symbol and half-action is initiated. The range strobe is positioned in-range from a closing-target and full-action is initiated. Then the manual Vc control is adjusted so that the range strobe and target video are moving at the same rate (refer to MAN Vc control this section).

AUTOMATIC

With AUTO selected, full range and angle tracking operations are accomplished automatically. The maneuver switch may be utilized to correct for changes in target speed which exceed the radar tracking capabilities. (Refer to maneuver switch in previous paragraphs).

AOJ OUT

The AOJ OUT position is used to override the acquisition-on-jamming feature of the radar. For example, if a source of noise or jamming occurs during search that prevents normal acquisition, the source may be used as a target to initiate lockon and automatically begin angle track operations. Placing the switch to AOJ OUT returns the system to a search configuration.

Display Knob

The display knob provides the following display selections.

B WIDE

The B WIDE position is used to select a full width (120°) B sweep during search operations. When half-action is initiated, the B-sweep is under manual azimuth control by the antenna hand control.

B NAR

In the B NAR position, the B-sweep scans a 45° sector which is manually positioned in azimuth by displacement of the antenna hand control.

PPI WIDE

The PPI WIDE position selects a plan position indicator sweep used during the MAP mode to scan a 120° sector.

PPI NAR

The PPI NAR position selects a narrow 45° PPI sweep which may be manually positioned in azimuth through the antenna hand control. The PPI display is drift compensated and is provided with a range cursor for

mapping or bombing purposes. There are no acquisition or lockon capabilities and the receiver gain is under the influence of the STC circuits. This display is automatically excluded in the 5 mile range.

VIS-IDENT (VI)

On aircraft without OFP P005; after air-to-air lockon is obtained the WSO may select the VI display to obtain VI aim dot steering. VI steering provides pure pursuit steering to the target except when range rate exceeds 87 knots and range is less than 6000 feet. In this case, the dot will indicate a veer-off by a sudden jump providing steering to pass to the right of the target until the range rate decreases below 67 Knots. In the rear quadrants, VI steering directs the aircraft to a position directly behind the target. The VI display can be used for close in, visual observation, or for accurate range information in radar trail.

On aircraft with OFP P005; after air-to-air lockon is obtained the WSO may select the VI display to obtain VI aim dot steering. VI provides pure pursuit steering to the target. When the range to the target decreases to less than 1000 feet, the break-X will appear as an anti-collision warning to the pilot. The steering dot will continue to display in those conditions.

If VI is selected during search operations, the acquisition symbol is removed from the VI display. Acquisition and lockon must be obtained using either the RDR or MAP displays. After radar lockon, the Rmax and Rmin/Rmax2 strobes, in range and hold altitude functions are disabled. Before OFP P005; after radar lockon the break X function is also disabled. The interlock switch must be OUT to launch an AIM-7 missile; the SHOOT lights are OFF.

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

)

NOTE

- AIM-7 missile launch in the VI mode should be accomplished only if the BST firing parameters can be met. Erroneous english bias will be supplied to the missile if the BST firing parameters are not met. In the VI mode, the AOA and LOS rate functions are removed from the lead angle error input to the english bias circuits. The BST profile will zero out any english bias errors.
- On DSCG aircraft before OFP P005; with VI selected, a target locked on, and the aspect knob in NOSE, displayed target altitude and aspect angle are in error.

After lockon, both scopes present range and range rate information. The VI range indicator displays accurate range rate inside approximately 12,000 feet and accurate range and range rate information inside 9000 feet. Range rate information is accurate when the range indicator is automatically activated (range pointer jumps from 0 to 9). The minimum range indication is 600 feet.

To operate the radar system in VI proceed as follows:

- a. Perform normal radar lockon procedures to achieve target lockon in the RDR or MAP mode.
- b. When the target is within 5 miles, position the display knob to VI.
- c. Maneuver aircraft to center aim dot. When range decreases to 1.5 miles, observe range indicator for range and range rate information.

Manual Vc Control Knob

The MAN Vc control may be rotated in a clockwise (0 thru 9) direction to estimate the range rate of a closing target in the manual track mode. With an opening range rate, the Vc control is rotated counterclockwise (0 thru 2). To operate the radar in manual track, proceed as follows:

- a. Place track switch to MAN and set MAN Vc control to the estimated range rate by observing target closing or opening rate.
- b. Initiate half-action and spotlight the target, then position the range strobe slightly below the target and initiate full-action (the antenna and receiver gain are under manual control and the complete attack display appears). Initial range is determined by the position of the range strobe, range rate is determined by the MAN Vc control setting.
- c. Adjust the MAN Vc control (if necessary) so that the target video and range strobe are moving in the same direction. When the correct Vc is determined, initiate half-action and place the range strobe directly over the target and initiate full-action and release.

Pulse Switch

The pulse switch is used to control the duration of the transmitted energy (pulse width) and the frequency of the transmit-listen cycle (pulse repetition frequency). The normal operating position is AUTO. During search operations the long (wide) pulse width and low prf is provided in all ranges. During tracking operations, pulse width switching is accomplished automatically as a function of target signal strength and range. Power level mode switching is operative only during automatic tracking, with the pulse switch in AUTO. With LONG pulse selected, the prf is low and the pulse width is wide which tends to increase the maximum detection range (all ranges considered). However, wide pulse reduces the ability to discern two or more targets on the same bearing. The SHORT pulse position selects a narrow pulse width for the AI ranges with a jittered high prf. Short pulse operation increases detection capabilities on close range targets. In the AIR-GND mode, the pulse switch has no effect since short pulse is automatically commanded. The cage mode also automatically selects short pulse operation.

Skin Track Light

The SKIN TRK light illuminates (green) only when tracking with range lockon. When tracking in HOJ or range memory, the light goes OFF. On DSCG aircraft (in addition to the SKIN TRK light) the T symbol illuminates to indicate that the radar is tracking. The T (track) symbol is provided only on the rear scope and is engraved in the scope face plate.

Radar Mode Knob

The radar mode knob is used to select the air-to-air and air-to-ground modes of operation.

RDR MODE

The RDR mode provides air-to-air search operations in all six ranges. Only the AI (5 thru 50) ranges are used for lockon and tracking. During search operations, a horizon line, elevation strobe, and acquisition symbol are displayed. The horizon line provides a constant indication of the aircraft attitude. The elevation strobe indicates the elevation angle of the antenna. The acquisition symbol indicates the position where the range strobe will appear when the action switch is pressed. The B-sweep is a vertical line moving horizontally in synchronization with the antenna azimuth movement. Range and angle tracking in this mode is initiated by acquiring a desired target in range and azimuth through use of the acquisition symbol and the range strobe. The acquisition symbol is positioned in range and azimuth (using the antenna hand control) to bracket the target. Pressing the action switch to half-action commands the radar into the acquisition

mode and causes the antenna to slew to the antenna hand control azimuth position. Using the antenna hand control and elevation thumbwheel, the WSO may adjust azimuth and elevation to obtain the maximum intensity of the target on the scopes. The range strobe, which is present when the action switch is pressed, may be precisely adjusted on the target to set up the initial tracking range. Pressing the action switch to full-action commands lockon. At lockon the radar switches into the track condition. During track operations the radar system generates the attack steering information for the AIM-7 or AIM-9 missile. This mode also provides range information to the sight if GUNS is selected on the throttle.

The following procedures demonstrate radar operations in the A/A search and acquisition modes.

- a. Place the radar power knob to OPR.
- b. Press the OPR/ERASE button (on DVST scope only); set the scope controls for the optimum display.
- c. Position the radar range knob to the desired range position.
- d. Select 1 BAR or 2 BAR scan and position the display knob in B WIDE or NAR.
- e. Adjust the elevation thumbwheel to the sector to be observed and adjust the receiver gain control for a well defined target return.
- f. Observe target range before initiating acquisition. If 100 or 200 mile range is selected, continue monitoring (spotlighting) target and switch to the applicable AI range when the target moves into the acquisition range.

NOTE

In the presence of clouds or clutter, select SHORT pulse. Use the CIR 1 or CIR 2 polarization in the presence of rain. However, if AIM-7 missiles are to be launched, the polar switch must be in the LIN or CIR 1 position.

- g. With the antenna hand control, bracket the target with the acquisition symbol.
- h. Press the action switch to full-action and adjust range strobe as required to lockon.
- i. When the range strobe is precisely on target, lockon occurs automatically and the track display appears.
- j. Release the action switch. Select the AIM-9 or AIM-7 attack display on the guns/missile switch.

ACQUISITION ON JAM (AOJ)

During search, if a source of noise or cw jamming of sufficient strength prevents normal acquisition, the jamming source itself can be used as the target; but only for angle tracking. Acquisition of the jamming source is less desirable because target range is not available. Because of this lack of range information, this method of tracking is useful only for a missile attack.

In acquiring the jamming source, the WSO brackets the azimuth position of the source with the acquisition symbol and presses the action switch to full-action. The system then automatically acquires the jamming source and begins automatic angle track.

HOME ON JAM (HOJ)

During a normal track condition, a target may begin jamming to prevent the radar from continuing normal track. The system then automatically switches to HOJ operation. At this time, angle track is maintained on the jamming source in place of the target, and range track is maintained by operating on the memorized range and range rate that were obtained from the target before the jamming began. The intercept can continue in the normal manner for a missile launch. If the target return reappears on the indicator, the radar can automatically reacquire the target and resume normal tracking. If this automatic action fails, the target can be reacquired by pressing the action switch to half-action, adjusting the range strobe on target with the antenna hand control, and then pressing the action switch to full-action. Normal tracking is resumed when the radar successfully reacquires the target. If the reacquisition is not successful, the system switches to AOJ operation.

NOTE

- In DVST aircraft, the HOJ condition is indicated by the illumination of the HOJ light (rear scope).
- On DSCG aircraft, HOJ is indicated by illumination of the engraved H symbol (in the upper left corner of the rear scope face plate). In addition to this indication, the range rate digits on both scopes flash at 4 Hz and the last digit (which is otherwise always zero) is replaced with the letter H.

MANUAL ACQUISITION AND TRACK

Under certain conditions, it may be desirable to track the target manually. To acquire such a target, the track switch must be placed to MAN, the target bracketed with the acquisition symbol, and the action switch pressed to half-action. The range strobe is positioned just in-range from the target (closing target) and the action switch is pressed to full-action. The MAN Vc control is rotated so that the range strobe remains at a fixed small distance from the closing target. Two options are available in manual track:

- a. Partially aided range track and full manual angle track may be used. This method is preferred in the absence of jamming.
- b. Automatic angle track is the second option.

As long as the jamming persists, the system maintains angle track on the jamming source. If there is no jamming, the range strobe is placed directly over the target to obtain angle track. If the range strobe is allowed to drift away from the target, the antenna servo system will not receive any error information and the antenna may drift off target.

When manual tracking is initiated on DSCG aircraft, observe that the range rate digits begin flashing when full-action is initiated. On the rear scope, observe that the engraved T symbol is not illuminated.

BORESIGHT (BST) MODE

In the BST mode during search and acquisition, the antenna is positioned to 0° in azimuth and -2° in elevation with respect to the fuselage reference line (FRL). The optical sight (depressed 35 mils) is used to aim the antenna at the target by maneuvering the aircraft to superimpose the target within the sight reticle. When the target is present within the B-sweep, the acquisition symbol and range strobe are positioned over the target and full-action is initiated. When lockon is achieved, a complete track presentation is displayed. The pilot may maneuver off boresight; the antenna continues to track the target. If radar lockon cannot be accomplished, the aspect knob may be used (depending on the attack aspect) to preset the simulated doppler applied to the AIM-7 missile. The range interlock circuits are bypassed and the missile may be launched at any time.

To operate the radar system in the boresight mode proceed as follows:

- a. Radar power knob - OPR
- b. Radar mode knob - BST (B-Sweep to 0° azimuth and El strobe to -2° elevation.)
- c. Sight mode knob - A/A, reticle appears at RBL (-2° in elevation and 0° in azimuth.)

NOTE

If AIM-7 missiles are to be launched the missile power switch must be in the CW ON position before missiles can be tuned and launched.

- d. Visually spot the target and maneuver the aircraft to position the target within the optical sight reticle.
- e. When the target is present within the B-sweep, position the acquisition symbol and range strobe over the target and initiate full-action to lock on the target.
- f. Position the guns/missile switch for the munition/attack display required.

CAGE MODE

Once the cage button is actuated by the pilot, the radar is immediately commanded to the 5 mile range, BST mode, with the transmitter ON in short pulse. The lead computing optical sight is commanded to the air-to-air mode if air-to-ground was previously selected. The automatic acquisition button may be actuated as previously described to obtain radar lockon.

If the radar is in an automatic acquisition search mode and the guns/missile switch is in the RADAR or HEAT position, pressing the cage button again terminates the automatic acquisition search, but the radar remains in the cage mode.

If a track condition exists (obtained by automatic acquisition or manually) lock is broken when the cage button is initially pressed, and the antenna returns to boresight when the cage button is released. If the guns/missile switch is in GUNS and the cage button is pressed, automatic acquisition mode is not terminated nor is a track condition broken. The pilot may terminate the cage condition by placing the weapon select knob to the B position or by switching out of the B position. The WSO may actuate the air-to-air button to

terminate the cage condition. Terminating the cage condition terminates automatic acquisition operation but does not cause the system to break lock (manual or automatic acquisition lock).

The cage command does not affect the TV display on the rear scope. A TV display may be selected on the rear scope with a radar display on the front scope. With a CAA lockon, the pilot can view only the radar presentation unless the WSO pushes the air-to-air button.

COMPUTER AUTOMATIC ACQUISITION (CAA) MODE

WARNING

On the ground, actuating the automatic acquisition function simultaneously provides nose wheel steering and automatic acquisition. Therefore, check personnel clear of the nose wheel area if the automatic acquisition function is checked on the ground.

The computer automatic acquisition mode utilizes the high speed digital capability of the ACM computer to control and enhance the target detection and automatic acquisition performance. The antenna scans in elevation at approximately $120^\circ/\text{sec}$ to facilitate target detection.

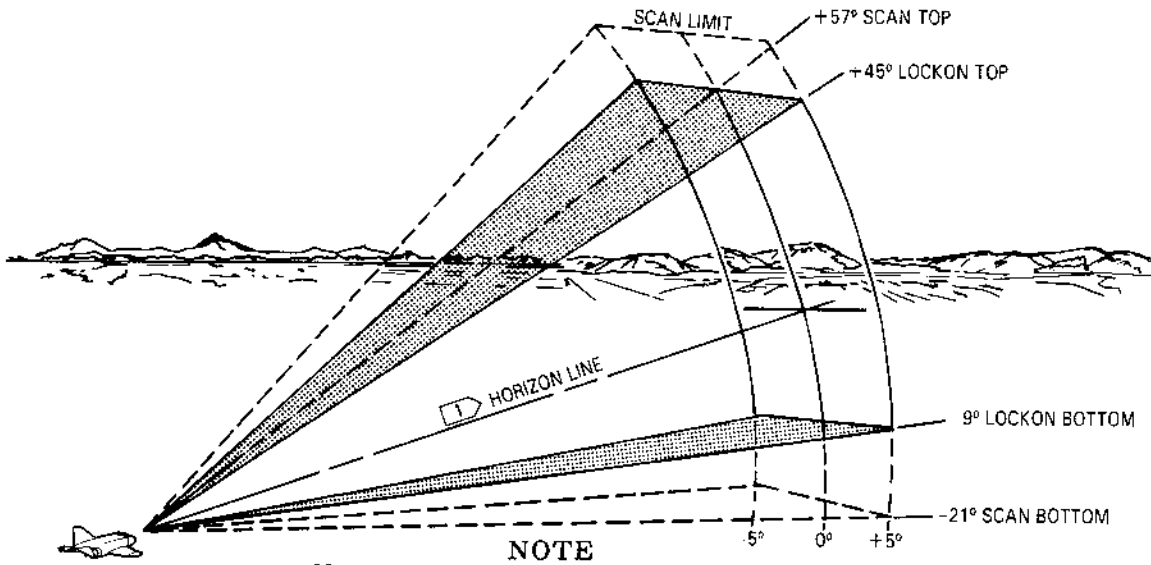
Before OFF P005, the antenna is positioned at 2° left during the upward scan and 2° right during the downward scan. Although the antenna scans from $+57^\circ$ to -21° in elevation and $\pm 2^\circ$ in azimuth (figure 1-12A), actual lockon capabilities are limited by computer software. Because of a necessary buffer zone at the extremes of the scan, lockon is limited to $+45^\circ$ to -9° in elevation and $\pm 5^\circ$ in azimuth. (The azimuth limits are this size because of the nutating radar beam.)

After OFF P005, the lock-on region is in 3 selectable azimuth corridors from -9° to $+45^\circ$ elevation. Each corridor is 3 bars wide with the bars positioned at -5° , 0° , and 5° (figure 1-12A). The center of the corridor is positioned at -15° , 0° , or 15° with the pinky switch.

Dynamic range limiting occurs when the CAA scan sweeps the antenna below the horizon line. This limiting takes into account fighter pitch and roll, and limits according to actual antenna angle below the horizon. Dynamic range limiting (figure 1-12A) reduces clutter problems while permitting automatic acquisitions to occur within the lethal gunnery envelope. Valid area above horizon extends to 5 miles within the scan region.

The ACM computer is used to analyze the radar video for valid target returns in the scan volume. Interference returns such as altitude lines, sidelobe discretions, mainbeam clutter returns, etc., are also present in typical radar video and must be discriminated against. The computer is programmed with various target recognition algorithms to enhance the acquisition of valid target returns while minimizing spurious lockons. It should be noted, however, that aircraft attitudes which minimize radar clutter returns (look-up aspects) also minimize spurious automatic acquisitions.

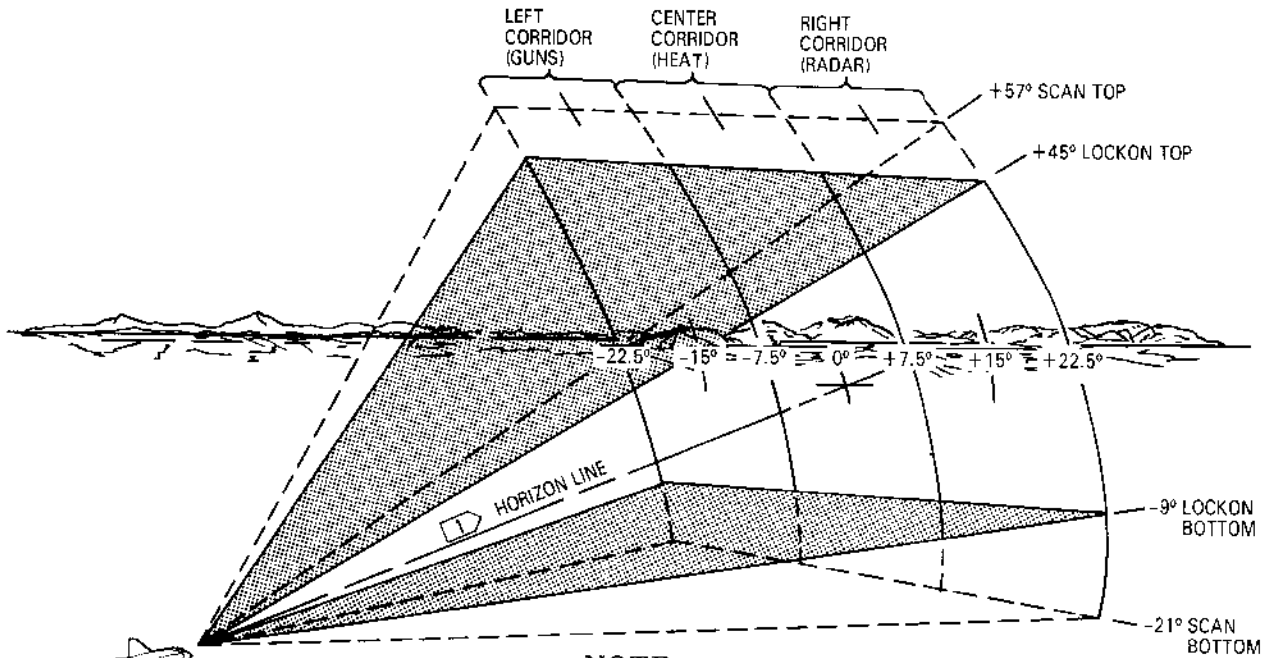
CAA SCAN PATTERN BEFORE OFF P005



NOTE
SCAN IS STABILIZED TO AIRCRAFT COORDINATES. DUE TO COMPUTER SOFTWARE LIMITATIONS, ACTUAL LOCKON CAPABILITY IS LIMITED TO +45° TO -9° IN ELEVATION AND ±5° IN AZIMUTH (ROTATING BEAM).

1 STAB OUT CONDITION WITH HORIZON LINE PRESENT.

AFTER OFF P005



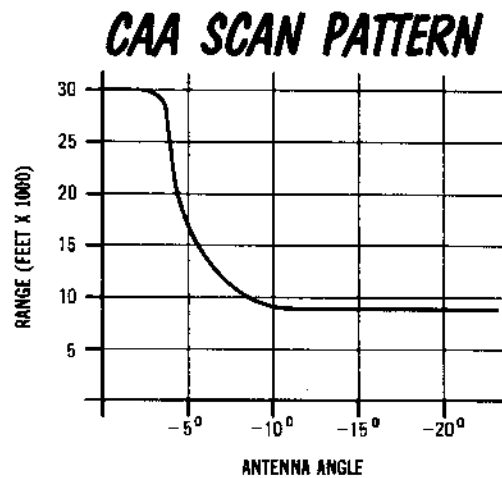
NOTE

- SCAN IS STABILIZED TO AIRCRAFT COORDINATES. DUE TO COMPUTER SOFTWARE LIMITATIONS, ACTUAL LOCKON CAPABILITY IS LIMITED TO +45° TO -9° IN ELEVATION AND ±8° AROUND THE CENTER OF EACH AZIMUTH CORRIDOR (ROTATING BEAM), PROVIDING A 1° OVERLAP. THE 7.5° REPRESENTS CENTER OF OVERLAP.
- AZIMUTH EDGES INCLUDE BEAMWIDTH EXTENSION. COMMANDED ANTENNA POSITIONS ARE 2.5° LESS.

1 STAB OUT CONDITION WITH HORIZON LINE PRESENT.

4E 34-1 1-(308-1)C

Figure 1-12A. (Sheet 1 of 2)



MAXIMUM ALLOWABLE TARGET DETECTION RANGE AS A FUNCTION OF ANTENNA ANGLE BELOW THE HORIZON.

4E-34-1-1-(308-2)C

Figure 1-12A (Sheet 2 of 2)

If the CAA mode attempts to lock on a return that either the radar or aircrew determines to be undesirable, the range of the undesirable return is memorized and any further acquisition at that range ± 200 feet is blanked out for three half-scans of the scan pattern. This feature permits the CAA mode to look for additional targets during the three half-scans without interference from the previously rejected return. Additionally, whenever loss of lock occurs on a return originally acquired with CAA, the range at which lock was broken (± 200 ft) is memorized and blanked out for three half-scans.

Automatic acquisition may be initiated only after pressing the cage button on the throttle and then pressing the auto-acquisition button in either cockpit (except during BIT test). When automatic acquisition is initiated, the range strobe automatically resets to 1000 feet range and the antenna is driven to 0° azimuth and -21° elevation. Only after the antenna reaches this angle $\pm 2^\circ$ does the automatic acquisition mode start. Since CAA is primarily an ACM mode, HI-G maneuver is automatically selected. Additionally, a STAB OUT condition with horizon line present exists during acquisition (no horizon line is present if the stab switch is in the OUT position). Once a track condition exists, control of system stabilization is returned to the stab switch. If a target is not present, the range strobe remains at 1000 feet and the antenna continues to scan.

To use the automatic acquisition mode without OFP P005 installed, the pilot first positions the aircraft to illuminate the target, presses the cage button, then presses the automatic acquisition button. The first antenna scan is at 0° AZ with boresighted targets given acquisition preference. If the target is not acquired within a few scans, or a false target is acquired, the pilot should press the cage button again (GUNS NOT SELECTED), reposition the aircraft as

necessary, and again press the automatic acquisition button.

To use the automatic acquisition mode with OFP P005 installed, the pilot should press the cage button, then select the desired scan corridor using the pinky switch, and then press the auto acq button. If a false target is acquired, the auto acq button should be pressed to reject it.

MAP B MODE

The **MAP B** mode is used during search operations at low altitude where ground clutter is a problem. This mode overrides other controls and places the system in 1-bar scan with linear polarization during search operation. This feature is useful since the antenna beamwidth is more concentrated which results in better target resolution. During acquisition and track operation, control of the polarization reverts to the POLAR switch and the feedhorn nutates.

In the 100 or 200 mile ranges, the spotlighting procedure may be used to position the antenna on the target and manually track the target until the interceptor is within AI range. To operate the radar system in the MAP B mode, perform the same procedures used for RDR modes except select MAP on the radar mode knob and B WIDE or B NAR on the display knob.

SPOTLIGHT

This procedure is a specialized method of search which is used when the radar range switch is placed to the 100 or 200 mile positions and if the target azimuth and elevation position is known. Pressing the action switch to

half-action inhibits automatic search and the antenna can be manually positioned to the target position. Acquisition or lockon cannot be initiated at these ranges. However, when full action is initiated, better target definition can be attained and the target can be manually tracked until within the AI range.

BEACON MODE

In the BEACON mode, the radar receives and displays signals from ground or airborne beacon transponders for navigational information. These signals are interrogated by the radar and displayed on the scopes as a single point with no other targets or ground clutter visible. The information is received in search operation only and may be displayed in B NAR or B WIDE, PPI WIDE or PPI NAR as desired. The search pattern in this mode is identical to the MAP mode, however, acquisition and track operations cannot be initiated because the action switch is disabled.

To operate the radar system in BEACON proceed as follows:

- a. Radar mode knob - BEACON
- b. Radar range knob - AS REQUIRED
- c. Radar display knob - AS DESIRED

AIR-TO-GROUND (AIR-GRD) MODE

The AIR-GRD mode is selectable in AI ranges 5 thru 50 miles. This mode provides radar range to non-discrete targets (moving or stationary targets obscured by ground clutter) along the antenna electrical boresight axis. With AIR-GRD selected, short pulse is automatically commanded and the range strobe is limited to a maximum of 20 miles. The antenna is positioned to RBL and is drift stabilized in azimuth. During an air-to-ground attack, the antenna is pointed at the target by superimposing the target in the optical sight piper. Automatic tracking (in range only) can be accomplished by initiating the normal lockon procedures. Lockon is maintained provided the target remains within the antenna beamwidth. The accuracy of the range signal (slant range) applied to the optical sight depends on how precise the pilot is tracking the target.

To operate the system in the AIR-GRD mode, proceed as follows:

- a. Radar power knob - OPR
- b. Radar mode knob - AIR-GRD
- c. Sight mode knob - A/G
- d. Reduce the receiver gain knob until only one return is visible.

NOTE

The receiver gain is reduced to prevent the viewing and tracking of side lobe return which could yield false air-to-ground range.

- e. Position acquisition symbol in center of return and initiate full-action to lockon and release action switch.

MAP (PPI) MODE

The MAP PPI mode is used in conjunction with the weapon release computer for radar bombing. In the MAP PPI mode, a plan position indicator (PPI) sector scan is displayed and a bombing range cursor is displayed in all ranges except AI 5. An offset cursor is displayed in the 10 and 25 mile ranges (and 50 mile on DSCG). The system has no lockon capability in the MAP PPI mode. The bombing range and offset cursors are automatically positioned by the WRCS.

On aircraft 71-237 and up, the cursors are positioned by the DMAS. (Refer to Weapon Release Computer, this section.) In this operation, the target or an identification point is displayed on the radar scopes and the aircraft is steered by following the display. This mode can be used for radar targets of opportunity, or for planned targets where the approach paths and RIPs are determined before the mission.

To operate the system in the MAP PPI mode, proceed as follows:

- a. Radar power knob - OPR
- b. Radar mode knob - MAP
- c. Radar range knob - ANY EXCEPT AI 5

NOTE

There is no MAP PPI capability in the 5 mile range; the system transfers to a B-type display.

- d. Radar display knob - PPI NAR or PPI WIDE
- e. Adjust the antenna elevation for the desired sector to be observed.
- f. Adjust receiver gain knob for a defined target or initial point.

TELEVISION (TV) MODE

The TV position on the radar mode knob is not used. Refer to AGM-65 description for methods of obtaining the TV display.

NOTE

AIM-7 missiles detune and cannot be tuned when the radar mode knob is in TV.

CONTROL MONITOR PANEL**Test Knob**

The test knob (figure 1-13) is functional with the radar power knob in TEST and is used to perform the BIT check. Each position checks a combination of circuits and programs a scope display. The circuits checked in any position are determined by the specific procedure. Some may be checked in more than one position by use of a different sequence of checks. Some circuits are checked by using more than one position. A complete BIT check is normally performed by the ground crew during maintenance. Aircrew BIT checks are included in section II for DVST and DSCG display systems. These checks are tailored to eliminate unnecessary ground operation time. The following paragraphs describe a more complete acceptance test criteria for the radar system.

NOTE

Prior to performing BIT procedures with the DSCG, check that the control monitor panel Vc switch is positioned down (2700).

TEST 0

The TEST 0 position is normally used when the system is not being tested. However, with the radar power knob in TEST, the regular search display is presented without targets. The B-sweep, acquisition symbol, range strobe, elevation strobe, and horizon line may be checked as follows:

- a. The B-sweep should be scanning either 120° or 45° depending on the position of the display switch. Monitor the vertical length and horizontal scan in all ranges. The horizontal scan fills the unmasked area of the scope within 1/8 inch (B-WIDE selected) and the B-sweep is approximately 3.5 inches. Initiate half-action and check for presence of the range strobe which should be aligned in the center of acquisition symbol. Check that the acquisition symbol moves vertically and limits its motion at top of the sweep by front and rear movement of the antenna hand control. Also, check that the acquisition symbol tracks the B-sweep in azimuth by lateral movement of the antenna hand control.

- b. The horizon line should be approximately 3.5 inches long with the center area blanked out and indicating 0° in roll. Check the horizon line vertical deflection by adjusting the HOR LN control on the forward scope. The minimum deflection should be $\pm 3/8$ inches as the control is rotated; then reposition the horizon line to zero degrees.

- c. Check that the elevation strobe is present on the right side of the scope and is approximately 1/4 inch long. If 2 BAR scan is selected, the strobe will jump at the end of each azimuth scan. There is no jump present if 1 BAR is selected. The manual control of the elevation strobe can be checked by rotating the elevation thumbwheel throughout the entire range. However, 1 BAR scan should be selected prior to this. As the elevation thumbwheel is rotated, check that the elevation strobe

FCS CONTROLS & INDICATORS

CONTROL MONITOR PANEL

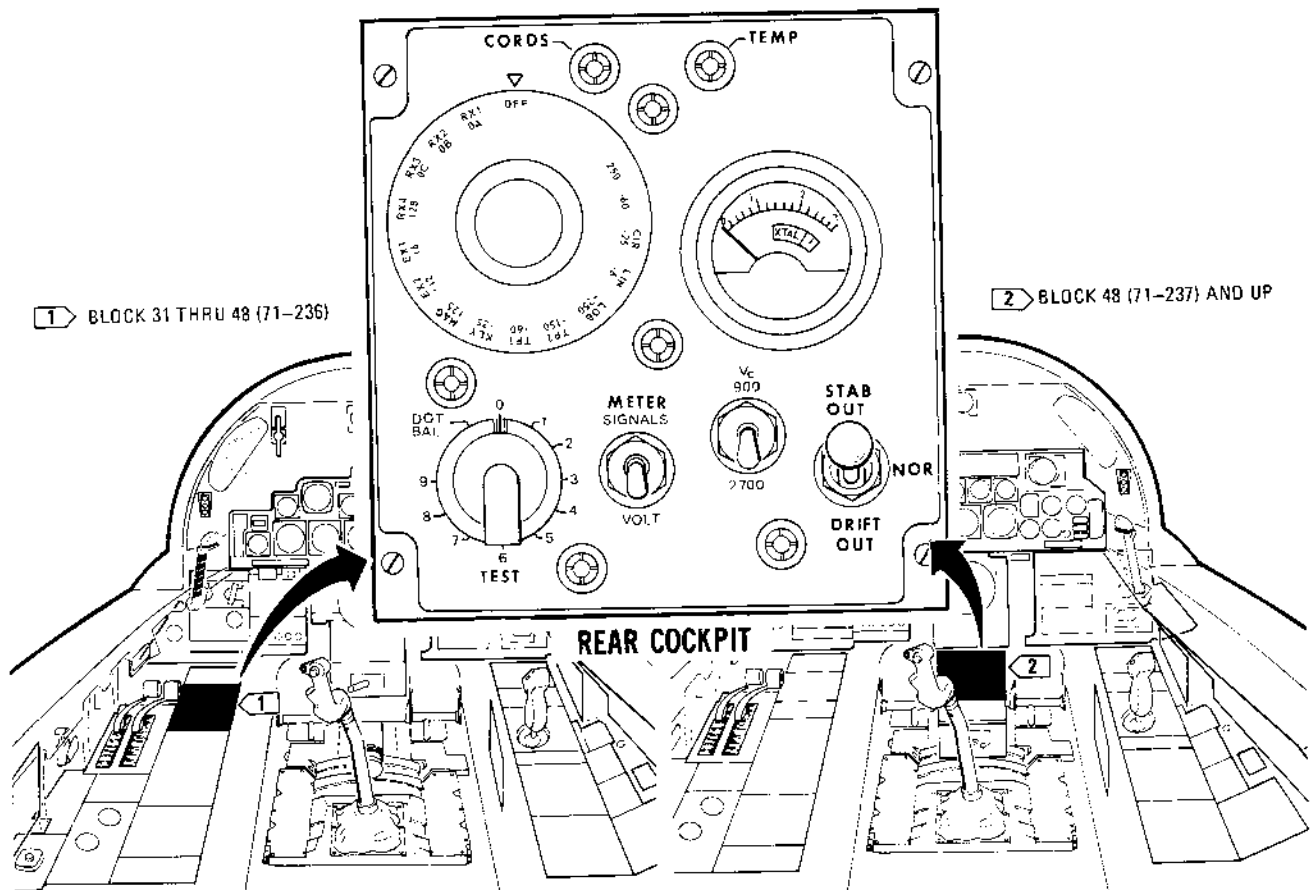


Figure 1-13

4E-34-1-1-(21)A

moves up at least 55° and down 55°.

d. In TEST 0, both scopes may be adjusted for the optimum presentation by setting the respective scope control; the BRT, CONTR, and the PER controls.

DSCG AIRCRAFT. The rear scope mode knob is positioned to RDR BIT to observe that the test grid is displayed. Check that the center azimuth line of the test grid is aligned with the upper and lower zero azimuth scribe lines on the scopes. Adjust the grid control knob, on the rear scope, throughout the full range and observe that the test grid on both scopes varies and can be completely extinguished.

DOT BAL

The DOT BAL position is a momentary position, spring loaded to TEST 0 which may be selected (and held) to provide a full track display. With the radar power knob in STBY and DOT BAL selected, the aim dot, ASE and range rate circle are centered and the range rate circle is approximately 3 inches in diameter. The range rate gap (Vc) is at the 12 o'clock position. With the radar power knob to TEST as DOT BAL is held, the aim dot positions approximately 1 inch down and 1 inch to the left (calibrated area) of center. The Vc gap rotates to the 3 o'clock position.

DSCG AIRCRAFT. The aim dot balance and range rate zero check is performed when DOT BAL is selected with the radar power knob in STBY. In this check, the aim dot is centered in the ASE circle and the range rate is digitally presented in the upper right corner of both scopes indicating 0 ± 20 knots. The aim dot and range rate sensitivity check is performed when DOT BAL is selected with TEST selected on the radar power knob. The aim dot is located down and left of center within the gap in the first range scribe and the range rate indicates 900 ± 50 knots. The DOT BAL position is also used to transfer recorded tactical parameters into the TIRS Memory Unit (refer to Tactical Information Retrieval System, this section).

TEST 1

When TEST 1 is selected, the horizon line moves up and to the right, within the blanked segments of the range and azimuth scribe marks. The B-sweep continues to scan and test targets are visible. With the RCVR GAIN properly adjusted and AUTO pulse selected, a minimum of eleven targets should be displayed. With SHORT pulse selected, a minimum of eight targets are visible (re-adjust the RCVR GAIN control if necessary). Initiate half-action and position the acquisition symbol out beyond the last visible target. When full-action is initiated, the range strobe

sweeps in and locks on before passing the eighth target from the top in SHORT pulse, and before passing the seventh target from the top when AUTO is selected. Lockon is indicated when the skin track light illuminates and the full track display appears. The track display consists of the range rate and ASE circle, aim dot, the Rmax/Rmin strobes and the acquisition symbol which follows the range gate. With the system locked on, note the affect on the number of targets as the RCVR GAIN control is rotated fully ccw (the number of targets does not reduce). Rotate the RCVR GAIN to the full cw position, initiate half-action and repeat the check; the number of targets decrease. Return the RCVR GAIN control to the optimum setting. The B-sweep, range lights (front scope), and range selections can be monitored simultaneously by switching the radar range knob through all the ranges. In this check, the appropriate range light comes ON in the AI 5 thru 50 positions and the test targets (both scopes) appear on the lower portion of the B-sweep when range increases. Also, monitor that the target and noise video is distinct and uniform for all ranges. Align the acquisition symbol between the 2nd and 3rd scribe lines and check that symbol remains at this point while the radar range knob is rotated through the AI positions.

The PPI scan and sensitivity time control (STC) feature may be checked in test 1 by selecting MAP, PPI (wide or narrow) on the radar mode and radar display knobs. Check that the radar range knob is out of the AI 5 position. A PPI sector scan appears which sweeps either 120° or 45°, the acquisition symbol is removed, and the elevation strobe indicates 1 bar scan. The PPI sweep length is approximately 3.5 inches and is shifted 5° to the right with targets visible. As the RCVR GAIN is rotated fully ccw to cw, observe that noise appears at the maximum range and gradually extends to the shorter ranges. Also in this test, the range cursor (bombing strobe) and offset cursors should be displayed (with TGT FIND selected). However, it may be necessary to adjust the RANGE and OFFSET CURSOR INT controls fully clockwise and to rotate the CROSS TRACK and ALONG TRACK knobs on the WRCS cursor control panel. Once the cursors are present, the cursor control knobs may be adjusted to align the cursors as follows:

- a. Move the range cursor to intersect the right edge of the display at approximately 35° down (or in the proximity of the fifth BIT target).
- b. Move the offset cursor to align with the first angular mark to the right of zero azimuth.

When dive toss (DT) is selected, observe the offset cursor removed. When the radar range knob is positioned to AI 5, both scope presentations revert to a B-type presentation. During this test, the computer functions may be checked by positioning the cw transmitter to ON and making a missile selection. This is accomplished as follows:

- a. Radar mode knob - RDR.
- b. Guns/missile switch - RADAR.
- c. RDR MSL power switch - CW ON.

NOTE

The tuned status of the AIM-7 missiles is assured when the RDR lights are ON for at least 1 minute.

- d. Lock on the third test target; the aim dot is stationary and centered within the upper calibration area. The ccw edge of the Vc gap will be at the 3 o'clock position. This is the correct position for the coding/ranging/ASE interlock, and 28 volt delayed computer functions for the AIM-7 missile.
- e. Turn the radar missile power switch OFF.

During TEST 1, the unlock time delay can be established and then used to check the range track memory capability of the system. This check is performed by locking on the second test target, then switching to TEST 0 and monitoring the time it takes the system to unlock. Break lock should occur within 4 to 6 seconds after the SKIN TRK light goes OFF. The range rate circle reduces in size after the SKIN TRK light goes OFF. Return to TEST 1, lockon same target, allow system to stabilize lockon, and switch to TEST 0 for a period of time equal to the unlock time minus 1 second. Observe that the SKIN TRK light goes OFF in TEST 0, illuminates in TEST 1, and lockon is maintained for at least 5 seconds. Repeat this procedure with SHORT pulse selected and check that the same results are obtained.

DSCG AIRCRAFT. When TEST 1 is performed, check that the appropriate range lamps illuminate on the front scope and that the range digit(s) are displayed as the range knob is switched through the range selections. All range selections are digitally displayed in the upper left corner of each scope.

The computer functions of coding/ranging/ASE interlock, and 28 volt delayed for AIM-7 missiles are digitally presented as follows:

- a. Locked on the third test target; the aim dot is stationary and centered within the limit box after lockon and the range rate indicates 900 ± 200 knots.

The DSCG offset cursor is displayed with AI 50 selected on the range knob. Observe that the T symbol, in the upper left corner of the rear scope, is ON and OFF in synchronization with the radar set control SKIN TRK light when the unlock time delay check is performed.

NOTE

When observation of the engraved H and T symbol is required, adjust the rear scope SCALE control knob for adequate brightness.

TEST 2

When TEST 2 is selected, the antenna positions 20° right of center and 40° above center (indicated by the B-sweep and elevation strobe positions). With SHORT pulse

selected and the radar locked on the tenth test target, the system will break lock within 30 seconds after illumination of the SKIN TRK light. Lock on the second test target; the system maintains lock for longer than 30 seconds. Vc gap is at 3 o'clock position if antenna gimbals are within $\pm 6^\circ$ of 20° right and $+40^\circ$ elevation. Aim dot is pegged at upper right edge of display. This is the correct position for computer readouts of head aim when AIM-7 missiles are selected.

Beacon operation may be checked by positioning the radar mode knob to BEACON, the pulse switch to AUTO, and observing that the targets momentarily disappear and at least one test target reappears.

DSCG AIRCRAFT.

Range rate is 900 ± 200 knots if antenna gimbals are within $\pm 6^\circ$ of 20° right and $+40^\circ$ elevation. Aim dot is pegged at upper right edge of display.

TEST 3

When TEST 3 is selected, the B-sweep and elevation strobe move to 0° in azimuth and elevation. In this test, the angle tracking capabilities of the system are checked by locking on a test target. After acquiring the fourth test target, the following is observed:

- The elevation strobe moves down 30° .
- The range rate circle diameter is approximately 2 inches.
- The ASE circle intersects the gap just below center (calibrated area).
- AGC action reduces the intensity of the weaker targets.

The aim dot begins rotating about the center of the scope between the ASE and range rate circles, exceeding neither by more than 1/4 inch. The aim dot rotation may also be monitored when locked on the tenth test target. In this instance, the aim dot rotation is within the ASE circle. These checks can be made with the pulse switch in the LONG and/or SHORT position to observe that the aim dot rotation is not affected. Disregard Vc indication.

The range display check can be made with LONG pulse selected in the AI 25 mile range as follows:

- The fifteenth target is aligned with the third scribe line from the bottom of the scope.
- The fifth test target is aligned with the first scribe line from the bottom of the scope.

Angle tracking is available in the boresight mode. This feature is checked in the same manner as previously described by positioning the radar mode knob to BST.

DSCG AIRCRAFT. In TEST 3, the ASE circle increases to 1.9 ± 0.1 inches in diameter. When locked on the fourth test target, the aim dot rotates between the ASE circle and

the segmented circle on the test grid. As the aim dot rotates, observe that the dot rotation exceeds neither the ASE or segmented circle by more than 1/4 inch. The aim dot rotates inside the segmented circle when locked on the tenth test target. Disregard range rate information.

TEST 4

In this test the HOJ and AOJ features of the radar can be checked by selecting TEST 4 with lockon previously achieved. Observe that all test targets disappear, and that the track presentation is displayed. Relock from HOJ is accomplished by initiating and holding half action. This removes the HOJ indication and the AOJ display is presented which consists of the ASE circle and aim dot. Full manual control of the range strobe is available by movement of the antenna hand control. The radar search display returns as the action switch is released. The AOJ track display is once again presented by initiating full-action. At this time the AOJ override feature may be checked by positioning the track switch to the AOJ OUT position. The track display is removed and the system returns to search.

The computer function checked in TEST 4 is the simulated doppler. With cw power ON, locked on, and the AIM-7 missile selected, the ccw edge of the Vc gap is between 1 o'clock and 2 o'clock. This is the correct position for the simulated doppler readout.

The remaining check (angle track drift) is performed by locking on a test target in TEST 3, switching to TEST 4, and positioning the B-sweep and EI strobe to zero azimuth and elevation respectively. Position the radar power knob to STBY and observe that neither the B-sweep nor elevation strobe drifts more than $\pm 5^\circ$ before break lock occurs. This should occur approximately 4 to 6 seconds after STBY is selected.

DSCG AIRCRAFT. In TEST 4, HOJ is indicated by illumination of the engraved H symbol in the upper left corner of the rear scope. At the same time, the range rate digits on both scopes flash at 4Hz and the letter H is displayed as the last digit. The computer function of simulated doppler (AIM-7) is checked by selecting RADAR on the guns/missile switch. The correct readout is 550 ± 150 knots. However, the last digit is the letter H as previously stated.

CAA elevation scan is checked in TEST 4 with VI display selected. The antenna EI strobe sweeps between $+57^\circ$ and -21° elevation. The dithered B-sweep scans $\pm 2^\circ$ in azimuth.

TEST 5

The TEST 5 position is used to check range rate, lead angle error, and PLMS.

The range rate function is indicated by the ccw edge of the Vc gap at the 12 o'clock position when the AIM-7 or HEAT missiles are selected.

The aim dot and range rate circle follow the filtered target velocity outputs for a stationary 1-mile target. The ASE circle (0.56 inch diameter) represents a 12 ft per second radius for maximum aim dot limit. The aim dot wanders within the ASE circle. Range rate indicates 0 ± 300 knots. Aim dot, ASE and range rate are not a function of missile selection.

The Computer automatic acquisition (CAA) check can be initiated by actuating the nose wheel steering button in either cockpit. CAA lockon is limited to one through four test targets in range. The action switch can be used to break lockon and to acquire lockon. Another feature which may be checked is cage operation. The cage check is performed with the radar power knob in STBY, radar mode knob in RDR, and AI 25 selected. When the pilot actuates the cage button, the radar display appears, the B-sweep and elevation strobe position to 0° in azimuth and elevation, and the AIR-TO-AIR light in the rear cockpit comes ON. Also, the 5-mile indicator on the front scope comes ON. Check that the transmitter is ON and short pulse is automatically selected by monitoring the MAG reading on the control monitor panel (0.9 to 1.15). As the AIR-TO-AIR light is pressed and released, observe that the radar returns to the conditions prior to cage. Position the radar power knob to OPR and lockon. Select GUNS and actuate the cage button. In this instance, the B-sweep and elevation strobe do not position to 0° in azimuth and elevation and the SKIN TRK light remains ON. Press and release the AIR-TO-AIR light, select AI 10 on the range knob, and deselect GUNS. Actuate the cage button and observe that the SKIN TRK light goes OFF, the B-sweep and elevation strobe return to 0° in azimuth and elevation. Return the radar power knob to TEST. The B-sweep and elevation strobe position to 20° right and 40° up respectively and the the RDR MAG indicates 1.4 to 1.8.

The PLMS check is performed by selecting MAP mode, AI 25, and LONG pulse. Lock on the fifth target and check radar MAG current between 1.4 to 1.8. Move the pulse switch to AUTO and check the MAG current drops to 0.9 to 1.15, indicating PLMS.

Continue tests by positioning the radar mode knob to AIR-GND. The MAG reading should indicate that short pulse is automatically selected (0.9 to 1.15). The B-sweep positions 5° left of center and the elevation strobe positions to 0° in elevation. The acquisition symbol is horizontally centered over the B-sweep. Position the antenna hand control in a front and rear direction and check that the acquisition symbol tracks the B-sweep vertically. Lock on the fourth test target and observe that the ASE circle is displayed and the range rate circle is not present.

DSCG AIRCRAFT. The aim dot and range rate follow the filtered target velocity outputs for a stationary 1-mile target. The ASE circle (0.56 inch diameter) represents a 12 ft per second radius for maximum aim dot limit. The aim dot wanders within the ASE circle. Range rate indicates 0 ± 300 knots. Aim dot, ASE and range rate are not a function of missile selection.

After OFF P005, when BIT 5 is selected, and the aspect knob is in the TAIL position, fighter heading is displayed in the Vc gap/range rate window. In order to obtain valid target headings, the fighter heading must be set by reference to a compass. The setting procedure uses the VI posi-

tion on the display knob. When BIT 5, TAIL aspect, and VI are all selected, the fighter heading in the Vc gap/range rate window increments by 10° approximately every 1.5 seconds. When the incrementing value becomes equal to the current fighter heading, VI should be deselected. This will stop the increment and the displayed value will then follow any fighter heading changes ($\pm 10^\circ$).

TEST 6

After OFF P005, in the first 10 seconds of Bit 6 the OFF version number will be displayed in Vc gap or range rate window. For example, OFF P005 will be displayed as about 500 knots.

TEST 6 is used to check AIM-7 attack display and interlocks. Rmax and Rmin positions are not a function of missile selection, but are stationary at 15 ± 1.5 miles and 5 ± 1.25 miles. The aim dot is stationary within the upper calibration area. The ASE circle is fixed in size at 0.56 inches in diameter.

The HOLD ALT light on the forward scope is ON. Initiate half-action and position the range strobe out beyond 14 miles. Position the antenna hand control to range in slowly towards minimum range.

When the HOLD ALT light goes OFF, AIM-7F presence is indicated by Vc at 3 o'clock or DSCG 900 knots with RADAR selected, AIM-7F loaded or simulated, and CW ON or STBY. Vc gap at 12 o'clock or DSCG 000 knots indicates AIM-7E loaded or simulated no AIM-7's loaded, or CW OFF.

With the range strobe between Rmax and Rmin, the IN RANGE light is ON and the SHOOT lights flash. IN RANGE and SHOOT lights are OFF and break X occurs when the range strobe is aligned with Rmin.

The remaining check with TEST 6 selected is performed to check the range and range rate indicator accuracy. In this test the radar display knob is positioned to VI, half-action is initiated, and the range strobe is positioned out to 5 miles. As VI is selected, the aim dot jumps up and to the right and the Rmax and Rmin strobes are not present. Using the antenna hand control, slowly range in towards zero range. Between 3 to 1.5 miles the range indicator on the range rate meter jumps to 9000 feet. Continue ranging in until zero range, then range out toward 1.5 miles. Observe that the range rate indicator shows a negative range while the range indicator moves out in range. Position the TEST knob to position 5 and lock on the first test target. The range indicator reads 6000 ± 400 feet and the range rate indicator reads zero ± 25 knots. Return to TEST 6, position the track switch to MAN, and initiate full-action and release. Rotate the MAN Vc control very slowly from (ccw) through 0 to 1 (cw). The range rate indicator moves from the ccw limit through zero to the fully cw limit.

NOTE

The MAN Vc control must be positioned very slowly for the range rate indicator to read properly.

DSCG AIRCRAFT. When TEST 6 is performed with the DSCG, the range rate indications are as follows:

- a. When the HOLD ALT light goes OFF, the range rate indication is between -430 to -60 knots.
- b. When the IN RANGE light comes ON, the range rate indication is between -150 to 380 knots.
- c. When the IN RANGE light goes OUT, the ASE circle disappears, and the break X appears, the range rate indication is between 1190 to 1370 knots.

During this check, the rear scope T symbol will be illuminated but the radar set control SKIN TRK light remains OFF.

Meter Switch

The meter switch (figure 1-13) is used in conjunction with the meter selector knob and the monitor meter to select either VOLT or SIGNALS for test purposes. With VOLT selected, the meter selector knob may be used to select the various positions used to test the aircraft power and the system power supply voltages. In the SIGNALS position the meter selector knob is used to test the various system current or signals used throughout the radar system.

Meter Selector Knob

The meter selector knob is a sixteen position rotary knob that provides test positions for voltage, current, or signals used by the radar. With the meter switch in the VOLT position, the inner rim of the knob selects a specific voltage for testing. When SIGNALS is selected, the outer rim of the knob selects the various system currents and signals for testing.

Monitor Meter

The monitor meter provides voltage, current and signal indications as determined by a position of the meter switch and the meter selector knob selections.

With the meter switch positioned to VOLTS and with -250 selected on the meter selector knob, the monitor meter indicates in the 1 area approximately thirty seconds after radar turn-on. When the meter selector is rotated to the other selected positions, the monitor meter indicates in 1 area if the voltages are correct. The exception is the +35 position. In this position the meter needle deflects 2.0 or greater for a normal indication.

Selecting SIGNALS on the meter switch and positioning the meter selector knob to RX1, RX2, RX3 and RX4 tests the radar crystals current. Normal indications are registered in the XTAL area. The EX1 and EX2 positions are used to test the electrical frequency control crystals and like the radar crystals, normal indications are in the XTAL area. When MAG is selected, the transmitter magnetron current is tested. During transmitter operation, the monitor meter indicates 0.9 to 1.15 for short pulse operation and 1.4 to 1.8 for long pulse operation. The KLY position on the meter selector knob provides a test of the cw transmitter and the monitor meter indicates 0.25 to 1.25 when the transmitter is radiating properly. The monitor meter indicates in the 1 area when the temperature and pressure interlocks are closed as TP 1 is selected on the meter selector knob. With TP 2 selected, the monitor meter indicates in the 1 area when the

waveguide pressure is normal. The monitor meter needle sweeps approximately 1.5 to 2.8 when LOB is selected, on the meter selector knob, and indicates antenna nutation is present. The LIN and CIR positions on the meter selector knob are selected to provide a linear and circular polarization check of the rf transmitter energy. In these tests, the monitor meter indicates in the 1 area for transmissions which are vertically polarized and when the energy is polarized in a right circular manner respectively. There is no deflection of the needle for transmissions which are polarized in a left circular manner.

Vc Switch

The Vc switch (figure 1-13) is used to select the scale factor for the range rate which is indicated by the Vc gap. The 900 position selects a Vc gap scale factor of 300 knots per 90° of rotation. The 2700 position selects a Vc scale factor of 900 knots per 90° of rotation. A good method of testing this feature is to position the radar power knob to STBY, select MAN on the track switch, position the acquisition symbol to 25 miles and initiate full-action to obtain a track presentation. Adjust the MAN Vc knob to position the ccw edge of the Vc gap to 2 o'clock. When 900 is selected, observe that the ccw edge of the Vc positions to the 6 o'clock position.

On DSCG aircraft, the Vc switch must remain in the 2700 position. The 900 position causes an erroneous Vc display.

Stab Switch

The antenna stabilization switch provides the following functions.

NOR

The NOR position provides inputs of pitch and roll to the radar antenna stabilization circuits. The switch must be pulled out of NOR to select the other positions.

STAB OUT

With STAB OUT selected, the horizon line is removed from the scopes and the system climb, roll and drift servos position to zero - zero (aircraft coordinates). If stabilization is not desired or when normal stabilization is inhibited the STAB OUT position is used.

DRIFT OUT

In the DRIFT OUT position, pitch inputs from the INS system are removed and the antenna utilizes aircraft pitch and roll inputs.

Temp Light

The TEMP light illuminates (amber) to indicate that an over temperature condition exists in the radar nose package. If the light is ON, position the radar power knob to OFF to prevent damage to the system. If operations must continue, a repeated check of the light should be made throughout radar operation.



During hot weather conditions delay radar turnon as long as practical. Damage to the radar or klystron transmitter may occur prior to illumination of the TEMP light.

Cords Light

This light is not used.

DVST RADAR SCOPE, REAR COCKPIT

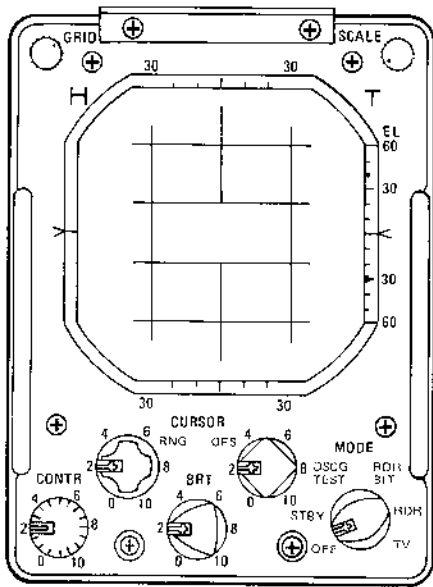
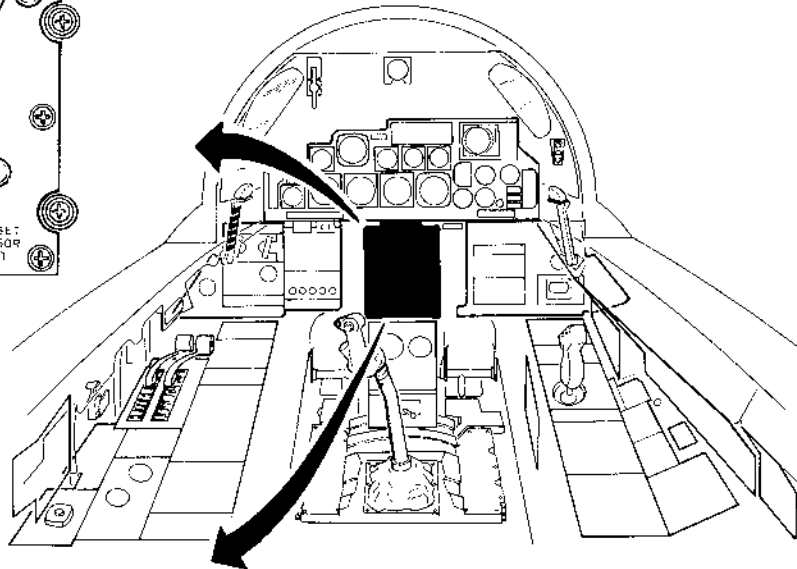
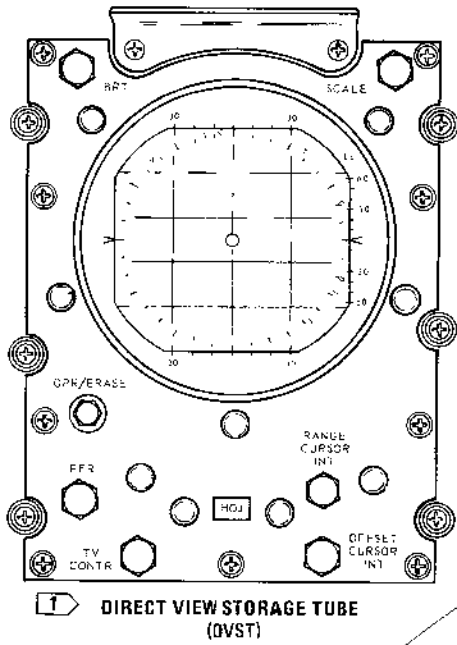
The following controls are located on the rear DVST scope (figure 1-14).

Operate/Erase Button

The OPR/ERASE pushbutton serves a dual function. The first function is to activate the scope after radar turn on. The second is to erase the scope display during search operation by holding the button pressed. During track operation the button has no function. The WSO controls the erasure on both scopes when this button is pressed.

FCS CONTROLS & INDICATORS

REAR COCKPIT RADAR SCOPE



- 1** BLOCK 31 THRU 36
- 2** BLOCK 36 AND UP

Brightness Knob

The BRT control knob may be varied to control the intensity of the radar A and B video.

Scale Knob

The SCALE control knob is used to control the scale marker lighting on the face of the scope. Full ccw rotation turns the light off.

Persistence Knob

The PER control knob is used to govern the time that the radar display will remain on both scopes during search operation.

TV Contrast

The TV CONTR control knob is not used.

Range Cursor Intensity Knob

The RANGE CURSOR INT control knob is used to control the intensity of the range cursor on both scopes during MAP PPI operation.

Offset Cursor Intensity Knob

The OFFSET CURSOR INT control is used to control the intensity of the offset cursor on both scopes during MAP PPI operation.

HOJ Light

The HOJ light illuminates (amber) to indicate that the radar has switched to home-on-jam operation and is using memorized range and range rate information.

DSCG RADAR SCOPE, REAR COCKPIT

The following controls are located on the front of the DSCG scope.

Mode Knob

The MODE knob has positions of OFF, STBY, DSCG, TEST, RDR BIT, RDR, and TV. These positions are used to control the DSCG components as follows.

- a. OFF. The OFF position is used to completely deenergize the DSCG components.
- b. STBY. The STBY position is used to hold the DSCG components in a warm up, no display condition.
- c. DSCG TEST. The DSCG TEST position is used to display a test pattern for checkout of the DSCG components. With DSCG TEST selected, a search display with eight shades of grey is presented to indicate normal operation. Count the background shading as one when this test pattern is displayed. For optimum results, AI 10 mile range should be selected since any other range selection will either expand or contract the pattern making it difficult to determine the number of grey shades.
- d. RDR BIT. The RDR BIT position is used to select a test grid with calibration areas provided for analyzing

radar operations. Refer to DSCG BIT CHECKS in section II.

e. RDR. The RDR position is used to select a radar grid without the test calibration areas. This grid may be presented with the conventional B-scan format or in a PPI sector scan format. The format is dependent on the display knob selection. With the B-scan or PPI scan displayed, the azimuth grid lines represent one fifth of the selected radar range. However, with the PPI sector scan displayed, the grid is fanned out to provide a more linear range representation.

f. TV. The TV position is used to select a TV raster format when EO weapons are aboard. When the TISEO is operating, the TV and WPN selections on the TISEO control panel enable the TV display.

On aircraft 71-237 and up the mode knob is used only to control the scope power. The mode knob must be in STBY to control video through the sensor select panel RDY/SELECT buttons.

Brightness Knob

The triangular shaped BRT control knob is used to control the overall brightness of the scope display.

Contrast Knob

The round shaped CONTR knob is used to vary the video contrast on the scope.

Cursor Control Knobs

The hex shaped RNG control knob is used to control the intensity of the range cursor on both scopes during MAP or BEACON PPI operation. The square shaped OFS control knob is used to control the intensity of offset cursor on both scopes in MAP or BEACON PPI operation.

NOTE

The BRT, CONTR, RNG, and OFS control knobs are provided with digits (numbered from 0 to 10) at the outer perimeter of each knob. These digits provide only a setting point to either increase or decrease the effect of the respective knob.

Grid Control Knob

The GRID control knob is used to control the intensity of the displayed grid.

Scale Control Knob

The SCALE control knob is used to control the intensity of the scope bezel scale lights.

RANGE (VISIDENT) INDICATOR

The range indicator (figure 1-15) displays accurate range rate information inside approximately 2 miles (12000 feet) and accurate range and range rate information inside 9000 feet. Range rate information is accurate when the range indicator is automatically activated (range pointer jumps from 0 to 9). When lockon exists with the radar display knob in either VI, B NAR or B WIDE, the range indicator is enabled to show the radar range in feet and the range rate in knots (opening or closing). When AIR-GRD is selected on the radar mode knob the indicator is disabled.

AIR-TO-AIR LIGHT

The AIR-TO-AIR light (figure 1-15) illuminates (green) to indicate that the cage mode has been initiated. The WSO can terminate the cage condition by pressing the AIR-TO-AIR light. This action causes the AIR-TO-AIR light to go OFF and returns the radar to the conditions established on the radar set control.

AUTO ACQUISITION BUTTON

With the cage mode selected, pressing either automatic acquisition button initiates radar operation as described under Computer Automatic Acquisition Mode, this section.

ANTENNA CONTROL PANEL

Antenna Hand Control

Foreward and rearward movement of the antenna hand control (figure 1-15) manually controls the range position of the acquisition symbol and range strobe during radar search and acquisition.

FCS CONTROLS & INDICATORS

ANTENNA HAND CONTROL, RANGE INDICATOR, SHOOT LIGHT

REAR COCKPIT

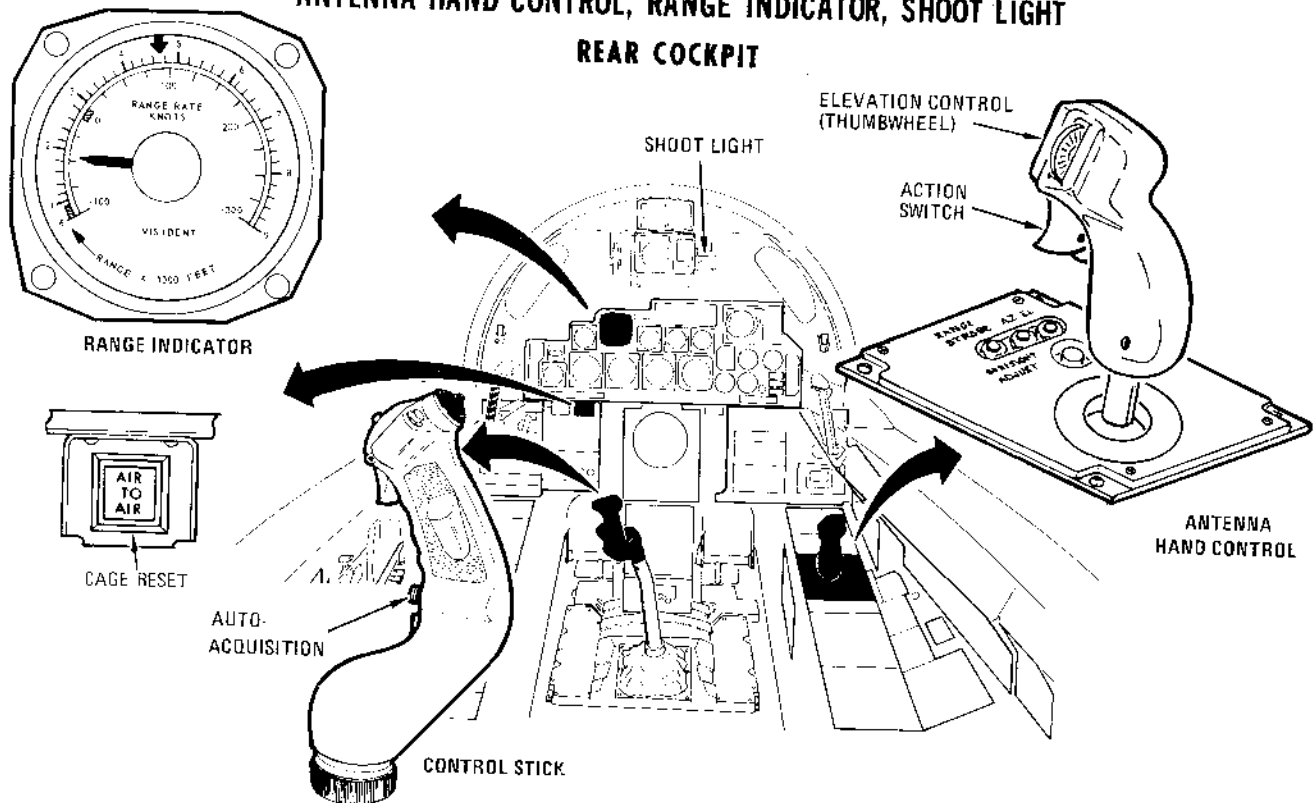


Figure 1-15

4E-34-1-1-123K

Side-to-side movement of the antenna hand control controls the azimuth position of the acquisition symbol and range strobe. During narrow scan, it controls the center of the narrow scan sector within the antenna azimuth gimbal limits. In acquisition and manual operation, it controls the azimuth position of the antenna. The hand control has no effect on the antenna position during wide scan or automatic track.

Antenna Elevation Control

The antenna elevation control is a rotating thumbwheel which controls elevation angle of antenna and elevation (el) strobe in search and acquisition. Rotating the elevation control through its full range causes the el strobe to move at least 50° up and 50° down but is limited to 60°.

Action Switch

The antenna hand control action switch is a three position double detent trigger switch that is used to initiate and reject radar tracking operation. Pressing the action switch to the first detent initiates half action and permits the WSO to manually control the acquisition symbol and antenna (B-sweep) azimuth position. When half action is commanded, the range strobe appears in the B-sweep and is aligned in the center of the acquisition symbol. Moving the antenna hand control in a forward/rearward direction

permits the WSO to position the range strobe vertically. By manipulating the antenna hand control, the range strobe and acquisition symbol can be precisely positioned to isolate a target for lockon. After a desired target is isolated, the action switch can be pressed to the second detent (full action) position to achieve radar lockon. In most cases, it is desirable to position the range strobe over the target prior to initiating the lockon procedure. Once positive lockon is achieved, the action switch may be released. A full track display appears to indicate when lockon is attained. The system may be returned to a search condition by pressing the action switch to half action and releasing. The result is that the track display disappears and the B-sweep begins scanning. The third position is the no action position and involves no specific operator action other than releasing the switch from the half or full action positions.

In DSCG aircraft, the action switch enables hand control AZ/EL commands to the TISEO and AGM-65 missile. (Refer to TISEO description and AGM-65 delivery in this manual.)

NOTE

Action switch radar functions apply only to the AI ranges since lockon capabilities are inhibited in the 100 and 200 mile ranges. However, the spotlight procedure can be utilized to manually track a target in these ranges.

Range Strobe and Boresight Adjustments

The RANGE STROBE and the AZ and EL BORESIGHT ADJUST controls are for use by the ground crew. The RANGE STROBE adjustment is used to adjust the position of the bombing range strobe. The BORESIGHT ADJUST controls are used to adjust the antenna boresight in air-to-ground mode.

RADAR SCOPE, FRONT COCKPIT

The DVST and DSCG front scopes are identical in appearance and operating controls.

Operate/Erase Knob (DVST Only)

The OPR/ERS pushbutton is used to activate the scope after radar turn on. Any subsequent activation will erase the scope display. The control has no function (not connected) on the DSCG scope.

Contrast Knob

The CONTR control is used to vary the displayed video/background contrast.

Brightness Knob

On the DVST scope the BRT control is used to control the intensity and brightness of the A and B display. On the DSCG, the control is used to control the overall brightness of the display.

Horizon Line Adjust

The pilot uses the HOR LN control to vertically center the horizon line on both scopes.

Scale Knob

The SCALE control is used to control the scale light intensity on the scope face plate.

FCS CONTROLS & INDICATORS

FRONT COCKPIT

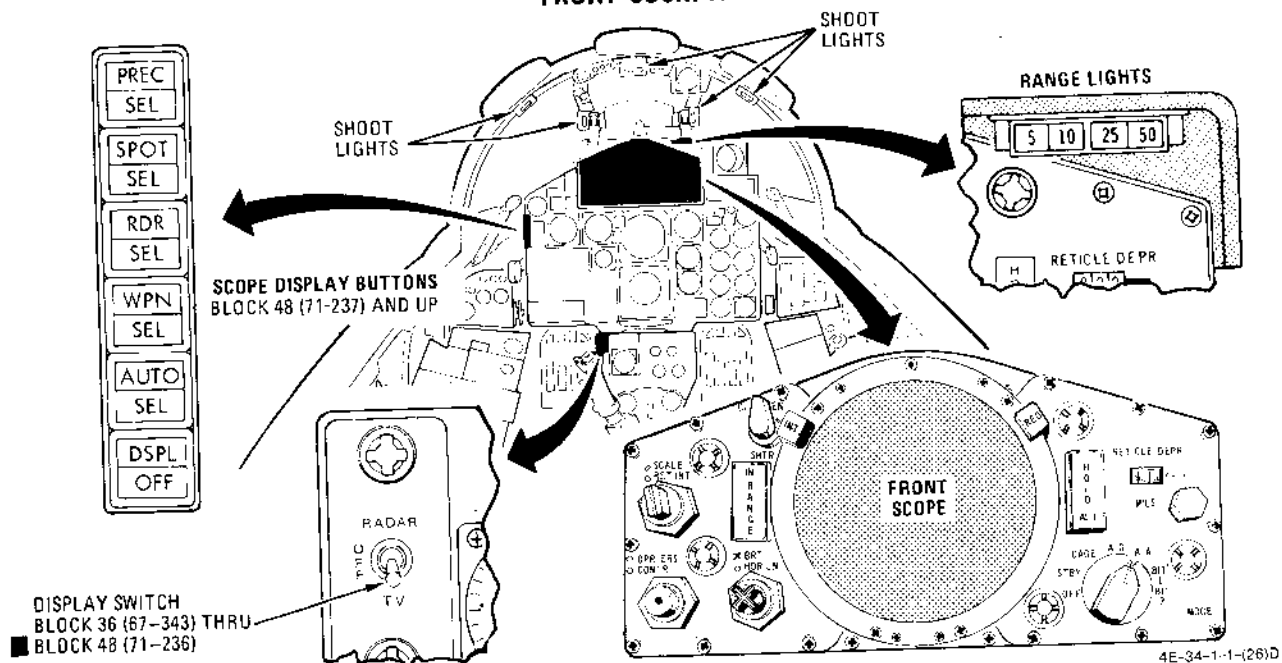


Figure 1-16

INT Tab

The INT tab is rotated ccw to increase the darkness of the radar display without degrading the video presentation. This control permits the pilot to adjust the scope display to the ambient light levels of the cockpit.

Red Tab

The RED tab is rotated cw to obtain a red scope display for night operations.

Hold Altitude Light

The illuminated HOLD ALT light is used while radar range tracking in all modes except VI, BST, and AIR-GRD. This light illuminates when a hold altitude condition has been computed. Refer to Computer Functions, Hold Altitude Light this section.

Shoot/In Range Lights

Five SHOOT lights (figure 1-3) are located in the front cockpit and one in the rear cockpit. The lights are clear and contain no legend and in conjunction with the IN RANGE light, alert the air crew to missile firing opportunities. The control and test features of these lights are

integrated with the flight instrument lights control knob and the warning lights test switch in the front cockpit. When the flight instrument lights control knob is moved from OFF, the SHOOT lights are deactivated and only the IN RANGE light flashes (at reduced intensity) to indicate the target is within missile firing parameter. The flight instrument lights control knob must be OFF to test the SHOOT lights with the warning lights test switch. The SHOOT/IN RANGE lights do not flash when the warning lights test switch is activated. The lights do not operate in VI or AIR-GRD modes.

Scope Display Switch, DSCG

The scope display switch provides independent pilot control of the scope display: OFF, RADAR, or TV (EO weapon).

SCOPE DISPLAY PANEL, DSCG

The scope display panel (figure 1-16) contains six display buttons which are used to independently control the display presented on the front scope.

Display Off

Pressing the DISPL OFF push button disables the front scope and no display is present.

Auto Select

With AUTO SEL pressed, the front scope displays the same presentation selected on the rear scope.

Weapon Select

The WPN SEL push button is pressed to receive and display TV weapon video.

Radar Select

The RDR SEL push button is pressed to display radar video.

Spot Select

The SPOT SEL push button is pressed to obtain TISEO video and selects the spotting (wide angle) field of view. (Refer to TISEO System.)

Precision Select

The PREC SEL push button selects the centers magnified portion of the TISEO display (spotting field of view).

Range Lights Panel

The four range lights (figure 1-16) are illuminated in conjunction with the range selected by the WSO (5 thru 50 miles).

With the DSCG scope, all range selections (AI 5 thru 200) are numerically displayed in the upper left corner of the scope.

RADAR PULSE SYSTEM

The transmitting cycle is initiated within the pulse repetition frequency (prf) generator. The prf generator initiates the starting time of the transmitted pulse, generates the electronic gates which are used to generate video error voltages, starts the scope range sweeps so they are synchronous with the transmitted pulse, and provides a variety of system synchronizing functions. To some extent, the operator has control over the timing or frequency of the triggers and also the characteristics of the transmitted pulse. The following text discusses the various relationships between narrow and wide pulses and how these pulse widths affect the pulse rate and transmit/receive times.

PULSE CONSIDERATIONS

The prf and transmitted pulse width basically depend on the radar switch positions and echo signal strength. Selecting the various switch positions is a manual operation while echo signal strength, as it relates to prf and pulse width, is an automatic operation. Therefore, the combination of manual selection and automatic operation

always provides the operator with optimum radar conditions.

The radar transmits either a wide pulse at low repetition frequencies or a narrow pulse at high repetition frequencies. The pulse repetition frequency and pulse width are important considerations in obtaining optimum results. The low repetition frequency provides a greater time interval between transmitted pulses and therefore has a greater range capability. Conversely, the high prf causes a reduction in maximum range capability because of the shorter time interval between pulses. Therefore, the low prf and long pulse width are used for long range operation and the high prf, short pulse width are used for short range operation.

The minimum range capability is partially limited by the pulse width because the receiver cannot supply an echo signal to the scopes while the transmitted pulse is ON. The pulse width also determines the range resolution. The radar is able to distinguish between targets that are close together during short pulse operation. When range resolution is important, especially at short ranges, the short pulse should be used.

During search operation, the pulse length and repetition frequency is determined by the position of the pulse switch or range knob. During track, the automatic switching circuit or the pulse switch controls pulse length and repetition frequency. With the range knob at 100 or 200 mile position, the low prf and long pulse are selected. In AI search, the pulse switch determines the prf and length. During track, if the pulse switch is in AUTO, the automatic power level mode switching (PLMS) circuits control the selection of prf and pulse length as a function of range and automatic gain control. With the pulse switch in SHORT or LONG, the automatic switching is inoperative and the pulse length corresponds to the position of the pulse switch.

PULSED TRANSMISSION

The circuits associated with pulsed transmission determine the pulse length and repetition frequency, supply synchronizing signals, and generate and transmit pulses of rf energy. A magnetron produces the pulses of rf energy at the selected prf. A waveguide provides the path for the rf energy from the magnetron to the antenna or dummy load. A waveguide switch directs the rf energy to the antenna during normal operation or to the dummy load during test. (The switch is energized by placing radar power knob to TEST.)

CW TRANSMISSION

The cw transmitter produces a modulated CW rf signal for radiation by the radar antenna. This signal provides guidance information for the AIM-7 missiles. The radar (cw) transmitter includes power supplies, a klystron oscillator, modulation circuits, and test circuits. Waveguide components route cw energy from the klystron oscillator to the radar set waveguide and antenna and to other components which develop pseudo and rear signals. The pseudo and rear signals are routed by coaxial cabling to signal horns which radiate the signals to the missiles.

(After TO 1F-4-1424, the pseudo doppler signal is deactivated). With the radar power knob in any position except OFF, the missile power switch controls operation of the cw transmitter. Placing the missile power switch to CW ON starts the klystron transmitter. Operation can be monitored on the control-monitor panel.

STANDBY OPERATION

With engines at idle and generators ON, the radar power knob may be positioned to STBY. Approximately 30 seconds after turn on, full power is applied throughout the radar system and the low voltage power supply (LVPS) power circuits are activated. At this point, the control monitor panel can be used to functionally test the voltages. An additional 2.5 minute delay is required for the power to be conditioned for normal operation. Full system operation can be initiated after approximately 3 minutes by positioning the radar power knob to OPR. The TEST position can also be selected to perform the BIT functions.

The radar power knob may be positioned to OPR or TEST prior to completion of the 2.5 minute time delay. However, full radar operation cannot be initiated until the power supplies reach their rated output and until certain components are preheated. Therefore, to ensure proper sequencing of radar system components, the 30 second and 2.5 minute time delays are automatically provided.

TRANSMITTING

Pulse transmission is the propagation of a series of high powered pulses of rf energy into space. This is accomplished by turning the radar transmitter ON and OFF very quickly. The frequency of this cycle is referred to as the pulse repetition frequency (prf). After each pulse transmission, enough time must be allowed for the energy to travel to and return from the most distant target. Therefore, the prf determines the maximum range of the radar. The duration (width) of the transmitted pulse influences the radar range and resolution. Wide pulses contain more energy and increase the maximum range. However, range resolution is limited with a wide pulse. (Resolution is the ability to discern small differences in range when two or more targets appear on the same bearing.) In addition, the minimum range is determined by the pulse width because the transmission must be completed by the time the return echo is received. Either a short or long pulse may be employed depending on the range and the pulse selections. The short pulse is 0.4 microseconds in width and is used for short range target detection. The long pulse is 2 microseconds wide and is used for long range target detection. Operation of the transmitter can be monitored on the control monitor panel. With SIGNALS selected on the meter switch, the monitor meter can be rotated to MAG to check magnetron current during pulse transmitter operation. The meter indicates 0.90 to 1.15 for a short pulse condition and 1.4 to 1.8 for long pulse condition.

EMERGENCY CONSIDERATIONS

Loss of video can be caused by the malfunction of various radar components; one is a transmitter failure. Transmitter operation can be verified by positioning the meter select switch to SIGNALS, the monitor select knob to MAG, and observing the monitor meter.

If the failure is caused by a loss of transmitter operation and if the loss is caused by the pressure or temperature interlock, operation may be restored by placing the radar power knob to EMER.



Operation in EMER may cause internal damage to the system.

NOTE

When EMER is selected, a red flag appears from under the power knob, which is an alert for maintenance personnel that EMER operation has been used. The flag cannot be reset without dismantling specific components.

Operation of either transmitter without adequate pressurization may damage the feedhorn assembly. Any damage degrades detection and tracking capabilities of the radar and reduces the range of effective guidance for the AIM-7 missile. Continued operation without adequate pressurization may burn the feedhorn and prevent further use of the radar. Operation without proper cooling or without allowing proper warm-up time can also damage the radar. The protective circuits are designed to shut off the transmitters when necessary to protect the equipment. None of the pulse transmitter protective circuits shut off operation of the cw transmitter. Therefore, if the pulse transmitter is shut off by the action of the protective circuits, the cw transmitter should be shut off immediately and not operated unless missiles are to be fired, and then it should be turned on only when necessary.

PROTECTIVE CIRCUITS

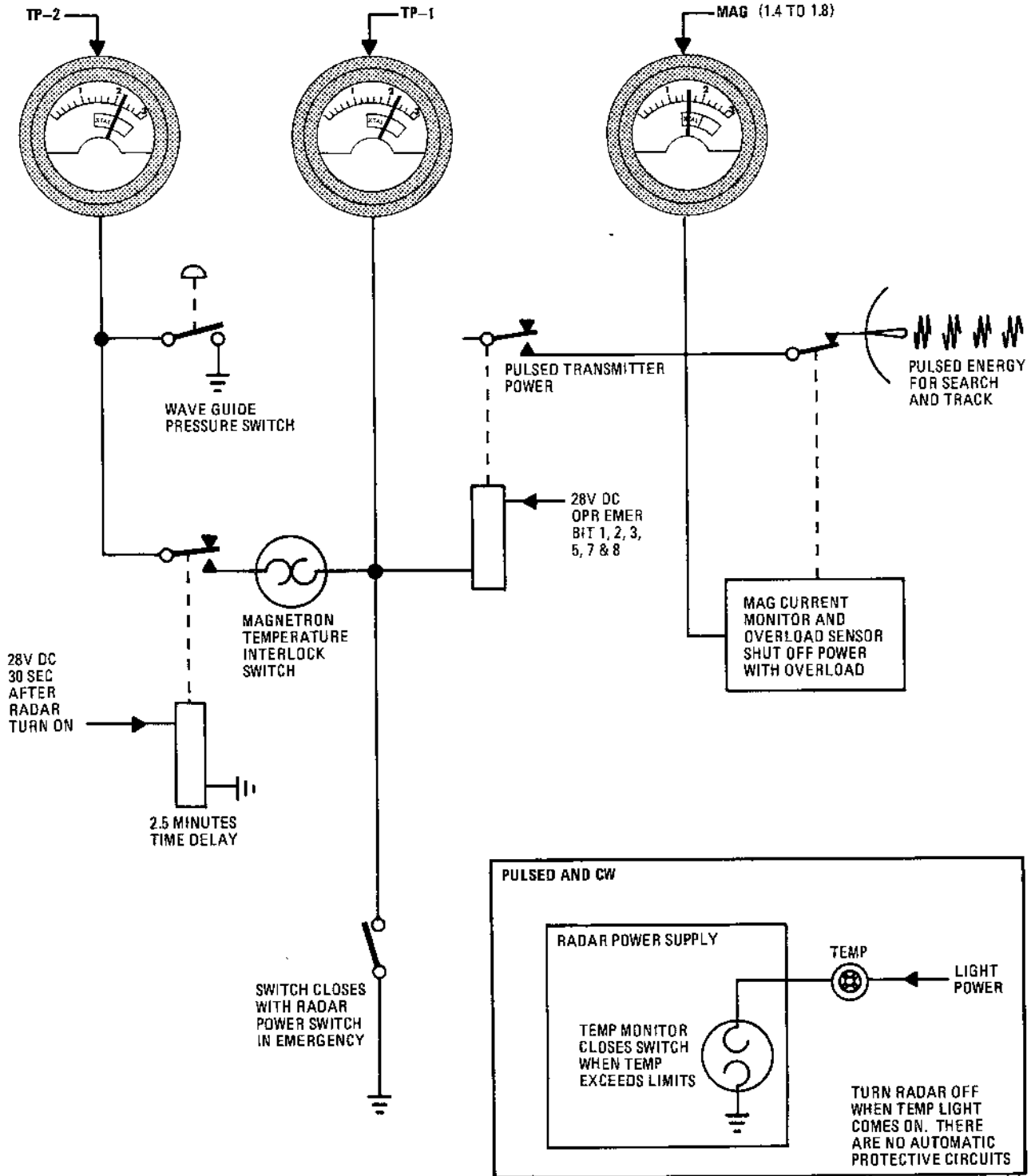
A filament voltage regulator, a regulator board, temperature interlock, pressure interlock, a 2.5 minute operate power delay relay, a high voltage spark gap, and associated circuits provide the major protective devices for the pulse transmitter.

The regulator board shuts the transmitter off in response to either an excessive load current or a misfiring of the magnetron. If the overload or misfiring is intermittent, the circuit automatically resets with little or no noticeable change in operation. If overloads occur frequently, (four or five times in quick succession) the transmitter will stay off until it has been manually reset by switching the radar power knob to STBY and back to OPR.

The pressure and temperature interlock switches and the 2.5 minute time delay relay are in series and in the ground path for the pulse transmitter power relays. If either switch opens, or the relay fails to energize, the prf trigger is removed from the high voltage circuits, turning the

FCS PROTECTIVE CIRCUITS

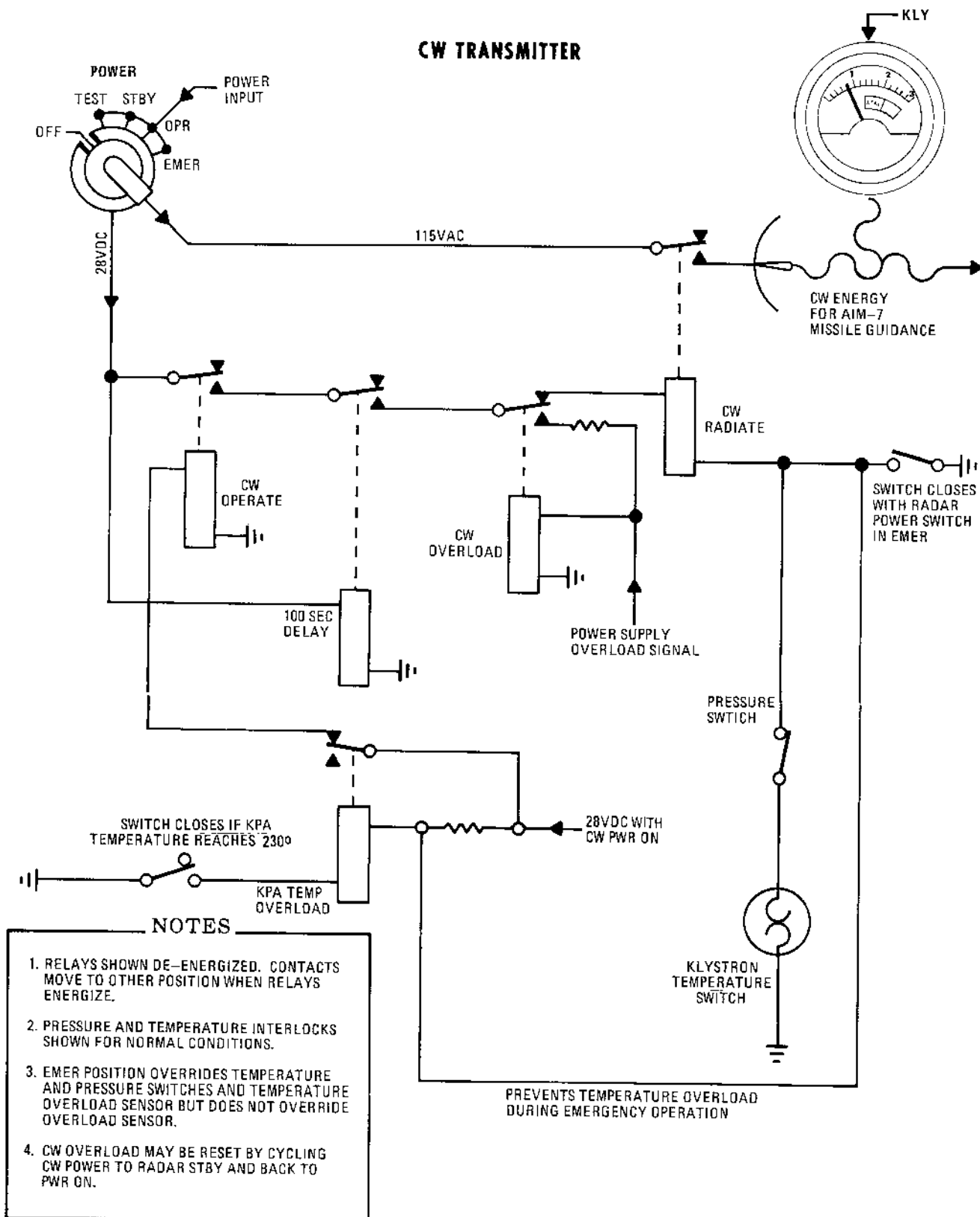
PULSED TRANSMITTER



4E-34-1-1-128-11

Figure 1-17 (Sheet 1 of 2)

FCS PROTECTIVE CIRCUITS (Continued)



4E-34-1-1-(28-2) A

Figure 1-17 (Sheet 2 of 2)

pulse transmitter off. The pressure interlock switch opens if the pressure inside the radar receiver-transmitter falls below 12 psia. The temperature interlock switch opens if the temperature gets above the safe limits. The delay relay is deenergized for the first 2.5 minutes after the system is turned on. All three of these interlocks turn the pulse transmitter off with the radar power knob in TEST or OPR. These three (pressure, temperature, and time delay) are overridden when the radar power knob is in EMER position. See figure 1-17.

The protective circuits for the cw transmitter include a thermal switch, a pressure switch, a klystron beam current monitor circuit, and a klystron collector temperature monitor circuit. These protective circuits interlock the high voltage relays and remove power from the cw transmitter. The thermal switch removes high voltage if the internal temperature of the cw transmitter exceeds 250°F. The pressure switch removes power if the pressure inside the case of the cw transmitter drops below 12.25 psia. The beam current monitor removes power if the beam current becomes excessive (300 to 360 milliamperes) and the temperature monitor circuit removes power if the collector temperature exceeds 446°F. The EMER position of the radar power knob overrides all of the protective circuits for the cw transmitter except the beam current.

With the radar power knob in any position except OFF, standby power is supplied to an elapsed time meter and the filaments of the cw transmitter.

After a 100-second delay, power is applied to the control portion of the high voltage circuits. High voltage cannot be applied to the klystron until the missile power switch is turned ON. If the 100-second delay is timed out, power is applied to the high voltage supply through current limiting resistors. The limiters are removed from the circuit 115 milliseconds after the 100-second delay times out or after the cw power switch is turned ON, whichever occurs last. The 115 millisecond delay starts operation at a reduced power to protect the tube against turn-on surge currents.

The EMER position of the radar power knob overrides protective circuits for both the pulse transmitter and the cw transmitter. Operation of either transmitter without adequate pressure or cooling may damage the radar set and should be avoided except in emergency conditions. However, mission requirements may require that the protective circuits be overridden. If so, the EMER position should be used. Under these conditions, the transmitters should be used as little as possible to complete the mission.

The EMER position does not override an overload in the cw power supply caused by excessive beam current. If an overload occurs, the cw transmitter is automatically turned off and held off until the cw overload relay is reset by cycling the missile power switch to RADAR STBY and back to CW ON.

ANTENNA SYSTEM

The radar antenna concentrates and reflects the transmitted energy, provides a receiving surface for the returning echo, and supplies angular information relative to aircraft vs target.

ANTENNA STABILIZATION

The radar antenna is space stabilized to maintain an established angle with respect to the horizon despite changes in pitch or roll attitude. Either the INS or the ARBCS provides pitch and roll data to stabilize the antenna.

The PRIM/STBY switch determines which reference system is used. In the PRIM position, the INS system provides pitch, roll, and drift information to the radar system. With STBY selected, the ARBCS provides pitch and roll information to the radar system. The reference system can be checked by observing the horizon line when the PRIM/STBY is switched between positions. In this check, the horizon line should not differ more than 1° in pitch and roll between the positions.

On aircraft 71-237 and up, with the PRIM/STBY switch in PRIM, the DMAS provides pitch, roll, and drift information to the radar system.

The radar antenna is space stabilized when the STAB switch on the control monitor panel is positioned to NOR or DRIFT OUT. The antenna scans in a plane horizontal to the horizon regardless of aircraft pitch and roll maneuvering. The vertical position of the antenna is displayed by the EL strobe with reference to the horizon. The horizon is 0° on the EL scale. In radar search and in auto track, the elevation angle is measured from the center of the radar beam to the horizon line. Refer to figure 1-18.

With STAB OUT selected on the STAB switch, the horizon line symbol is removed from the scope display and the radar antenna scans in a plane horizontal to the wings of the aircraft. The vertical position of the antenna is displayed by the EL strobe with reference to the RBL (0° on the EL scale). In radar search and in auto track the elevation angle is measured from the center of the radar beam to the RBL.

NOTE

In AIR-GRD and BST radar modes, the RBL is the EL scale zero reference line regardless of STAB switch position.

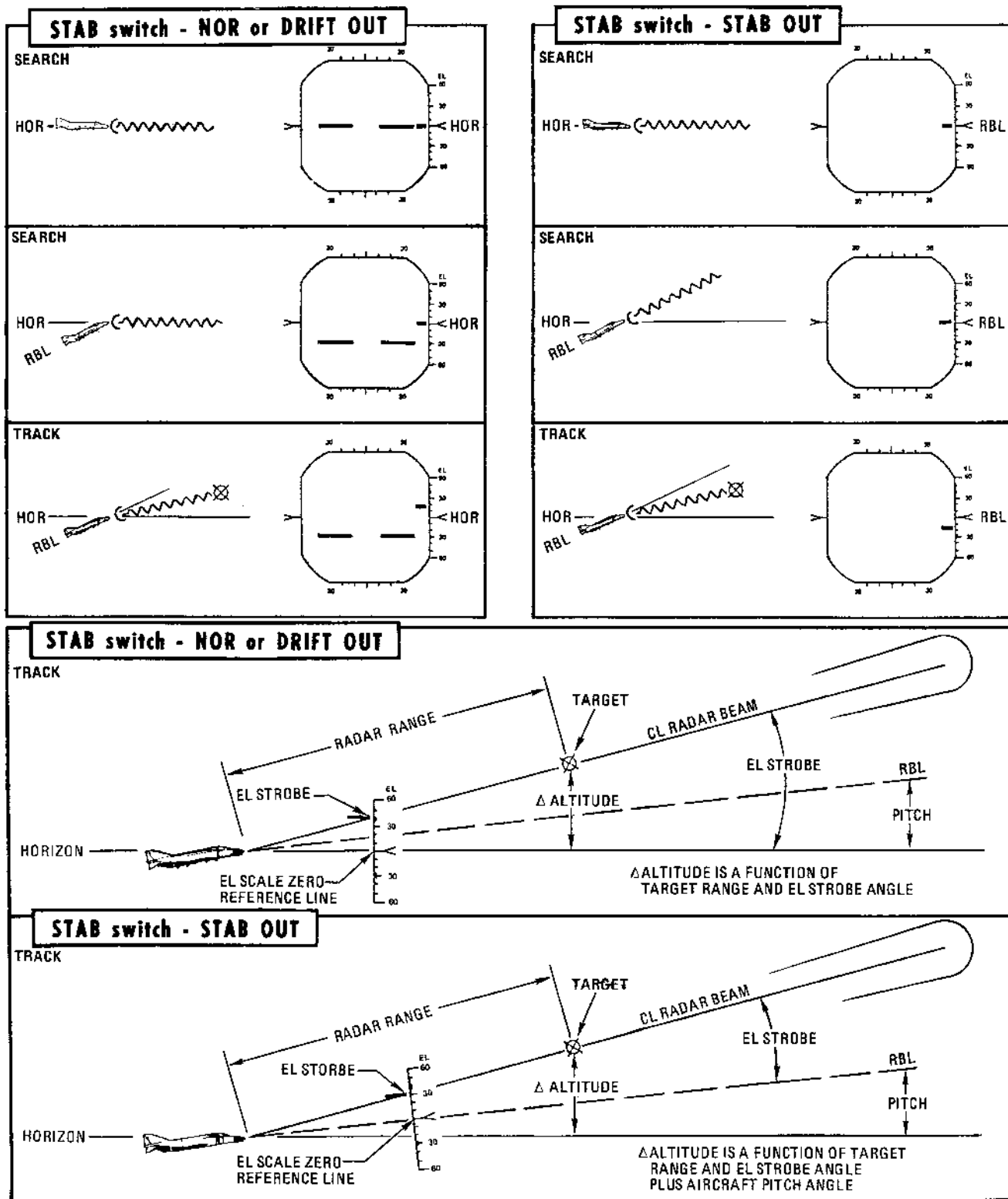
When CAA mode is selected, a STAB OUT condition with horizon line present exists during acquisition. (The horizon line is not present if the stab switch is in the OUT position). Once a track condition exists, control of system stabilization is returned to the stab switch.

Antenna and EL Strobe Positioning

During search, the thumb wheel controls antenna elevation position which is indicated by the EL strobe (figure 1-18). During track, the thumb wheel is disconnected. The EL strobe continues to indicate antenna elevation position as the antenna follows the target. When lockon is broken, the antenna returns to the position selected by the thumb wheel. If the WSO selects half-action during the 5-second memory, the antenna retains the elevation and azimuth position assumed

RADAR ANTENNA STABILIZATION

Thumbwheel Input = ZERO

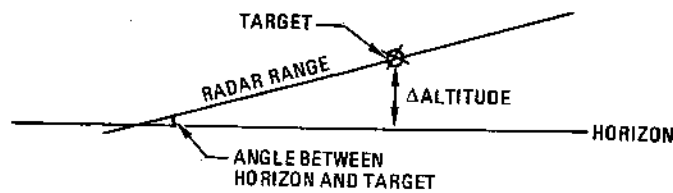
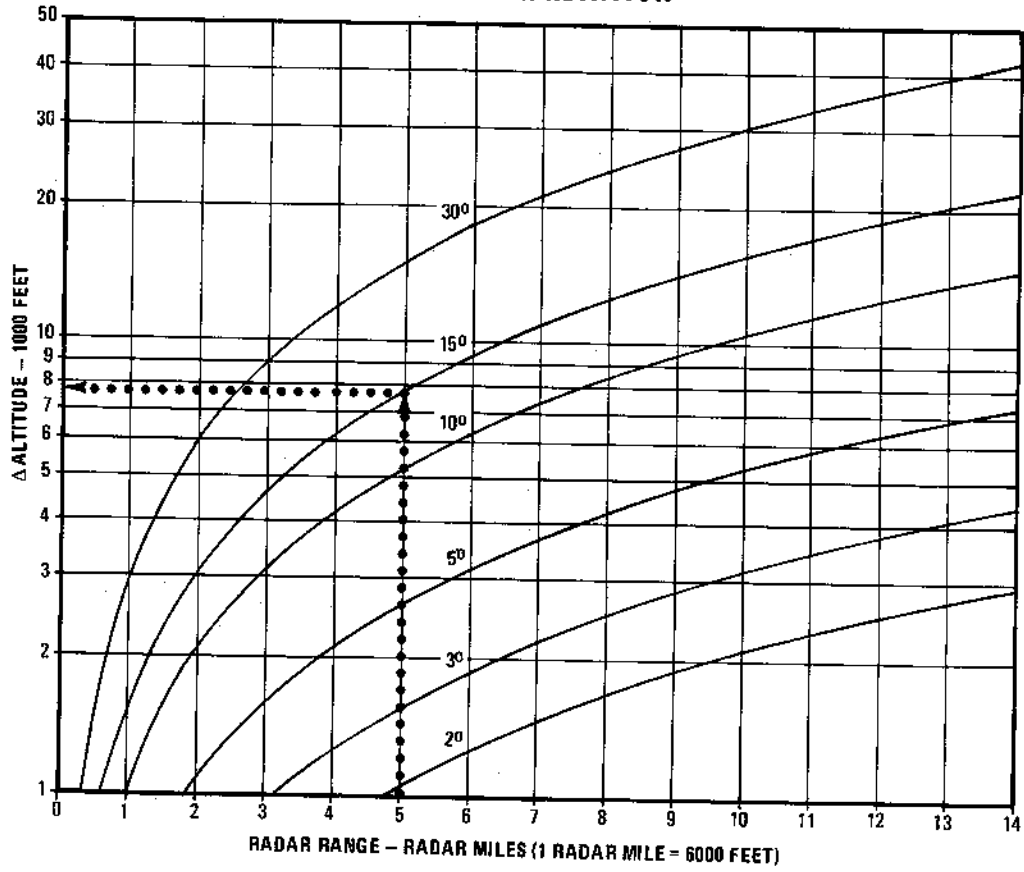


4E-34-1-1-(29-1)

Figure 1-18 (Sheet 1 of 2)

RADAR ANTENNA STABILIZATION (Continued)

EL STROBE INTERPRETATION



NOTE

WITH STAB OUT, ADD AIRCRAFT PITCH ANGLE TO EL STROBE ANGLE.

Figure 1-18 (Sheet 2 of 2)

during track for as long as half-action is used, and the hand control controls only the range strobe position. Relock is then obtained by positioning the range strobe over the target and selecting full-action.

El Strobe Interpretation

The aircrew can determine the approximate vertical distance of the target (Δ Altitude) using information supplied by the el strobe and the known target range. With stabilization selected, Δ altitude is a function of antenna elevation angle and target range. For example: el strobe indicates 15° above horizon, the aircraft is in a 5° climb angle, and target range is shown to be 5 miles; therefore, Δ altitude is approximately 8,000 feet.

With STAB OUT selected, Δ altitude is a function of antenna elevation angle plus aircraft pitch angle and target range. For example: el strobe indicates 10° above RBL, the aircraft is in a 5° climb angle, and target range is 5 miles; therefore, Δ altitude is approximately 8,000 feet. Note that the aircraft pitch angle must be added to the antenna elevation angle indicated by the el strobe when computing Δ altitude with STAB OUT selected. Refer to figure 1-18.

NOTE

The EL scale is not calibrated to indicate aircraft pitch angle by the position of horizon line.

ANTENNA RADIATION PATTERN

The pulse transmitter generates rf pulses of proper duration, amplitude, frequency, and prf which are propagated into a pressurized waveguide that is coupled to the antenna system. The energy is radiated into a parabolic reflector which focuses the energy into a highly directional concentrated beam which is reflected forward into space. The direction of the beam is determined by the position of the reflector. Two basic radiation patterns are available which are referred to as the nutating and non-nutating pattern. The nutating pattern is accomplished by offsetting the antenna feedhorn and applying a spinning motion at the base of the feedhorn. The speed of the feedhorn is not constant since the drive changes every $1/4$ second at 4 cycles per second between the limits of 52 to 67.8 cycles per second. Nutating the feedhorn increases the main beam width from 3.7° to 6.7° which is required for angle track. However, nutation is also used in acquisition and some search modes. Changing the nutation speed as previously described reduces the possibility of losing angle track because of jamming. For a list of conditions in which feedhorn nutation is utilized, refer to figure 1-19.

The nutating beam provides accurate tracking information by comparing the returns as they appear in the individual lobes. Figure 1-19 illustrates a single target at two positions within the nutating beam. When the target is at No. 1 position, the target echo appears in the receiver as an amplitude modulated signal. The amount of amplitude modulation is proportional to the amount of target angular displacement from the center of the radar beam. This amplitude modulated signal (composite error signal) is routed to the tracking circuits and converted into an antenna drive voltage. The antenna drive voltage

moves the antenna to No. 2 position. With the antenna in No. 2 position, there is no further modulation envelope, and thus no further antenna movement. If the target moves away from the center of the radar beam, an error signal is again generated to move the antenna back over the target.

The non-nutating beam is useful at long ranges (100-200 miles), provided the azimuth and elevation of the target has been established or is generally known. The non-nutating beam will provide maximum signal reception when the operator stops automatic search and positions the antenna on the known target. This procedure (spotlighting) concentrates maximum rf energy for target illumination. Neither acquisition nor track can be initiated during this spotlight condition. With the feedhorn in a non-nutating condition, the beam width is much narrower at the longer ranges, resulting in much better resolution.

Antenna Polarization

The polarization of the radiated energy is determined by the position of the quarter-wave plate in the feedhorn. The position of the plate is controlled by the POLAR switch when operating in the radar mode. Either linear or circular polarization may be selected. The LIN position is the normal position and the polarization is vertical. This position provides the best detection under normal clutter conditions. In the CIR 1 or CIR 2 positions, the rf energy is rotated in a clockwise or counterclockwise direction from vertical. These positions may be used to improve detection during weather or clutter conditions. During search in the MAP mode, the polarization is linear regardless of the POLAR switch position. However, if Half Action or Full Action is selected, the feedhorn will be polarized as selected with the POLAR switch. In the BCN mode, CIR 2 polarization is automatically commanded.

Operation of the quarter-wave plate and polarization may be monitored on the voltage monitor panel. Except for AIM-7 missile operation, the switch position is optional, with the best position being the one that provides the best detection. CIR 2 position is not compatible with AIM-7 missile operation.

NOTE

Due to the polarization of the AIM-7 rear antennas, only the LIN or CIR 1 positions can be used when the AIM-7 missile is to be launched.

ANTENNA MOTION

The radar antenna is hydraulically driven and electrically controlled. The control may be provided automatically or manually. The specific control operation depends on the mode of operation. Automatic or manual operation is possible in both search and track. Automatic operation is provided by the antenna positioning circuits. Manual operation is initiated by the action switch and controlled by the antenna hand control.

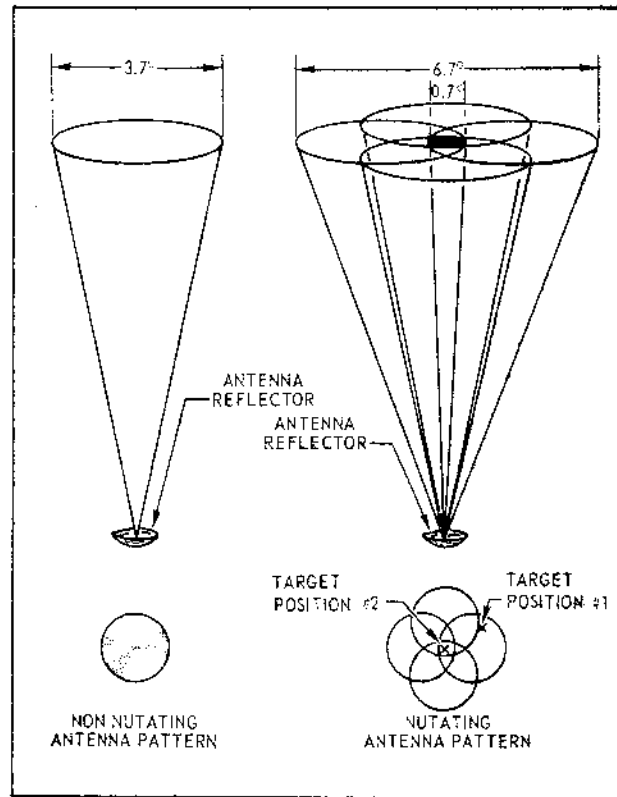
Automatic search operation is partially under manual control. The elevation control wheel determines the center of the elevation scan area. The position of the SCAN switch determines whether the elevation coverage will be

RADAR ANTENNA PATTERNS & NUTATION

RADAR MODE VS NUTATION

MODE KNOB	RANGE KNOB	ACTION SWITCH POSITION	NUTATION	
			YES	NO
RDR, BST, or AIR-GRD	ALL	Release	X	
MAP	ALL	Release		X
RDR or MAP-B	A1	Half Action	X	
		Full Action	X	
	100	Half Action	X	
		Full Action		X
	200	Half Action	X	
		Full Action		X
MAP-PPI	ALL	Half Action or Full Action		X
BST or AIR-GRD	A1	Half Action	X	
		Full Action	X	
	100	Half Action	X	
		Full Action		X
	200	Half Action	X	
		Full Action		X

TYPICAL NUTATING & NON-NUTATING RADAR BEAM



4E-34 1-1-(30)

Figure 1-19

1-bar to 2-bar scan and the position of the DISPLAY switch determines the width of the scan.

The three basic operations of the antenna may be classified as search, acquisition, and track. These classifications are arbitrary with individual judgement determining when one ends and the other begins. Acquisition is a transitional stage between search and track. Manual operation may sometimes be considered search or track, depending upon the intent of the operator. Again arbitrarily, manual search is manual operation with a search display and manual track is manual operation with a track display.

Automatic antenna positioning is controlled by the scan pattern generator during normal radar search operation and by the angle track positioning circuits during automatic track operation. As the antenna moves, it provides signals representing this motion (position and rate). These signals are used to synchronize displays (B-sweep and el strobe) on the radar scopes so that the antenna position can be determined from either cockpit.

Automatic Search

During automatic search, the antenna moves back and forth, illuminating targets and receiving reflected signals within the scan area. Two azimuth and two elevation scans are available during radar mode. The antenna scans an azimuth of 120° in wide scan and 45° in narrow scan operation as selected by the DISPLAY knob.

The RDR and MAP modes are the primary modes used during automatic search operation. In RDR mode, two elevation scans are available. The SCAN switch selects either 1-bar or 2-bar elevation scan. In MAP mode, elevation scan is always 1-bar and the feedhorn does not nutate during automatic search. Without nutation, the elevation angle of coverage is approximately 3.7°. With nutation (RDR mode) single bar scan, the elevation coverage is approximately 6.7°. With 2-bar scan, the antenna jumps 3.75° in elevation at the end of the scan. Because of this jump and feedhorn nutation, the antenna elevation coverage is 10.45°.

In BST or AIR-GRD modes, the antenna scan is stopped and aligned along the longitudinal axis of the aircraft. These two modes are used for other purposes and are not normally considered as search modes.

In the MAP mode, either a B-display or a PPI-display may be selected. A mapping display of the terrain ahead of the aircraft is provided. The feedhorn does not nutate and elevation coverage is always one bar. Acquisition and lockon are possible with the display knob at B NAR or B WIDE and antenna scans as selected by this knob. With the display knob in any other position, lockon is not possible.

If the TV mode is being used in DSCG aircraft, the radar, except for the radar scopes and indicator circuits, is not used. The radar is actually placed in a STBY mode. In DVST aircraft, if the WSO selects TV on the radar mode knob, the antenna is deliberately positioned 20° to the right and 40° up from the aircraft centerline.

NOTE

AIM-7 missiles detune and cannot be tuned when the radar mode knob is in TV.

The BEACON mode can also be used during search, but requires a special application. (Refer to BEACON mode under Special Applications.)

Manual Search

During manual search, the antenna position is controlled by the antenna hand control and the elevation control wheel. Manual search is initiated by the action switch. When the switch is pressed, the antenna comes under manual control. The half-action position prevents lockon and the full-action position provides lockon capability in AI ranges. Either position may be used for manual search. Normally, the half-action position is used. But under certain conditions it is desirable to use full-action; i.e., to eliminate feedhorn nutation and further concentrate the radar beam in 100 or 200 mile ranges.

Acquisition

Acquisition is possible in the RDR, BST, MAP B, or AIR-GRD modes. Antenna motion during BST and AIR-GRD modes is the same as during search. Antenna motion is acquisition during RDR and MAP B modes is controlled manually.

Acquisition is accomplished by pressing the action switch. At this time, the antenna immediately moves to the azimuth position commanded by the antenna control and to the elevation position commanded by the elevation control wheel.

The initial phase of acquisition is manual search. The feedhorn nutates and the antenna is controlled manually. When the desired target is selected, track operation can be initiated by pressing the action switch to full-action. (Radar must be in AI range.)

Track

During automatic track operation, the antenna movement is controlled by the angle track error signal. This signal is developed within the radar set. As the target moves off center from the radar beam, an error signal is detected and used to drive the antenna back over the target. In the RDR and MAP-B modes, the antenna tracks the target from the angle information that has been derived from the changes in target amplitude and the range information derived from the radar pulse. The antenna continues to track the target as long as sufficient signal strength is available at the receiver.

During manual angle track operation, the antenna movement is controlled by the position of the elevation control and the antenna hand control. When the track switch is at manual, manual track operation is obtained by pressing the action switch to full-action and releasing.

In the AIR-GRD mode, the antenna is positioned along the longitudinal axis of the aircraft and provides slant range to the target.

In the BST mode, the antenna is positioned along the longitudinal axis of the aircraft. If auto acquisition lockon occurs, the antenna will leave boresight and track the target in range and angle.

RECEIVING

The transmitted pulse is reflected off the target, received by the antenna, and reflected back into the antenna feedhorn. The received rf energy is directed down the waveguide through the electronic switch and into the rf receiving circuits. The rf section of the receiver can be checked by placing the monitor switch to the EX or RX positions and observing the monitor meter. Indications should be in the XTAL range.

RECEIVER GAIN CONTROL

The receiver gain establishes the best video display regardless of the target environment. Target environment includes both jamming interference and heavy clutter areas. There are several circuit applications whereby optimum receiver conditions are controlled. However, only those controlling factors which are of prime importance to the aircrew will be covered in this discussion.

Automatic Gain Control (AGC)

The automatic gain control (AGC) feature controls the gain of the receiver to provide video signals of a predetermined amplitude to the radar tracking circuits. When the system is tracking a target, the AGC circuits sample the amplitude of the target return and then adjust the gain of the receiver to provide the proper signal amplitude. During tracking operation, the video is amplified relative to target range. This ensures that the video level is controlled only by the target being tracked. Otherwise, a strong target at the same heading as the desired target might reduce the receiver gain where the desired target return would be lost in receiver noise.

The AGC system also provides the means whereby the receiver can detect jamming signals and thus initiate Acquisition-on-Jam (AOJ) and Home-on-Jam (HOJ) operation. These two receiver characteristics are covered in the Radar Operation (Air-to-Air) section under their respective titles.

Manual Gain Control

Manual control of the receiver gain is made during search and manual track by adjusting the COARSE and FINE receiver gain controls. The receiver gain control knob is used to control the contrast between target return and background interference (or target-to-noise contrast). If the gain is set too low, excellent contrast will result. However, the radar detection range is degraded. If the gain is set too high, detection range is again degraded because the target may be lost in the noise. Receiver gain is partly operator preference, which develops through experience. Normally, the gain should be set where the background interference (noise) appears as random specks on the scope. The manual gain control circuits are switched out of the circuit when the radar locks on a target.

Sensitivity Time Control (STC)

There is no specific switch available to the aircrew labeled STC. However, when the radar mode knob is in MAP and the display knob is in PPI, the RCVR GAIN controls adjust the STC. STC is also available in auto acquisition, air-to-ground, and beacon PPI modes. The STC varies the gain of the receiver as a function of range or time. Immediately after the transmitted pulse, the STC provides a relatively low receiver gain which gradually increases at an exponential rate until maximum gain within the limits of the receiver has been achieved.

PULSE WIDTH VS RECEIVER CHARACTERISTICS

The operator has the choice of either a wide or narrow band radar receiver. If the pulse select switch on the radar set control panel is set at SHORT, the transmitted rf emerges from the radar magnetron as short bursts of rf energy, and the linear amplifier in the receiver is switched

to wide band. With the PULSE switch set at LONG, the transmitted rf is a wide burst of rf, and the receiver is switched to narrow band. If the pulse switch is set at LONG, the radar system will retain the long pulse, narrow band operation despite target signal strength which would normally cause the radar to switch over to a narrow pulse. This automatic switching is called power level mode switching (PLMS).

PLMS SWITCHING

Power level mode switching is a function of AGC and radar range. PLMS is the automatic process of switching the radar from long pulse to short pulse receiver operation when the combination of target echo strength and range are sufficient to maintain track with short pulse operation. This switching occurs only when the pulseselect switch is in the AUTO position. Short pulse is automatically commanded in AIR-GRD mode from the radar mode switch, and in auto-acquisition, regardless of the position of the pulse select switch but this is not PLMS.

DISPLAY SYSTEM

The display system is the communication link between the fire control system and the aircrew. The system provides visual attack mode displays based on the radar mode and/or the munition selected on the throttle guns/missile switch. With the DVST, both crew members receive the same attack mode displays. With the DSCG, the aircrew may individually select radar or TV video.

DVST

The DVST display is provided by using three electron guns. One of the electron guns provides low velocity electrons which are used to flood the entire viewing area. The other two guns (A and B) are high velocity guns with sharply focused electron streams. The A and B guns penetrate the storage surface of the DVST and allow display of the signals. All symbols are displayed by controlling the deflection and intensity of the A and B guns. A detailed explanation of these circuits is included in TO 1F-4E-2-19.

DVST DISPLAY SYMBOLS

The following paragraphs describe each symbol in relation to figure 1-20.

a. Range Strobe. The range strobe is an intensified portion of the B-sweep and is present during acquisition and track.

b. Rmax Strobe. The Rmax strobe is a short horizontal line that is displayed directly above the Rmin strobe to the left of the B-sweep during all range tracking modes except VI or AIR-GRD. Rmax indicates maximum missile launch range.

c. Acquisition Symbol. The acquisition symbol is two short vertical lines and is displayed in all AI ranges during search and acquisition in all modes except VI, MAP-PPI or BEACON PPI. The acquisition symbol also is present over the range strobe during air-to-air track. The acquisition symbol position is controlled by the antenna hand control.

d. Rmin Strobe, before OFP P005. The Rmin strobe is a short horizontal line that moves vertically along the left side of the B-sweep when range tracking in all modes except VI and AIR-GRD. In the ACM mode the Rmin strobe indicates minimum launch range for the selected missile. In the LRI mode, the strobe indicates Rmax2, a no-escape Rmax for a target that does an 8-G turn away followed by constant speed flight.

Rmin/Rmax2 strobe, after OFP P005. The Rmin/Rmax2 strobe is a short horizontal line below the Rmax strobe during track operations. The Rmin strobe indicates minimum launch range for the AIM-9 in MISSILE mode. For AIM-7, the lower strobe represents Rmax2 a no escape Rmax for a turn-and-cruise target. Rmin/Rmax2 and Rmax strobes are displayed in all range tracking modes except air-to-ground and VI. After an AIM-7 launch, the strobe also displays the missile range until hit or until it reaches the Rmax strobe.

e. Dithered B-Sweep. The dithered B-sweep is a widened B-sweep presented in acquisition, track, boresight, and air-to-ground.

f. Horizon Line. The horizon line is a broken straight line (part of it blank) displayed in all modes except when the stabilization switch on the control-monitor is at STAB OUT. The horizon line is always parallel to the horizon except during certain BIT functions.

g. Elevation Strobe. The elevation strobe is a horizontal line, 1/4 inch long, at the right side of the scope. It is always present and indicates the antenna elevation angle.

h. Offset Cursor. The offset cursor is a vertical line displayed in the 10 or 25 mile range in MAP PPI or BEACON PPI as a bombing reference. Display and position is controlled by the WRCS.

i. Aim Dot. The aim dot is displayed during radar track. The relationship between the dot and ASE circle indicates the attack steering requirements. Before OFP P005, the aim dot position is computed for two environments: Long Range Intercept (LRI) and Air Combat Maneuvering (ACM). Refer to Computer Functions, this section.

j. Allowable Steering Error (ASE) Circle. Before OFP P005, the ASE position and size are computed for two environments, LRI and ACM. After OFP P005, the ASE circle position and size are computed according to the missile launch envelope. Refer to Computer Functions this section.

k. Break X. Before OFP P005, an X is displayed at minimum missile launch range while range tracking is in any mode except VI or AIR-GRD. In LRI mode and at the computed minimum firing range of the missile, the SHOOT lights go OFF and break X appears on the scope. In ACM mode, the break X is inhibited and does not appear except to indicate a computer malfunction. A continuous break X indicates a computer malfunction.

After OFP P005, the break X is displayed at a minimum launch range to indicate that the attack mode should be discontinued. Break X indications, in conjunction with the front scope IN RANGE light are a function of the radar computer. The break X is not displayed in air-to-ground modes. It will display when range is less than 1000 feet in VI mode. In MISSILE mode and at the computed minimum firing range of the missile the SHOOT lights go OFF and break X appears on the scope. A continuous break X in MISSILE mode indicates a computer malfunction.

l. Vc Gap. The Vc gap is the blanked portion of the Vc or range rate circle. The Vc gap indicates opening or closing range rate when range tracking. Scale factor depends on Vc switch position.

Before OFP P005, erroneous Vc gap indications are avoided by, not selecting NOSE on the aspect knob during radar track.

After OFP P005, the LRU-1 must be notified that the aircraft has a DVST using the procedures under Radar Turn-on in section II. If these procedures are not used, the NOSE, FWD, and TAIL positions of the aspect knob will give erroneous Vc indications. If BIT 6 is selected, the OFP version number is displayed by the Vc gap for the first 10 seconds.

m. PPI Sweep. The PPI sweep is displayed in MAP PPI, or BEACON PPI as an azimuth-range presentation of radar information in polar coordinates.

n. Range Rate Circle. The range rate circle is approximately 3.25 inches in diameter during normal radar range track. During range track memory, HOJ, or manual range track, the size decreases to 1.9 inches in diameter.

o. Bombing Range Strobe. The bombing range strobe appears as an intensified arc in the MAP PPI or BEACON PPI modes and in all ranges. The strobe is used as a fixed range reference in bombing operations, or as a positionable range cursor in WRCS target find or offset bomb modes.

p. B-Sweep. The B-sweep is the vertical range line in all modes except MAP PPI or BEACON PPI and indicates azimuth angle of the antenna.

DSCG

The DSCG (aircraft 67-343 and up) is comprised of the front and rear radar scopes and the Indicator Control Unit (ICU). The ICU contains all of the circuitry necessary to convert electro-optical sensor data into a TV format. The ICU also produces all the fire control symbology and generates the alphanumeric numbers displayed on each scope. The scopes accept the radar or electro-optical inputs and provide a raster display on a cathode ray tube. Radar information can be displayed in the following formats: radar B-scan, search, acquisition and track, and a PPI display. A detailed explanation of the DSCG circuits is provided in TO 1F-4E-2-19.

DVST DISPLAY SYMBOLS

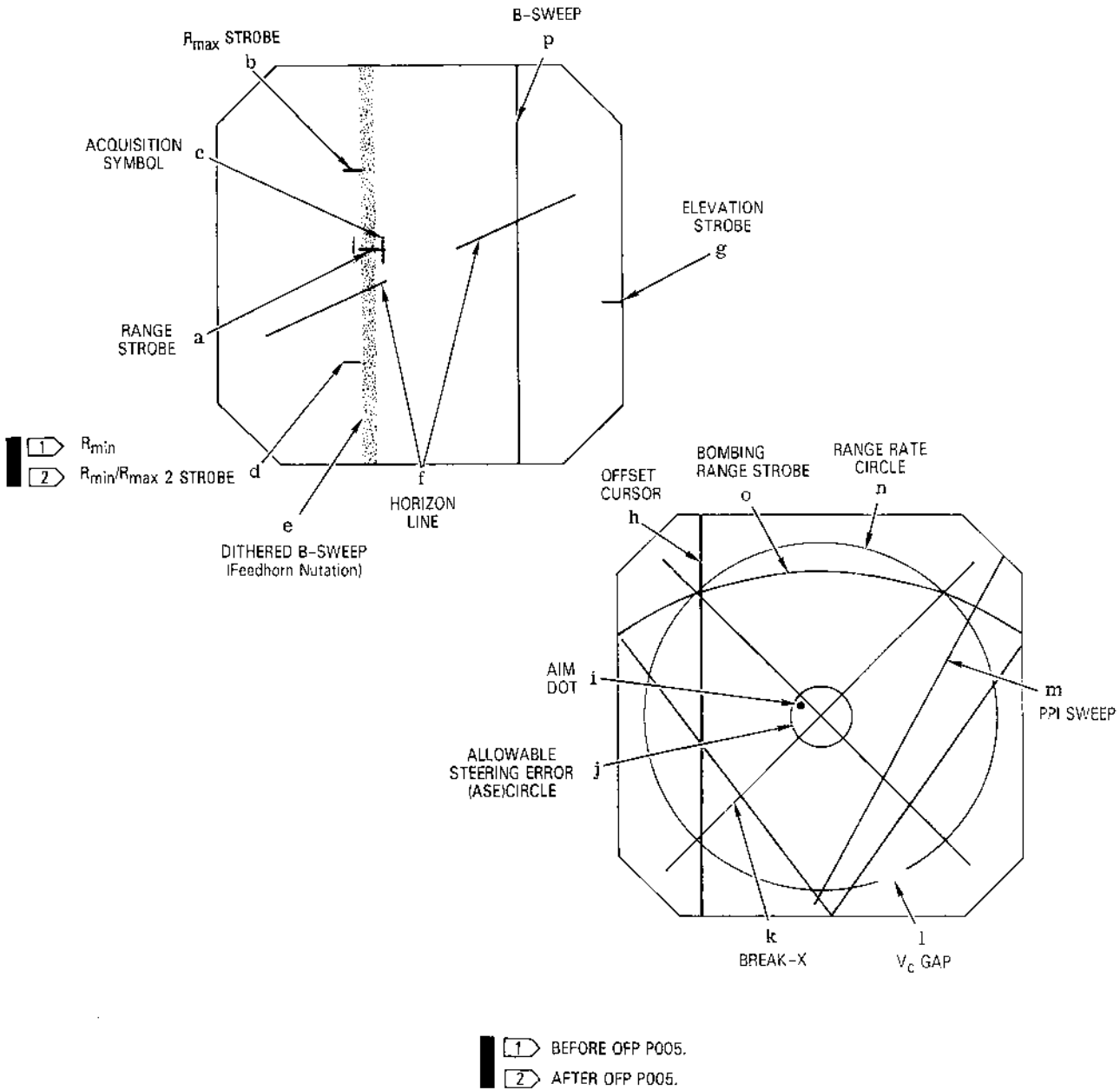


Figure 1-20

DSCG DISPLAY SYMBOLS

The DSCG symbols are illustrated in figure 1-21. The various DSCG grids are shown in figure 1-22. The symbology displayed during radar operations includes the following.

a. **Horizon Line.** The horizon line is a straight line consisting of two segments. The horizon line is displayed at all times provided that STAB OUT is not selected on the control monitor panel. The horizon line constantly indicates the antenna reference plane with respect to the aircraft attitude. During normal radar operations the horizon line is parallel to the horizon. The exception is during certain BIT functions (refer to DSCG BITS in section II). A hori-

zon line (HOR LN) adjust knob is provided on the front indicator which is used for zero pitch adjustment of the horizon line on both scopes.

b. **Elevation Strobe.** The elevation strobe is displayed as a short horizontal line on the right side of the scope. The primary function of the elevation strobe is to indicate antenna position. Manual elevation control is commanded in search operations by rotating the elevation thumbwheel control on the antenna hand control. The strobe may be positioned anywhere within the elevation limits (at least $\pm 50^\circ$) marked on the right side of the scopes. In STAB NOR, the vertical position of the strobe indicates antenna elevation angle with respect to the horizon. In STAB OUT, the elevation strobe represents the antenna angle with respect to aircraft RBL.

)

)

)

.

.

)

)

)

)

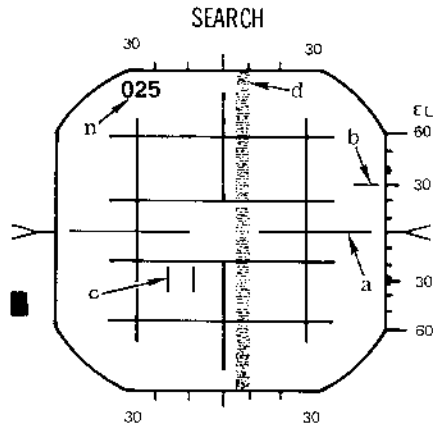
)

)

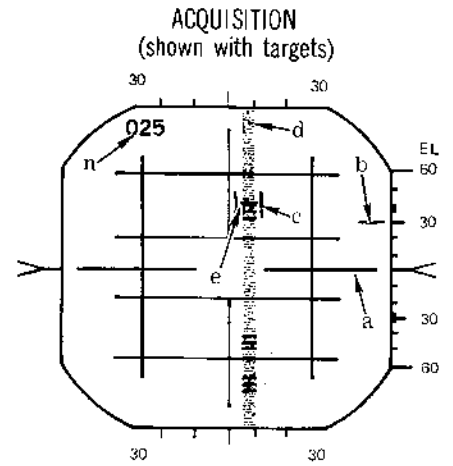
)

DSCG SYMBOLS

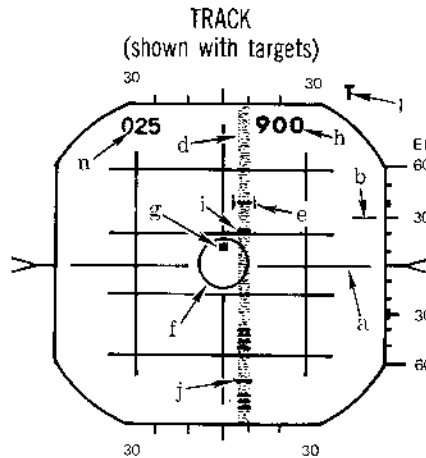
(AIRCRAFT 67-343 AND UP)



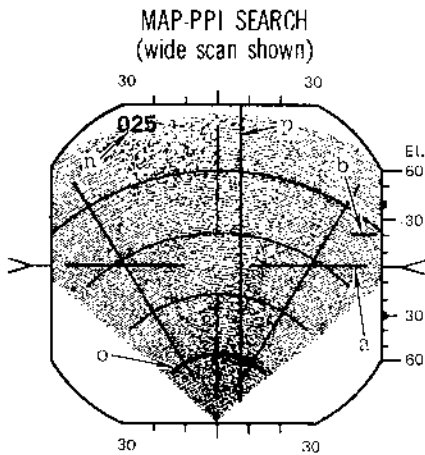
SEARCH IS OBTAINED IN A NO ACTION CONDITION WITH A CHOICE OF WIDE OR NARROW SCAN AVAILABLE.



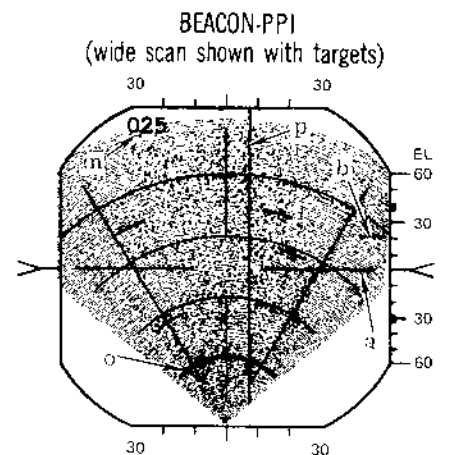
ACQUISITION IS ACCOMPLISHED BY BRACKETING THE TARGET WITH THE ACQUISITION SYMBOL, INITIATING HALF ACTION, AND POSITIONING THE RANGE STROBE OVER THE TARGET.



AFTER ACQUISITION, TRACK IS OBTAINED BY PRESSING THE ACTION SWITCH TO FULL ACTION AND HOLDING UNTIL LOCKON IS ACHIEVED. THE ACTION SWITCH IS RELEASED AFTER THE TRACK DISPLAY IS OBTAINED.



MAP PPI SEARCH CAN BE SELECTED WITH A CHOICE OF WIDE OR NARROW SCAN. ACQUISITION AND TRACK CAN NOT BE OBTAINED; THE ACTION SWITCH IS DISABLED. WITH A 15 RANGE SELECTED, THE DISPLAY REVERTS TO A B-SCAN FORMAT.



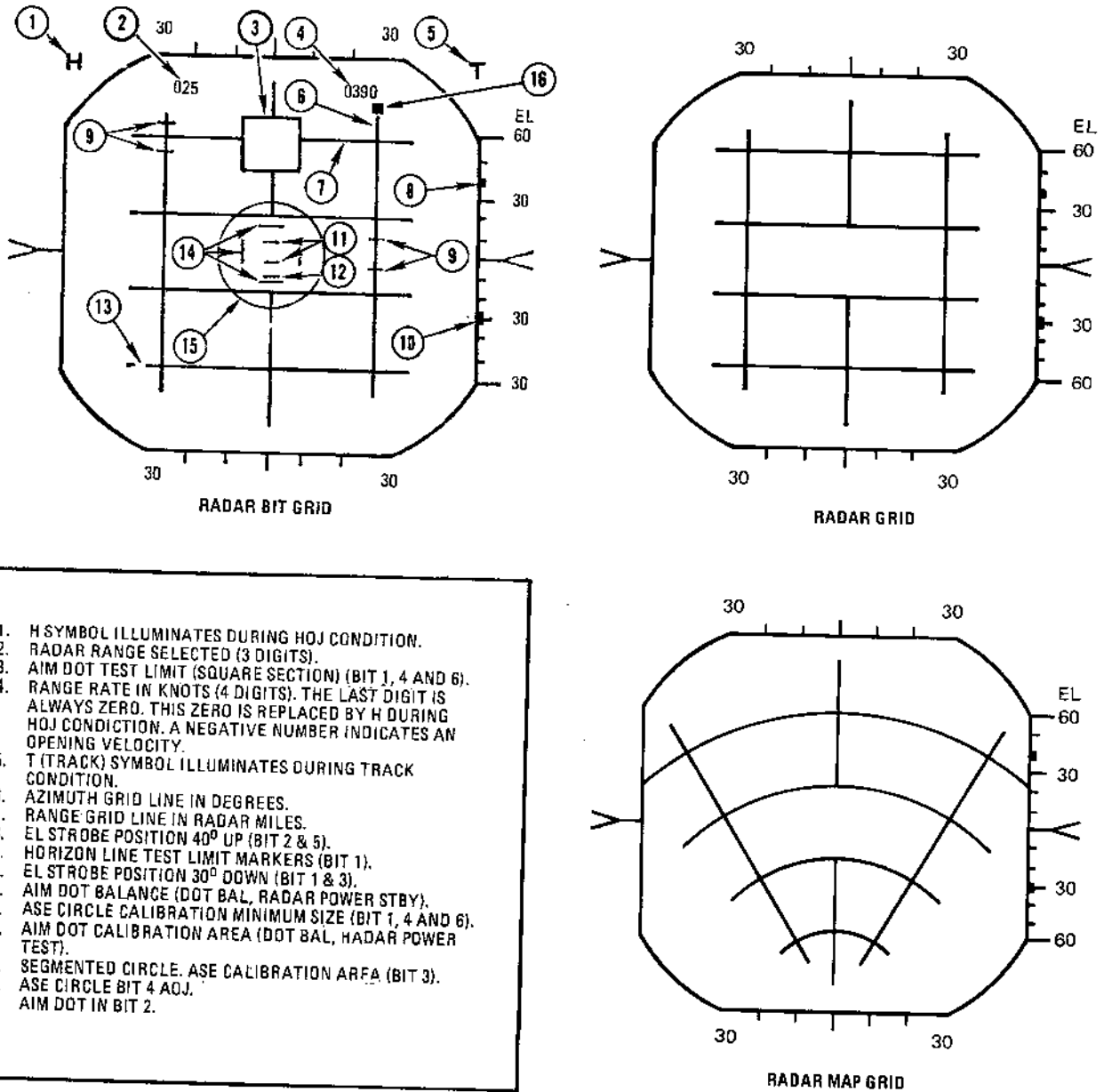
THE BEACON SEARCH PATTERN IS IDENTICAL TO THE MAP PPI SEARCH DISPLAY. BEACON INFORMATION IS RECEIVED IN SEARCH OPERATION ONLY AND MAY BE DISPLAYED IN THE B-SCAN FORMAT.

4E-34-1-1-(32)B

Figure 1-21

DSCG GRIDS

(AIRCRAFT 67-343 AND UP)



4E-34-1-1-(33)C

Figure 1-22

c. Acquisition Symbol. The acquisition symbol is displayed as two short vertical lines which are 1/4 inch apart. The position of the acquisition symbol represents the azimuth position that the range strobe and antenna will assume when half-action is initiated. Horizontally, the acquisition symbol tracks the B-sweep within 1/16 inch when the antenna hand control is moved from left to right. Fore and aft movement of the antenna hand control controls the vertical movement of the acquisition symbol which is limited to the top of the scope. The acquisition symbol is displayed in all AI ranges during search and acquisition except in VI, MAP PPI, or BEACON PPI modes. The acquisition symbol is present over the range strobe during air-to-air track.

d. B-Sweep. The B-sweep is a vertical line moving in synchronization with the antenna azimuth scan. Horizontal displacement of the B-sweep from the center of the scope indicates the angular position of the antenna in azimuth. During search operations, the antenna azimuth scan is controlled by the display knob to provide either a 120° (WIDE) or 45° (NAR) scan. With WIDE scan selected, the B-sweep horizontal scan fills the unmasked scope area within 1/8 inch. The center of the narrow scan is positionable at least +32.5° from 0° azimuth by the antenna hand control. The length of the B-sweep represents range using the vertical scope axis. Zero range is the bottom of the scope and the top of the scope represents the range selected.

e. Range Strobe. A range strobe appears in the B-sweep as an intensified portion of the sweep when half-action is initiated and is aligned in the center of the acquisition symbol. When a target appears in the B-sweep, the range strobe can be manually positioned over the target prior to initiating (full-action) track operation. After lockon is achieved, the range strobe is automatically positioned to indicate target range.

f. ASE Circle. The allowable steering error (ASE) circle is displayed in the center of the radar scope to indicate the computed allowable steering error. During BIT 3, the circle is 1.9 ± 0.1 inches in diameter and is used for checking the angle track function (refer to DSCG BITS in section II). Before OFP P005, the ASE circle position and size are computed for two environments, LRI and ACM. After OFP P005, the ASE circle position and size are computed according to the missile launch envelope. Refer to Computer Functions, this section.

g. Aim Dot. The aim dot is a small square symbol that appears on the scope after lockon is achieved. Dot displacement (with respect to the ASE circle) indicates the attack steering error and the direction in which the aircraft must be maneuvered to assume the computer attack course. This steering function is provided by the radar computer (refer to Computer Functions in this section for more details). Before OFP P005, the aim dot position is computed for two environments, LRI and ACM. Refer to Computer Functions, this section.

h. Range Rate. Range rate is presented as numeric symbols in terms of opening (minus) or closing velocities. During track operations, the range rate is constantly up-dated to provide the aircrew with accurate opening or closing rates. The maximum and minimum rates that can be displayed are limited to the radar computer parameters.

Before OFP P005, with valid range track and the aspect knob in the NOSE position, the range rate window will alternately display target altitude for 2 seconds followed by aspect for 4 seconds.

After OFP P005, with valid range track and the aspect knob in NOSE, numbers displayed in the range rate window represent target altitude. When the aspect knob is in the FWD position numbers displayed in the range rate window represent aspect angle off the target tail. When the aspect knob is in the TAIL position numbers displayed in the range rate window represent an approximate target heading. If BIT 6 is selected, the OFP version number is displayed in the range rate window for the first 10 seconds.

i. Rmax Strobe. The Rmax strobe appears as a short horizontal line over the B-sweep during track operation. The strobe indicates maximum missile launch range.

j. Rmin strobe before OFP P005. The Rmin strobe appears as a short horizontal line below the Rmax strobe during track operations. Minimum launch range is indicated by the Rmin strobe with either AIM-7 or AIM-9 missiles selected. The Rmin and the Rmax strobes are displayed in all range tracking modes except air-to-ground and VI modes. In the ACM mode the Rmin strobe indicates minimum launch range for the selected missile. In the LRI mode the strobe indicates Rmax2, a no-escape Rmax for a target that does an 8-G turn away followed by constant speed flight.

Rmin/Rmax2 strobe after OFP P005. The Rmin/Rmax2 strobe is a short horizontal line below the Rmax strobe during track operations. The Rmin strobe indicates minimum launch range for the AIM-9 in MISSILE mode. For AIM-7, the lower strobe represents Rmax 2, a no escape Rmax for a turn-and-cruise target. Rmin/Rmax2 and Rmax strobes are displayed in all range tracking modes except A/G and VI. After an AIM-7 launch, the strobe also displays the missile range until hit or until it reaches the Rmax strobe.

k. Break X. The break X is displayed at minimum launch range to indicate that the attack mode should be discontinued. Break X indications, in conjunction with the front scope IN RANGE light, are a function of the radar computer.

Before OFP P005, the break X is not displayed in the air-to-ground or VI modes. In LRI mode and at the computed minimum firing range of the missile, the SHOOT lights go OFF and break X appears on the scope. In ACM mode, the break X is inhibited and does not appear except to indicate a computer malfunction. A continuous break X in LRI or ACM mode indicates a computer malfunction.

After OFP P005, the break X is not displayed in air-to-ground modes. It will display when range is less than 1000 feet in VI mode. In MISSILE mode and at the computed minimum firing range of the missile the shoot lights go OFF and break X appears on the scope. A continuous break X in MISSILE mode indicates a computer malfunction.

l. T Symbol. The T (track) symbol is engraved in the upper right portion of the rear scope face plate. The T symbol illuminates to indicate that the radar is in a track condition. When the T symbol is illuminated, the SKIN TRK light on the radar set control is also ON. The same parameters that affect the SKIN TRK light also affect the T symbol except for BIT 6 testing. In BIT 6, the T symbol is illuminated but the SKIN TRK light remains OFF.

m. H Symbol. The H symbol is engraved in the upper left portion of the rear scope face plate. The H symbol illuminates to indicate when the radar system switches to HOJ operation. In addition to the H symbol, both scope range rate digits begin flashing at 4 Hz and the last digit (which is always a zero) is replaced with the letter H.

n. Radar Range. During all operating modes, the selected radar range is numerically presented in the upper left corner of both scopes.

o. Bombing Range Strobe. The bombing range strobe appears as an intensified arc in the MAP PPI or BEACON PPI mode displays and in all ranges except AI 5. The bombing strobe is used as a range reference for bombing operations, or as a positionable range cursor in WRCS target find and offset bomb modes.

p. Offset Cursor. In offset bomb or target find modes, the offset cursor is displayed as a straight line in the 10, 25, or 50-mile ranges only and in the MAP PPI or BEACON PPI modes. The position of the offset cursor is controlled by the WRCS.

TACTICAL INFORMATION RETRIEVAL SYSTEM (TIRS)/SNAPSHOT FUNCTION

The Tactical Information Retrieval System provides a means for preserving tactical information consisting of aircraft parameters, target parameters and missile firing parameters. The system consists of aircraft controls and the fire control computer memory for collection and storage of the data, memory unit interfacing with a test connector on the aircraft for retrieval, and a printer (maintenance function) for displaying contents of the memory unit.

Collection of the data is initiated by squeezing the trigger to second detent in the front cockpit. The pertinent data for the specific tactical situation is recorded in the fire control computer memory. Ground crews can interface with the computer memory by means of a memory unit which connects to J115 test connector at door 172. The data is then dumped into the memory unit for display on a printer. The parameters recorded and an explanation of their meaning are outlined in figure 1-22A.

A total of 15 snapshots are possible in the TIRS mode. The snapshots are cumulative (even if radar power has been removed) until a total of 15 are recorded. Additional closing of the trigger switch will not write over any snapshots already taken.

Before OFP P005, write over of snapshot data will occur only after old TIRS data has been dumped. (Dumping TIRS data before a mission will ensure the program is reset for new data.) The TIRS data may be dumped any number of times provided no new snapshots have been taken. Once data has been dumped and at least one snapshot taken, all old data is lost.

After OFP P005, write over of snapshot data will occur only after old TIRS data has been dumped, or DOT BAL and VI are selected together. (Dumping TIRS data before a mission will ensure the program is reset for new data.) The TIRS data may be dumped any number of times, or DOT BAL and VI selected together, provided no new snapshots have been taken. Once data has been dumped and at least one snapshot taken, all old data is lost.

TIRS data records only when the radar is locked on (manual track, auto track, track memory, or HOJ and during radar BIT). TIRS will not record when a break X is displayed due to a computer malfunction.

RADAR OPERATING CHARACTERISTICS

Characteristics of radar operation in various modes are listed in figure 1-23. An explanation of radar operation and selection of various modes is included under radar operation air-to-air, air-to-ground, beacon mode, visident mode, and television mode.

RADAR GROUND OPERATION WITH ENGINES OPERATING

The following radar operating restrictions apply during ground operation of the radar when engines are operating to prevent overheating and subsequent damage to the radar. The radar overtemp light on the volt monitor panel (rear cockpit) illuminates when the temperature has exceeded normal radar operating temperature range. Refer to Section II, Radar Turn On.

CAUTION

During extended ground operation, the radar may become overheated due to insufficient cooling combined with high ambient temperatures or low engine power setting. Under these conditions, if the radar overtemp light illuminates, turn the radar OFF.

a. During ground operations, the radar power knob should be in STBY or OFF except when required for BIT or preflight tests. The missile power switch on the missile control panel must be in OFF except when cw power is required for BIT.

b. If the radar overtemp light illuminates, the power knob should be placed to OFF. If radar operation is required, the engine power setting must be advanced to approximately 85% rpm.

RADAR OPERATION (AIR-TO-AIR)

The following includes modes of operation that are most effective with a specific scan pattern, range limitations, automatic acquisition, lockon, display implications and missiles. The overall discussion is generally divided into the three transitional phases of operation; search, acquisition and track, followed by missile information.

NOTE

To increase the service life of the radar feedhorn assembly components, the MAP mode should be used, except when mission requirements dictate use of the radar mode.

RADAR DISPLAYS (AIR-TO-AIR)

Radar scope displays for air-to-air search, acquisition, and track are shown in figure 1-24.

SEARCH

There are two basic methods used during the search phase of a particular mission; automatic and manual. However, manual search is synonymous with the acquisition phase. The difference is a matter of target range and operator intent.

Automatic Search

During automatic search the antenna is driven back and forth in azimuth to illuminate targets in front of the aircraft. Two azimuth scan coverages are available; **B WIDE** where the antenna sweeps through an azimuth angle of 120°; and **B NAR** where the antenna sweeps through an azimuth angle of 45°.

(

(

(

(

(

(

(

(

(

(

(

(

(

TIRS/SNAPSHOT FUNCTIONS

TIRS/SNAPSHOT SYMBOLS	DEFINITION	SOURCE/ DESTINATION	SCALE FACTOR/ SENSE	CONVERSION FACTOR	NOTES
1. AIRCRAFT	Aircraft Tail Number for TIRS Data.	Inserted by ground Personnel During TIRS Transfer.	Four Digit Tail Number.	N/A	
2. SNAPSHOT NO	Indicates Sequence of Data.	N/A	N/A	Sequence 1 thru 15.	
3. MODE	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 5px;">5</div> <div style="margin-right: 5px;">LRI, ACM, CCM, VI</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 5px;">6</div> <div>Missile, CCM, VI.</div> </div>	Computer Program.	N/A	N/A	ACM is Printed anytime AIM-9 Selected
4. TIME	Radar Power on Time.	Computer Clock.	HRS/MIN/SEC.	N/A	Time Starts After 30 Sec. Radar PWR on time. Will Reset if Radar Power is Cycled.
DISCREET INPUT SIGNALS TIRS/SNAPSHOT SYMBOLS	DEFINITION	SOURCE	SENSE	CONVERSION FACTOR	NOTES
1. AIRGD	Radar Air to Ground Mode.	Radar Mode Knob—Air to Ground.	1 Indicates Selected	N/A	
2. GUNS	Gun Selected.	Guns/Missile Switch—GUNS.	1 Indicates Selected	N/A	Armament Safety Override Pressed or Airborne.
3. BRSGT	Radar Boresight Mode.	Radar Mode Knob—BORESIGHT.	1 Indicates Selected	N/A	
4. TEST	Radar Test Mode.	Radar Mode Knob—TEST.	1 Indicates Selected	N/A	
5. SPSEL	AIM-7 Selected.	Guns/Missile Switch—RADAR.	1 Indicates Selected	N/A	Armament Safety Override Pressed or Airborne.
6. RNGLK	Radar in Manual Track, Track, Track Memory, HDJ or BIT 6.	Radar Synchronizer.	1 Indicates Selected	N/A	
7. CCM	Radar AOJ Mode.	Radar Synchronizer.	1 Indicates Selected	N/A	
8. VISI	Radar VI Mode.	Radar Display - VI	1 Indicates Selected	N/A	Radar Mode Knob Map or Radar.
9. SPARE	Not Used				
10. 7 FSNS	AIM-7 or Sim Plug on Board.	AIM-7 Umbilicals.	1 Indicates Selected	N/A	CW Power—STBY or ON.
11. 9 JUCG	AIM-9 Missile Head Uncaged.	AAR Button—Pressed.	1 Indicates Selected	N/A	Aircraft armed.
12. SNPSH	Snapshot Function.	Trigger, Second Detent.	1 Indicates Selected	N/A	
13. TAIL	Tail Aspect.	Radar Aspect Knob TAIL.	1 Indicates Selected	N/A	
14. VC900	Closing Velocity Scale Switch.	Monitor, Vc Switch-900	1 Indicates Selected	TIMES 3	
15. SPARE	Not Used				
16. AACQ	Computer Auto Acq. Selected.	Radar Set Control Computer Auto Acq. Selected.	1 Indicates Selected	N/A	

4E-34-1-1-(309-1)B

Figure 1-22A (Sheet 1 of 4)

TIRS/SNAPSHOT FUNCTIONS (Continued)

DISCREET INPUT SIGNALS TIRS/ SNAPSHOT SYMBOLS	DEFINITION	SOURCE	SENSE	CONVERSION FACTOR	NOTES
17. STRF	Station Right Forward Selected	AIM-7 Firing Circuits	1 Indicates Selected	N/A	
18. STLF	Station Left Forward Selected	AIM-7 Firing Circuits	1 Indicates Selected	N/A	
19. STRA	Station Right Aft Selected	AIM-7 Firing Circuits	1 Indicates Selected	N/A	
20. STLA	Station Left Aft Selected	AIM-7 Firing Circuits	1 Indicates Selected	N/A	
21. DTBAL	Dot Bal Selected	Monitor, Test, Dot Bal Selected	1 Indicates Selected	N/A	
22. BIT 1 THRU 6	Radar BIT Test 1 Thru 6	Monitor, Test, BIT 1 Thru 6 Selected	1 Indicates Selected	N/A	
23. AACQB	Auto Acq. Button Pressed	Nose Wheel Steering/ Auto Atq. Button Pressed	1 Indicates Selected	N/A	
24. SPARE	Reserved for Alternate Missile Sensing				
25. SPARE	Not Used				
26. SPARE	Radar Skin Track	Skin Track Light	1 Indicates Selected	N/A	
27. SPARE	Radar Beacon Selected	Radar Mode Knob-- BEACON	1 Indicates Selected	N/A	
DISCREET OUTPUT SIGNALS	DEFINITION	DESTINATION	SENSE	CONVERSION FACTOR	NOTES
1. SCAN	Enables Computer Control of Antenna	Antenna Servo	1 Indicates Enabled	N/A	
2. MAC III	Dog Fight Tone Enabled	AIM-7 Missiles	1 Indicates Enabled	N/A	
3. ALT 1	AIM-7 Altitude Function	AIM-7 Missiles	1 Indicates Ground	N/A	
4. ALT 2	AIM-7 Altitude Function	AIM-7 Missiles	1 Indicates Ground	N/A	
5. SWAFT	AIM-7 Altitude Function	AIM-7 Missiles	1 Indicates Ground	N/A	
6. RLKO	AIM-7 Doppler Range Rate Select	AIM-7 Missiles	1 Indicates Radar Range Rate. 0 Indicates Aspect Plus True Airspeed	N/A	
7. INTLK	AIM-7 Firing Interlocks	Missile Firing Circuits	1 Indicates Closed Condition. 0 Indicates Open Condition.	N/A	
8. BRKX	ACM Computer Break X Command	Radar Display	1 Indicates Enabled	N/A	
9. SHOOT	ACM Computer in Zone Command	Aircraft Display	1 Indicates Enabled	N/A	
10. SPARE	Not Used				

4E-34-1-1-(309-2)

Figure 1-22A (Sheet 2 of 4)

TIRS/SNAPSHOT FUNCTIONS (Continued)

DISCREET OUTPUT SIGNALS	DEFINITION	DESTINATION	SENSE	CONVERSION FACTOR	NOTES
11. HDALT	ACM Computer Hold Altitude Command	Aircraft Display	1 Indicates Enabled	N/A	
12. SPARE	Not Used				
13. 7FSEL	ACM Computer AIM-7F Command	CW Electronics and Missile Firing Circuits	1 Indicates Commanded	N/A	
14. FULAC	ACM Computer Full Action Command	Radar Synchronizer	1 Indicates Enabled	N/A	
15. CWIBT	CWI BIT Test	CWI BIT Test Voltage to Display	1 Indicates CW BIT Enabled	N/A	
16. TGTR	ACM Computer Half Action Command	Radar Synchronizer	1 Indicates Enabled	N/A	
PARAMETERS	DEFINITION	SOURCE DESTINATION	SCALE FACTOR/SENSE	CONVERSION FACTOR	NOTES
1. ANTELDT	Antenna Elevation Rate	Antenna Rate Gyro	Degrees per Second/Up Positive	N/A	
2. ANTAZDT	Antenna Azimuth Rate	Antenna Rate Gyro	Degrees per Second/Right Positive	N/A	
3. ANGATTK	Angle of Attack	CADC	Degrees/Positive when RBL is above Velocity Vector		
4. RNGDOT	Radar Range Rate	Synchronizer	Feet per Second/Negative is Closing Velocity	168.8 Feet per Second per 100 Knots	
5. RANGE	Radar Range	Synchronizer	Feet per Second/Positive	6000 Feet Per Radar Mile	
6. ANTEL	Antenna Elevation Position	Antenna Resolver	Degrees/Up Positive		
7. ANTAZ	Antenna Azimuth Position	Antenna Resolver	Degrees/Right Positive		
8. ROLL	Aircraft Roll Angle	INS	Degrees/Positive Right Wing Down		
9. PITCH	Aircraft Pitch Angle	INS	Degrees/Positive Nose Up		
10. HEADING	Aircraft True Heading	INS	Degrees/Positive East		
11. FBTRALT	Fighter Altitude	CADC	Feet/Positive Above Sea Level		Barometric
12. TGT ALT	Target Altitude	N/A	Feet/Positive Above Sea Level		Reference to Barometric
13. ASE	Allowable Steering Error	Display	Degrees/Positive		ASE Scaling and Aim Dot Scaling are Compatible (IE. ASE = 30 ⁰ , Dot AZ = 30 ⁰ , Dot EL = 0 ⁰ , Dot will fall on circle)
14. STRDT EL	Aim Dot Elevation	Display	Degrees/Up Positive		
15. STRDT AZ	Aim Dot Azimuth	Display	Degrees/Right Positive		
16. R MAX	Maximum Missile Launch Range	Display	Feet/Positive	6000 Feet per Radar Mile	

4E-34-1-1-(309-3)

Figure 1-22A (Sheet 3 of 4)

TIRS/SNAPSHOT FUNCTIONS (Continued)

PARAMETERS	DEFINITION	SOURCE/DESTINATION	SCALE FACTOR/SENSE	CONVERSION FACTOR	NOTES
17. R MIN	Minimum Missile Launch Range	Display	Feet/Positive	6000 Feet per Radar Mile	
17A. R MAX2	No Escape Rmax	Display	Feet/Positive	6000 feet per Radar mile	
18. HDAIMAZ	AIM-7 Head Aim Azimuth	Umbilical	Degrees/Right Positive	N/A	
19. HDAIM EL	AIM-7 Head Aim Elevation	Umbilical	Degrees/Up Positive	N/A	
20. EBIAS AZ	AIM-7 English Bias Azimuth	Umbilical	Degrees/Right Positive	N/A	
21. EBIAS EL	AIM-7 English Bias Elevation	Umbilical	Degrees/Up Positive	N/A	
22. STRER AZ	Steering Error Azimuth	N/A	Degrees/Right Positive 1 inch = 42°		4
23. STRER EL	Steering Error Elevation	N/A	Degrees/Up Positive 1 inch = 42°		4
24. TGTVEL	Target Velocity	N/A	Feet per Second Positive		
25. FBTRVEL	Fighter Velocity	N/A	Feet per Second Positive		In ACM Mode must have valid LOCK
26. TGTACC	Target Acceleration	N/A	Feet per Second per Second		1
27. ASPANG	Aspect Angle	N/A	Degrees		2
28. PREDPLA	Predicted Roll Angle	N/A	Degrees		3

NOTES

- 1 RADIAL TARGET TURN RATE-FT/SEC/SEC DIVISION BY 32.2 PRODUCES MULTIPLES OF GRAVITY IN G's.
- 2 ANGLE BETWEEN TARGET VELOCITY VECTOR AND LINE OF SIGHT. ANGLE IS POSITIVE CLOCKWISE FROM THE NOSE OF THE TARGET WHEN LOOKING DOWN ON THE TARGET. ASPECT IS ZERO ON THE NOSE OF THE TARGET.
- 3 ROLL INCLINATION ANGLE BETWEEN THE PLANE OF ACTION AND THE PLANE CONTAINING THE PREDICTED FIGHTER VELOCITY VECTOR.
- 4 THE STEERING ERROR IS THE DEVIATION FROM PRESCRIBED COURSE. LEAD PURSUIT INSIDE R MAX AND LEAD COLLISION OUTSIDE R MAX.
- 5 BEFORE OFF P005.
- 6 AFTER OFF P005.

4E-34-1-1-(309-4)B

Figure 1-22A (Sheet 4 of 4)

RADAR OPERATING MODE CHARACTERISTICS

* SHORT PULSE : HIGH PRF
LONG PULSE : LOW PRF

MAP-B MODE AND RADAR MODE

OPERATION	RANGE	PULSE SWITCH	PULSE * WIDTH	ANTENNA SCAN PATTERN	SCOPE DISPLAY SYMBOLS
SEARCH	ANY	AUTO, LONG	LONG	MAP MODE: 1 BAR. RDR MODE: 1 OR 2 BAR, FEED HORN NUTATION.	EL STROBE HORIZON LINE ACQ SYMBOL IN AI RANGE.
	AI	SHORT	SHORT		
	100, 200	SHORT	LONG		
ACQ.	AI	AUTO, LONG	LONG	MANUAL CONTROL	SAME AS SEARCH, PLUS RANGE STROBE
		SHORT	SHORT		
AUTO TRACK OR HOJ	AI	AUTO	BEFORE PLMS LONG, AFTER PLMS, SHORT	FOLLOWS TGT IN AZ AND EL.	RANGE RATE AIM DOT ASE CIRCLE RANGE STROBE EL STROBE HORIZON LINE RMAX RMIN BREAK X ACQ SYMBOL
		SHORT	SHORT		
		LONG	LONG		
AOJ	AI	AUTO, LONG	LONG		AIM DOT, RANGE STROBE FIXED ASE CIRCLE, EL STROBE, HORIZON LINE
		SHORT	SHORT		
MANUAL TRACK	AI	AUTO, LONG	LONG	MANUAL CONTROL	SAME AS AUTO TRACK
		SHORT	SHORT		

CAGE MODE (AIR-TO-AIR)

SEARCH	ANY (5-MILE AUTO SELECTED)	ANY	SHORT	FIXED AT RBL	ACQ SYMBOL HORIZON LINE EL STROBE
ACQ (MANUAL OR AUTO)				RANGE STROBE POSITION IN RANGE AUTOMATICALLY OR MANUALLY.	SAME AS SEARCH PLUS RANGE STROBE
AUTO TRACK				FOLLOWS TGT IN AZ AND EL	SAME AS RDR AUTO TRACK
CAA	5	ANY	SHORT	<ol style="list-style-type: none"> 1 ANTENNA SCANS IN ELEVATION FROM -21° TO +57° AND IN AZIMUTH ±2° 2 ANTENNA SCANS IN 3 SELECTABLE AZIMUTH CORRIDORS FROM -21° TO +57° IN ELEVATION 	RANGE STROBE - 1000 FT B-SWEEP - FOLLOWS ANTENNA IN AZIMUTH. EL STROBE - FOLLOWS ANTENNA IN ELEVATION. HORIZON LINE - PRESENT ACQ SYMBOLS - FOLLOW RANGE STROBE.

BORESIGHT MODE

SEARCH	ANY	LONG	LONG	FIXED AT RBL WITH FEEDHORN NUTATION	SAME AS CAGE MODE
	AI	SHORT	SHORT		
	100, 200	SHORT	LONG		
ACQ.	AI	AUTO, LONG	LONG		
		SHORT	SHORT		
AUTO TRACK IN RANGE ONLY OR HOJ	AI	AUTO	BEFORE PLMS LONG, AFTER PLMS, SHORT.	FOLLOWS TGT IN AZ AND EL.	SAME AS RDR AUTO TRACK
		SHORT	SHORT		
		LONG	LONG		
AUTO TRACK	5	ANY	SHORT	FOLLOWS TGT IN AZ AND EL.	SAME AS RDR AUTO TRACK

Figure 1-23 (Sheet 1 of 2)

RADAR OPERATING MODE CHARACTERISTICS (Continued)

MAP - PPI MODE (OFFSET BOMBING & TARGET FIND)

OPERATION	RANGE	PULSE SWITCH	PULSE WIDTH	ANTENNA SCAN PATTERN	SCOPE DISPLAY SYMBOLS
SEARCH ONLY	10, 25 50, 100 200	LONG	LONG	WIDE OR NARROW AZIMUTH SCAN ONE BAR EL SCAN WITH NO FEEDHORN NUTATION	BOMBING RANGE STROBE OFFSET CURSOR WITH 10 & 25 MILE (& 50 IN DSCG) & PPI SCAN
	5	LONG	LONG		ACQ SYMBOL & B SCAN
	10, 25, 50	SHORT	SHORT		BOMBING RANGE STROBE OFFSET CURSOR WITH 10 AND 25 MILE & PPI SCAN
	100, 200	SHORT	LONG		ACQ SYMBOL & B SCAN
	5	SHORT	SHORT		

AIR - TO - GROUND MODE (DIVE TOSS & DIVE LAYDOWN)

OPERATION	RANGE	PULSE SWITCH	PULSE WIDTH	ANTENNA SCAN PATTERN	SCOPE DISPLAY SYMBOLS
SEARCH	AI	ANY	SHORT	DRIFT STABILIZED RBL	FEED HORN NUTATION. EL STROBE HORIZON LINE ACQ SYMBOL
ACQ.					RANGE STROBE ADDED TO SEARCH DISPLAY
TRACK					HORIZON LINE EL STROBE RANGE STROBE FIXED ASE CIRCLE

VISIDENT MODE (AFTER LOCKON IN MAP - B OR RDR)

OPERATION	RANGE	PULSE SWITCH	PULSE WIDTH	ANTENNA SCAN PATTERN	SCOPE DISPLAY SYMBOLS
TRACK (AFTER PLMS) & HOJ	AI	AUTO	SHORT	FOLLOWS TGT IN AZ AND EL.	RANGE RATE ASE CIRCLE AIM DOT RANGE STROBE EL STROBE HORIZON LINE ACQ SYMBOL
		SHORT	SHORT		
		LONG	LONG		
AOJ	AI	AUTO, LONG	LONG		FIXED ASE CIRCLE AIM DOT RANGE STROBE EL STROBE HORIZON LINE
		SHORT	SHORT		

BEACON MODE

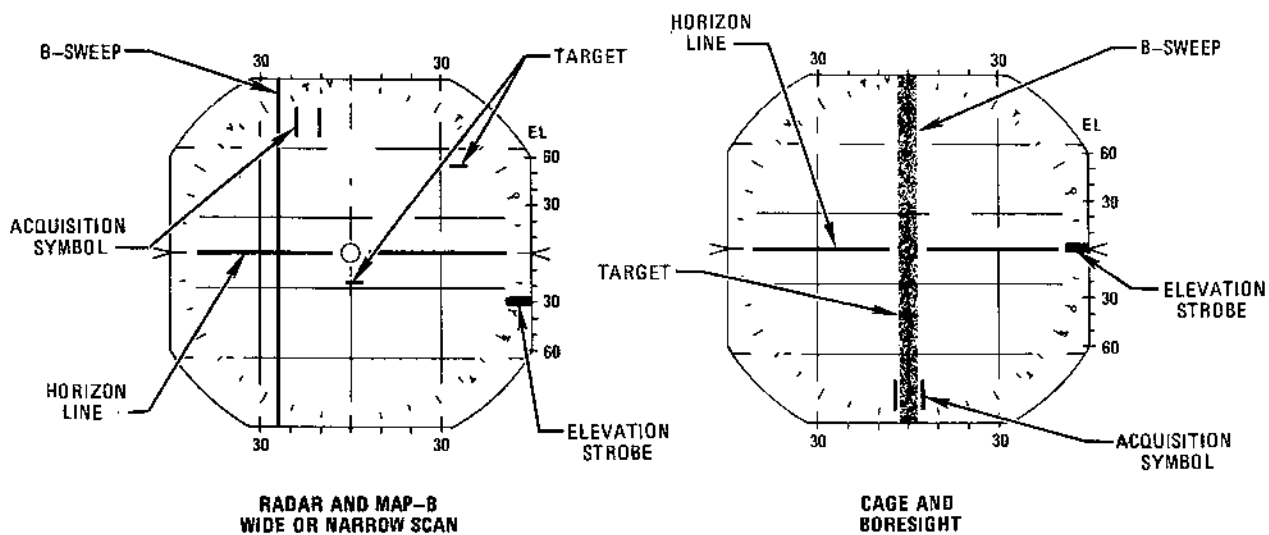
OPERATION	RANGE	PULSE SWITCH	PULSE WIDTH	ANTENNA SCAN PATTERN	SCOPE DISPLAY SYMBOLS
B-DISPLAY SEARCH ONLY	ANY	AUTO, LONG	LONG	ONE BAR SCAN WITH FEED HORN NUTATION	B-SCAN EL STROBE HORIZON LINE BEACON VIDEO ONLY
	AI	SHORT	SHORT		
	100, 200	SHORT	LONG		
PPI-DISPLAY SEARCH ONLY	SAME AS MAP-PPI			SAME AS MAP-PPI EXCEPT WITH FEED HORN NUTATION IN PPI SCAN AND B-SCAN	SAME AS MAP-PPI EXCEPT WITH BEACON VIDEO ONLY

- 1 BEFORE OFF P005.
- 2 AFTER OFF P005.

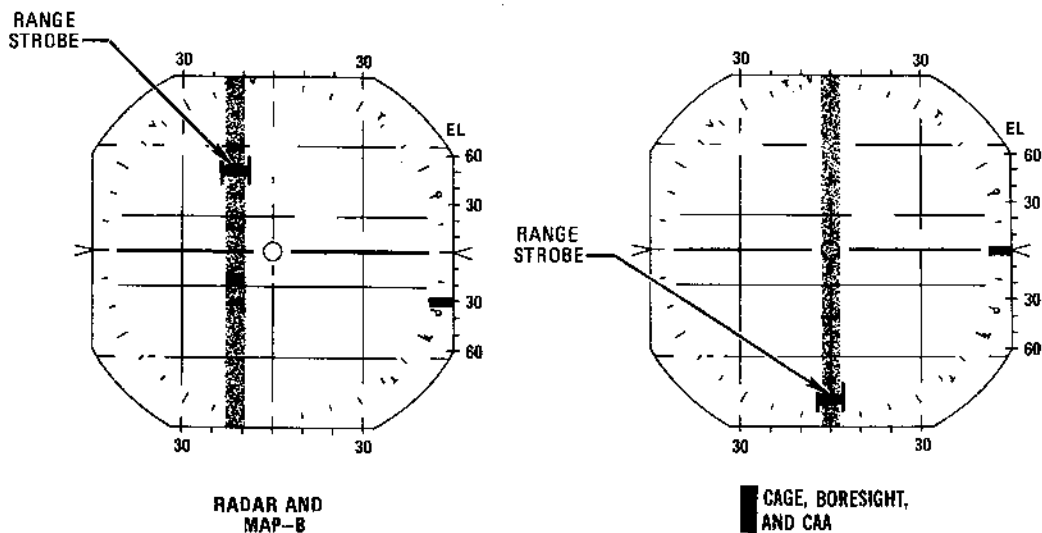
Figure 1-23 (Sheet 2 of 2)

SCOPE DISPLAYS (AIR-TO-AIR)

SEARCH



ACQUISITION

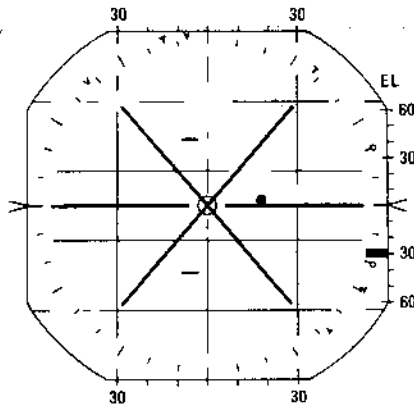
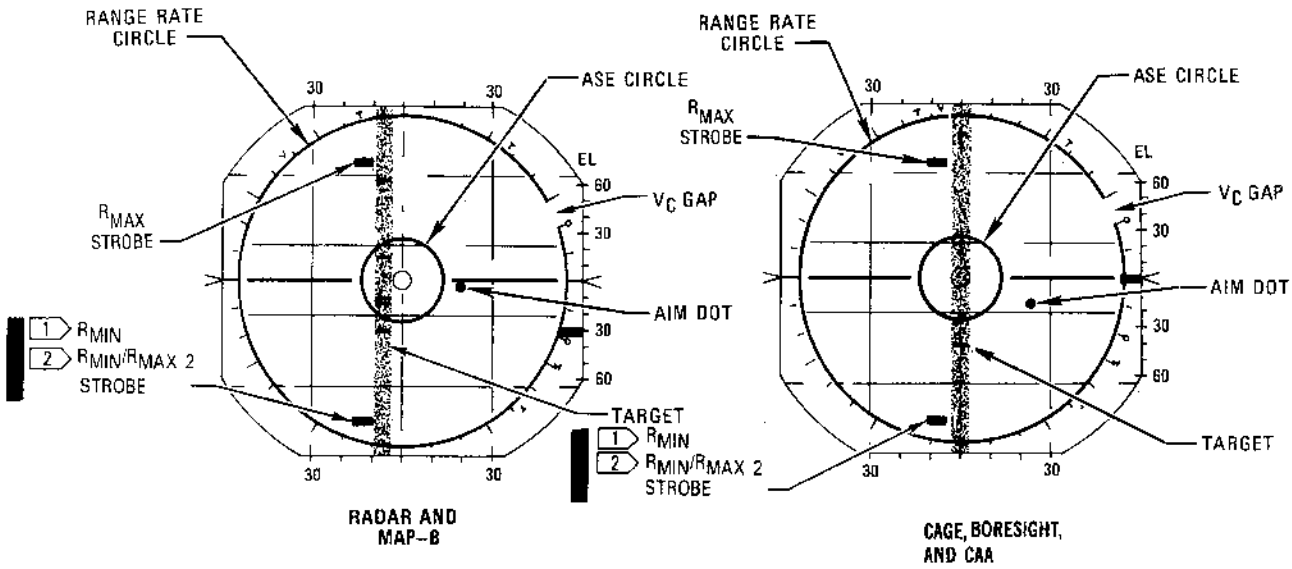


4E-34-1-1-(35-1)C

Figure 1-24 (Sheet 1 of 2)

SCOPE DISPLAYS (AIR-TO-AIR) (Continued)

TRACK



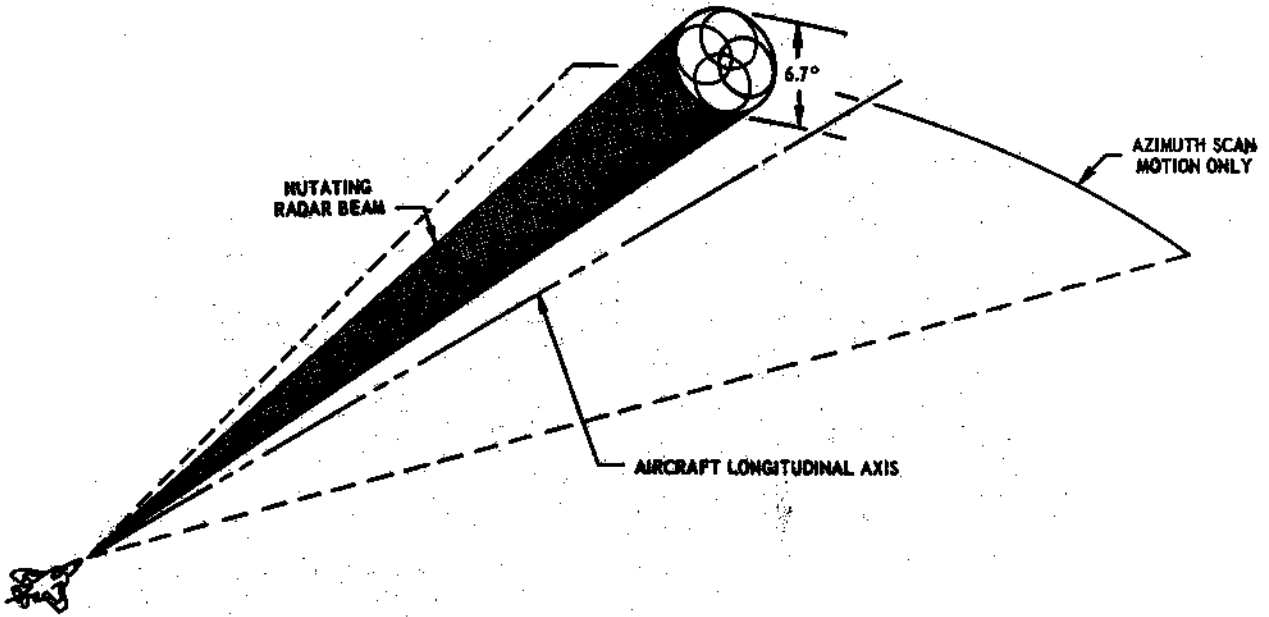
BREAK X
 (APPEARS WHEN TARGET REACHES R_{MIN})
 CONTINUOUS BREAK X INDICATES
 COMPUTER MALFUNCTION.

- 1 BEFORE OFF P005.
- 2 AFTER OFF P005.

Figure 1-24 (Sheet 2 of 2)

SEARCH SCAN PATTERNS

ONE BAR SCAN



TWO BAR SCAN

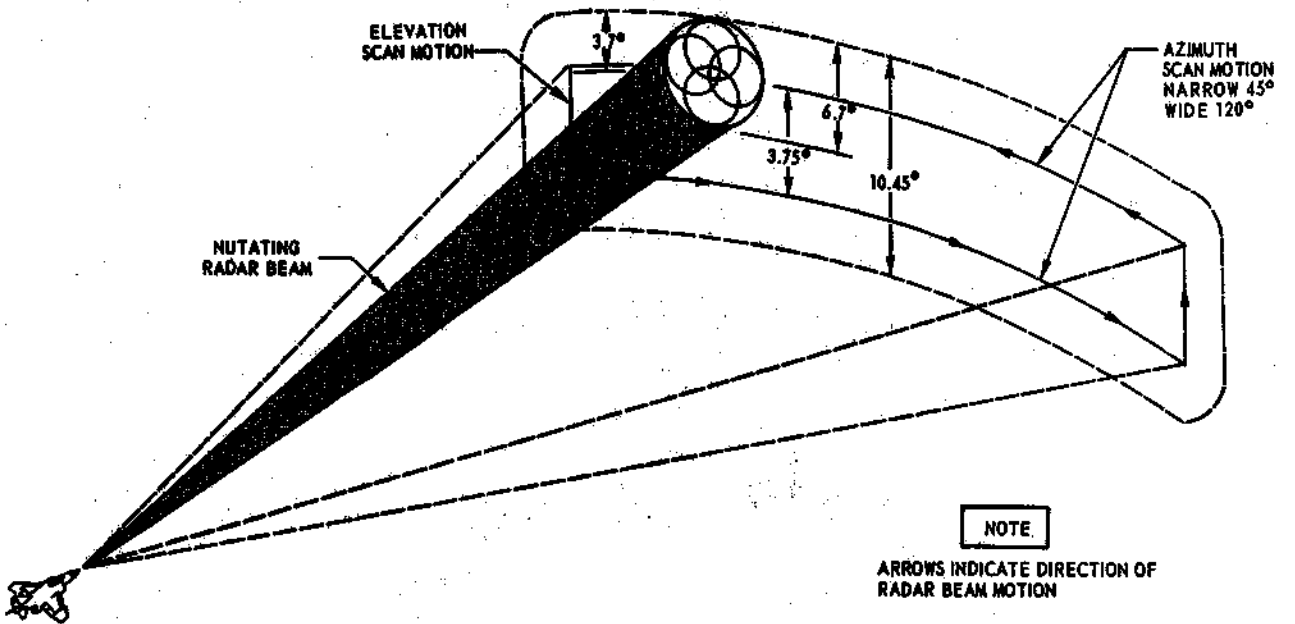


Figure 1-25

Two elevation scan are available: 1 BAR and 2 BAR. In the one-bar scan the antenna does not move in elevation but sweeps back and forth in azimuth only. Consequently, the scan height is equal to the beam width or approximately 3.7° . In two-bar scan the antenna not only sweeps in azimuth but at the end of each azimuth sweep jumps 3.75° in elevation. The 2-bar scan is only available in the RDR mode of operation. In RDR mode, the beam of transmitted energy from the antenna is nutated by rotating the antenna feedhorn. Nutation increases the beam width from 3.7° to 6.7° . During two-bar scan, the total elevation coverage is 10.45° .

During narrow scan (B NAR), the center of the antenna scan pattern can be positioned in azimuth within 37.5° left or right of the longitudinal axis of the aircraft. The vertical center of the antenna scan pattern can be varied in elevation during one-bar or two-bar scan within the limits of 50° relative to the boresight axis. Figure 1-33 illustrates a search pattern using both 1 bar and 2 bar scan patterns.

Typically, the initial search phase (in the RDR mode) is initiated with the display knob at B-wide, the range knob at 50 miles, the antenna scan switch in 2-BAR and the pulse switch in LONG or AUTO.

To increase surveillance coverage and thus increase detection probabilities, the antenna elevation control can be rotated, moving the antenna up and down within the mechanical limits of $+60^\circ$ to -60° .

Air-to-air search can also be accomplished with the radar mode knob in MAP and the display knob in either B WIDE or B NAR. The antenna traverses 1 bar scan only and the antenna feedhorn stops its nutation. This results in a narrower beam and is therefore less susceptible to heavy ground clutter. This indicates that during low level air-to-air search operations, where ground clutter may be a problem, and radiation coverage is not the prime criteria, the operator can select the MAP B mode of operation.

The MAP B mode can also be useful for navigation and determining storm area dimensions.

NOTE

PPI WIDE and PPI NAR are available in the MAP mode, and the BEACON mode. However, they are not normally air-to-air functions.

Manual Search

To initiate manual search, press the action switch to the half-action position. The half-action position stops the antenna from automatically scanning and provides manual antenna positioning control. Manual positioning is now used to point the antenna at a target which has been previously detected or to search for targets within a specific area. With the range knob at 100 or 200 mile position, spotlight operation is obtained by pressing the action switch to full-action. Spotlight action stops feedhorn nutation which results in the width of the transmitted radar beam being reduced to minimum, hence

permitting maximum rf energy to be concentrated in the desired area.

If greater beam width is desired, the action switch is released to the half-action position, thus restoring feedhorn nutation. If the action switch is released completely, the radar is returned to the automatic search condition and the antenna resumes its established scan pattern.

ACQUISITION

Acquisition is the process of locking on a target. Normal acquisition is initiated in AI ranges in RDR, MAP B or BST mode. CAA is available in cage mode. Also, an AOJ mode is available.

Normal Acquisition

For normal acquisition, place the radar into operation, select desired AI range and either MAP B or RDR mode. When the target is detected, bracket the target with the acquisition symbol and press the action switch to half-action. At this time, the range track system generates an additional range gate which is mixed with the video to provide the range strobe. Position the range strobe over the target and press the action switch to full-action. Acquisition is successful when the system locks on. A track display appears and the antenna automatically tracks the target. The action switch may be released. After lockon, the position of the antenna hand control and elevation control have no effect on the position of the antenna or range strobe. Both are controlled automatically during track.

Acquisition-On-Jam (AOJ)

During search, if a source of noise or cw jamming is encountered of sufficient strength to prevent acquisition, the jamming source can be used as the target, but only for angle tracking. Acquisition of the jamming source is less desirable than normal acquisition, because range information normally available by radar cannot be obtained from the direct transmission of the jamming source. Because of this lack of range information, this method of tracking is useful only for a missile attack. In acquiring the jamming source, the operator brackets the azimuth position of the source with the acquisition symbols and presses the action switch to full-action. The radar then automatically acquires the jamming source and begins angle track.

Successful AOJ operation is indicated by a display similar to the regular track display without the range rate circle, Rmax strobe, and Rmin strobe (before OFF P005), or the Rmin/Rmax2 strobe (after OFF P005). If the operator attempts to lock on a target in a heavy clutter environment, and the radar recognizes the clutter as jamming, the operator can disable AOJ operation by placing the track switch to AOJ-OUT.

Acquisition in BST Mode

Acquisition in BST mode can be performed by the WSO to assist the pilot in target acquisition and lockon. After lockon, angle track is automatically obtained to provide both range and angle track. When the WSO selects the

BST mode, the B-sweep is positioned to 0° azimuth and -2° elevation. Neither the optical sight (A/A mode) nor the radar antenna is drift stabilized. The AIM-7 missile firing interlocks are bypassed until the system locks on and the aspect knob controls simulated doppler supplied to the AIM-7 missile. The WSO can take control of the range gate by selecting half-action and locking on a target in BST. The pilot must select cage mode before automatic acquisition buttons function.

AUTOMATIC ACQUISITION AND CAGE

Refer to Computer Automatic Acquisition mode, this section.

TRACK

The tracking system is basically two different systems which operate together to provide range and angle track capabilities under various operating conditions. The track circuits normally operate automatically under manual control but alternate operation is available. In air-to-air operation, the angle track circuits keep the radar antenna pointed at the target and the range track circuits measure the distance to the target.

Angle Tracking

During automatic angle track operation, the antenna is driven by position error signals that are generated by the nutating radar beam. The initial antenna position is controlled manually by placing the acquisition symbol over the target on the radar scope and pressing the action switch. Normally, the system locks on and automatically tracks the target using the conventional pulsed radar angle track techniques of conical scanning. Other techniques are used when conventional tracking is not possible.

The angle track circuits normally receive an input from the range track circuits which is used to identify the specific target. This range information is required for normal range track operation; however, it is not essential for angle track. When certain types of jamming are encountered, the radar switches to HOJ operation and the angle track information is obtained from the jamming source. When jamming signals prevent normal track, the system may lock on the jamming signal and track in angle only (AOJ).

The angle track circuits may also be operated manually by placing the track switch to MAN and pressing the action switch to full-action. A full track display appears and the antenna is under manual control. The action switch may be released and the antenna position may be controlled by the side-to-side movement of the antenna hand control and by movement of the elevation control.

Another alternate angle track capability may be obtained by placing the radar mode knob to BST and flying the aircraft to keep the antenna pointed at the target. Angle track information is now obtained from the optical sight system and the aircraft provides the positioning signals. In this case, tracking is done in what is correctly called search operation because the angle track circuits in the radar set take command if the radar is locked on.

Angle track operation may be checked on BIT 3. The test circuits simulate a moving target and cause the antenna to move which causes the aim dot to move in a circle within certain limits.

In TISEO aircraft, the radar antenna may be slaved to the TISEO LOS when the TISEO system is optically locked on.

Range Tracking

The range to a target is determined by measuring the time between the transmitted and received pulse. Range tracking is accomplished by measuring this time for each pulse and making corrections for changes in target position. The initial range is established by the position of the range strobe which is controlled by the antenna hand control prior to lockon. After lockon, the radar automatically repositions the range strobe as target range changes.

If the target fades while the radar is tracking during normal range track operation, the system switches to a memorized range and range rate. The memory circuits keep the range changing at the same rate. If there is no

change in rate, the range will be correct and the system will automatically relock if the target reappears within 5 seconds. If the range rate changes, the range will not be correct when the target reappears and must be reset by placing the range strobe back on the target. Angle track memory is retained while the action switch is held in the half-action position and the antenna remains pointing at the last known target position, regardless of the antenna hand control movements. Therefore, to reacquire lockon, move the hand control (with the action switch in half-action) to position the range strobe over the target when it reappears and press the action switch to full-action and release. To return to search, press the action switch to half-action and release.

Loss of range tracking may be determined by observing the SKIN TRK light or the radar scope. The SKIN TRK light goes out and the size of the range rate circle is reduced when the radar is operating on a memorized range and range rate.

On DSCG aircraft, when the radar is operating on memorized range and range rate information, the SKIN TRK light and T (track) symbol go out and the range rate digits flash at 4 Hz to indicate this condition. The flashing range rate digits are presented on both indicators. Only the WSO can monitor the T symbol and SKIN TRK indications.

Home-On-Jam (HOJ)

HOJ operation is indicated by the HOJ light on systems with the DVST.

If the target begins using a jammer to prevent the radar from continuing normal track, the system automatically switches to HOJ operation. At this time, the range track circuits begin operating on memory and the angle track circuits begin angle tracking the jammer. Operation is similar to a fading target except that it is not limited to 5 seconds. If the jammer is turned off and the range rate is correct, the system automatically returns to full range and angle track. If range is not correct, system will return to search 5 seconds after the jamming signal is removed, unless the range strobe is manually placed over the target and action switch is pressed to full-action to relock on the target.

On DSCG aircraft, HOJ is indicated when the engraved H symbol illuminates and by the flashing range rate digits. Additionally, the last range rate digit, which is always zero, is replaced by the letter H. The range rate indication is presented on both scopes while the engraved H symbol is only provided on the rear scope.

Manual Tracking

For manual track operation, the antenna and range strobe are both controlled manually. Manual track operation is performed with the TRACK switch at MAN when necessary to keep the antenna pointed at the target. Manual angle track is controlled by the antenna hand control and manual range track is controlled by the MAN Vc knob.

COMPUTER FUNCTIONS

The FCS digital computer processes data and provides proper launch information to the missiles and missile firing circuits. Head-up information is provided to the aircrew by the SHOOT/IN RANGE lights with a backup head down radar scope display. Intercept information is provided via the radar scope display in conjunction with various mode dependent indicator lights.

INTERCEPT COMPUTATIONS

Intercept information is provided to the aircrew through the following symbols:

- a. Range Rate Circle and Vc Gap (DSCG range rate readout)
- b. Aim Dot
- c. ASE Circle
- d. Hold Altitude Light
- e. Rmax and Rmin/Rmax2 Strobes
- f. Shoot/In-Range Lights
- g. Break X

DVST Range Rate Circle and Vc Gap

The range rate circle displays the Vc gap. When the range tracking circuits are operating in normal range track, the circle is 3.25 inches in diameter. During manual range track, HOJ track memory, and BIT 3, the range rate circle is reduced to 1.9 inches in diameter.

The Vc gap indicates the rate at which the distance between the aircraft and target is changing. After the radar is locked on, the range track circuits automatically track the target and provide range rate information to the computer. The computer processes the information and provides it to the display circuits where it is used to position the Vc gap. When range information is lost, the radar continues to range track on a memorized range and range rate for 5 seconds. If the target range information reappears, the radar returns to normal range track, provided the memorized range and range rate are correct. Otherwise, the radar returns to search operation.

During manual range track operation (all display systems), range rate information is not available from the automatic range track circuits and must be selected manually. The position of the MAN Vc control determines the range rate.

During BIT, the Vc gap is used to display test data. A test signal is used to position the Vc gap. The position depends on the specific BIT. Correct positions indicate proper operation of the circuit being tested.

The display sensitivity of the Vc gap is determined by the position of the Vc switch during automatic or manual range

tracking. The following chart shows opening and closing velocities for the 900 and 2700 positions.

Gap Position	900 Position	2700 Position
11:00 o'clock	100 knots opening	300 knots opening
12:00 o'clock	0 knots	0 knots
1:00 o'clock	100 knots closing	300 knots closing
2:00 o'clock	200 knots closing	600 knots closing
3:00 o'clock	300 knots closing	900 knots closing
4:00 o'clock	400 knots closing	1200 knots closing
5:00 o'clock	500 knots closing	1500 knots closing
6:00 o'clock	600 knots closing	1800 knots closing
7:00 o'clock	700 knots closing	2100 knots closing
8:00 o'clock	800 knots closing	2400 knots closing
9:00 o'clock	900 knots closing	2700 knots closing

Before OFP P005, when the radar is locked on to a target, do not select NOSE on the aspect knob; erroneous Vc indications will result. After OFP P005, the LRU-1 must be notified that the aircraft has a DVST using the procedures under Radar Turnon in section II. If these procedures are not used, the NOSE, FWD, and TAIL positions of the aspect knob will give erroneous Vc indications.

DSCG Range Rate

Range rate information is digitally presented in the upper right corner of each scope. Closing velocities are displayed by the digits while opening velocities are preceded with a minus character. During track operations, range rate is continuously updated to provide the aircrew with accurate digital range rate information. Since the Vc switch (on the control monitor panel) was intended to be used with an analog representation of range rate, the 900 position of the Vc switch is not used with the DSCG system. The maximum and minimum rates that can be displayed are determined by the radar computer design parameters. When the radar system is operating on memorized range and range rate, the range rate digits flash at 4 Hz. In addition to this indication, the T (track) symbol and the SKIN TRK light go out. During the BIT checks, the range rate readouts provide indications of radar computer functions (refer to DSCG BIT CHECKS in section II).

Before OFP P005, when the radar is locked on to a target and the aspect knob is in NOSE, the range rate window alternately displays target altitude and aspect angle. After OFP P005, when the radar is locked onto a target and the aspect knob is in the NOSE position, numbers displayed in the range rate window represent target altitude. When the aspect knob is in FWD, numbers displayed in the range rate window represent aspect angle off the target tail. When the aspect knob is in TAIL, numbers displayed in the range rate window represent an approximate target heading. If BIT 6 is selected, the OFP version number is displayed in the range rate window for the first 10 seconds.

INTERCEPT COMPUTATIONS (BEFORE OFP P005)

AIR COMBAT MANEUVERING (ACM)

The ACM solution is automatically selected by the computer if the target is 5 miles or less in range and fighter altitude is less than 32,000 feet. The solution is valid for both maneuvering and non-maneuvering targets. In this environment, the pilot is provided with valid launch envelope indications for the AIM-7E/F and AIM-9P-2/-3/N-2/-3 missiles.

The mechanization used within the computer to derive an accurate and complete solution depends on determining specific target information, using a stored missile zone comparison technique, and determining missile capability against the selected target. The computer then determines whether or not the fighter is, at that moment, within the missile capability.

The computer receives information from the CAD/C, INS and radar. Using filtering techniques, the computer determines target aspect, altitude, direction, velocity, and turn rate. By comparing data with the missile launch envelope stored within the computer memory, missile capability is determined on a real time basis.

The ASE circle represents the angular limits of the computed launch envelope. This circle is centered on the scope with the center of the circle being the position of the fighter velocity vector. With RADAR selected, the ASE circle indicates the angular limits of the missile launch capability with respect to the fighter velocity vector. The size of the circle is fixed at 0.56 inch in diameter. The computer continuously rescales the relationship between the aim dot and the ASE circle. Therefore, the display indicates the relative size and position of the missile pointing vector with respect to the angle limits of the launch envelope. The angular launch limits have been satisfied when the dot is within the circle.

ACM DISPLAY (AIM-7)

Rmax and Rmin Strobes

Rmax represents the missile's maximum range capability in the measured tactical environment. The displayed Rmax is limited to 5 miles in ACM mode. The Rmin strobe represents the minimum range capabilities that the missile possesses under the measured conditions.

Rmax and Rmin are displayed valid for pilot pickle, not missile away. The Rmax and Rmin computation allows for the 1.5-second delay between trigger squeeze and missile away.

Since ACM engagements occur within 5 miles or less (within visual range), the range requirements of the missile are easily met. However, the angle requirements are constantly changing, primarily due to target maneuvers, and become of prime importance in a successful engagement.

Shoot/In Range Lights

The SHOOT lights provide additional indications of valid launch parameters. These lights and the IN RANGE light should be used along with current tactical considerations to determine actions to be taken. To avoid an AIM-7 launch in the main beam clutter, the SHOOT lights are inhibited when AIM-7 is selected, aspect angle is $90^{\circ} \pm 9^{\circ}$, and the elevation angle is lower than 5° above the horizon. Flashing operation and high intensity of the SHOOT lights improve daylight visibility awareness. With a valid lock-on, the IN RANGE and SHOOT lights indicate that missile launch parameters are satisfied and the missile may be launched. When the instrument panel dimming control is used for night operation (intensity down) the SHOOT lights are off but the IN RANGE light operates at reduced intensity. ACM information is also provided to the radar scopes. The display takes into account all relevant attack parameters including target aspect, speed, direction, and acceleration, and defines when a valid launch situation exists. It can provide steering indications to bring about, maintain, or restore a launch situation.

Aim Dot

The aim dot indicates the center of the instantaneously available missile envelope. The center of the ASE circle is the fighter velocity vector. The aim dot position with respect to the center of the ASE circle indicates the relative angle which the fighter velocity vector must change in order to point to the center of the envelope. Absolute angle size cannot be determined from viewing the scope since aim dot scaling is constantly changing as a function of attack geometry and dynamics. However, relative angle size with respect to angular limits can be determined with the aid of the ASE circle. With the dot centered, the fighter velocity vector is pointing directly at the center of the missile envelope.

Allowable Steering Error (ASE) Circle

In the ACM mode, the ASE circle is a depiction of the launch envelope.

Break X

When in ACM mode, the break X is inhibited and will not appear except to indicate a computer malfunction (see BIT discussion).

ACM DISPLAY (AIM-9)

Shoot/In Range Lights

The SHOOT and IN RANGE lights should be used along with current tactical considerations to determine actions to be taken. When in ACM mode with HEAT selected, the missile envelope is computed for a boresighted missile unless the ARR button is pressed. If the missile is allowed to self track, the envelope computed is for this off bore-sight situation. SHOOT light operation is determined by a computer decision of whether or not the fighter profile is within the missile launch envelope.

Range Rate Circle/DSCG Range Rate

Indicates the same information for both AIM-7 and AIM-9 missiles.

Aim Dot

When HEAT is selected in ACM mode and the missile seeker head is caged, the aim dot indicates a boresight pursuit course. When the aim dot is centered, the missile is aimed directly at the target. When the missile seeker head is uncaged (ARR button pressed), the aim dot represents the missile pointing vector (see AIM-7 aim dot).

Allowable Steering Error (ASE) Circle

In ACM mode, the ASE circle is a depiction of missile launch envelope. With HEAT selected in ACM mode and the missile seeker head caged, the ASE circle is fixed at 0.2 inches in diameter which represents 1.2° (6° /inch scale). When the missile seeker head is uncaged, the ASE circle is fixed at 0.56 inch in diameter which is identical to AIM-7 ACM full envelope determination.

Rmax and Rmin Strobes

The Rmax and Rmin strobes are based on missile envelope determination for a boresighted missile when the AIM-9 head is caged. The Rmax and Rmin values change as the target maneuvers. When the head is uncaged, calculation of Rmax/Rmin is an integral part of the computation of the full launch envelope.

Rmax and Rmin are displayed valid for pilot pickle, not missile away. The Rmax and Rmin computation allows for the 0.5-second delay between trigger squeeze and missile away.

Break X

The break X is inhibited in ACM mode and does not appear except to indicate a computer malfunction.

LONG RANGE INTERCEPT (LRI)

The LRI mode is automatically selected by the computer if the target distance is greater than 5 miles or the fighter altitude is greater than 32,000 feet. A 1G target is assumed by the computer. Additional target information (target aspect and velocity) is available within the digital computer. This allows a more accurate determination of missile performance which produces wider tolerance for interceptor steering commands.

LRI DISPLAY (AIM-7)

Range Rate Circle/DSCG Range Rate

Indicates the same information as in ACM mode.

Aim Dot

The aim dot provides steering commands to enable the aircrew to fire the missile as soon as possible. Dot position with respect to the center of the scope represents required course change. One inch deflection represents 42° of angular error. When the aim dot is centered, the aircraft is flying the correct course.

The aim dot provides three different steering commands (figure 1-26): collision setting; a transition between collision and lead pursuit steering; and lead pursuit steering. To minimize time-to-intercept, collision steering is used at long range. Transition steering starts 2 miles outside Rmax with collision steering and ends at Rmax with lead pursuit steering. The aircraft will have the maneuver to keep the aim dot centered. Inside Rmax, lead pursuit steering is used because it minimizes the missiles post-launch maneuvers. At tail aspect angles, lead pursuit steering is always used.

When the aircraft rolls to center the aim dot, APQ-120 rate gyro transients make the steering dot jump. To make the dot stable, the computer uses the rate gyro outputs it received prior to roll until the fighter roll angle is established and the transients settle.

Allowable Steering Error (ASE) Circle

The allowable steering error circle represents the maximum angular deviation from the desired course allowed to maintain a valid shoot condition. Additional information generated by the computer (target aspect and altitude) allows a detailed determination of missile performance. Because of this factor, the allowable deviation from the desired course is a maximum of 25° with the digital computer. However, absolute maximum is dependent on lead angle required for the intercept.

The lead angle is never less than $\pm 5^\circ$. This minimum would occur outside Rmax and inside Rmin. If the lead angle required for the intercept is less than 25° for the AIM-7E or less than 35° for the AIM-7F, the ASE circle starts to increase in diameter at approximately Rmax

until it reaches its maximum 25° at $R_{min} + 3/4 (R_{max} - R_{min})$. It maintains this maximum permitted deviation until $R_{min} + 1/4 (R_{max} - R_{min})$ and then decreases to approximately 5° at R_{min} . If the required lead angle is greater than 25° for the AIM-7E or 35° for the AIM-7F, the maximum ASE expansion can be less than 25° but never less than 5° .

Rmax and Rmax2 Strobes

In the LRI mode, Rmax and Rmax 2 are displayed. The Rmax strobe represents the true maximum range of the AIM-7 missile. A missile launched at maximum relative range will intercept the target with a velocity equal to its launch velocity. It is the maximum launch range against a non-maneuvering target for maximum separation between fighter and target at missile impact. For high altitude/high speed targets, the maximum relative range is compared to the seeker limit for a large target and the lesser of the two is used for the Rmax strobe. Otherwise, the maximum relative range is compared to the seeker limit for a 2 square meter target and the lesser of the two is used for the Rmax strobe.

The Rmax2 strobe replaces the Rmin strobe and provides a higher confidence against a maneuvering target. Rmax2 computation is based upon a target performing an 8-G turn away and cruise (constant airspeed) maneuver.

Rmin is not displayed in LRI. Break-X will occur when the range is less than Rmin. In situations where the target is within 5 NM and/or the fighter is below 32,000 feet MSL, the FCS automatically switches to the ACM mode prior to LRI AIM-7 Rmin. Rmin is still calculated as the true minimum range of the AIM-7 missile, independent of Rmax. A minimum time of flight dependent on interceptor speed and altitude is determined, then transposed into minimum range as a function of aspect angle and closing rate. Target altitude is finally used to compensate for any altitude differential.

Shoot/In Range Lights

The IN RANGE light operates in conjunction with the SHOOT lights. When in LRI mode, the lights are ON when target range is between Rmax and Rmin and the aim dot is within the ASE circle. To avoid an AIM-7 launch in the main beam clutter, the SHOOT lights are inhibited when AIM-7 is selected, aspect angle is $90^\circ \pm 9^\circ$, and the elevation angle is lower than 5° above the horizon.

Break X

When in LRI mode, at the computed minimum firing range of the AIM-7 missile, the SHOOT/IN RANGE lights go OFF and a break X appears on the scope. At this point, the firing interlocks to the missile are opened automatically, which disables the missile launch circuitry if interlocks are IN. The computer interlock may be overridden by selecting interlocks OUT. The ASE circle and range rate circle are removed when the break X appears. Continuous break X indicates a computer malfunction (see BIT discussion).

INTERCEPT COMPUTATIONS (AFTER OFF P005)

MISSILE MODE

MISSILE mode is the term applied to the algorithm used within the LRU-1 digital target intercept computer to provide proper launch cues. It is used when a full system lock-on is obtained. The selection is valid for non-maneuvering targets. An Rmax2 strobe is provided for a "no escape" maneuvering target. The algorithm takes into account all relevant attack parameters including target aspect, speed, and direction, and defines when a valid launch situation exists. It can provide steering indications to bring about, maintain, or restore a launch situation.

The mechanization used within the computer to derive an accurate and complete solution depends on determining specific target information, using a built in missile simulation, and determining missile capability against the selected target. The computer then determines whether or not the fighter is, at that moment, within the missile capability.

The computer receives information from the CAD/C, INS, and radar. Using filtering techniques, the computer determines target aspect, altitude, direction, velocity, and turn rate.

MISSILE DISPLAY (AIM-9)

Rmax and Rmin Strobes

Rmax represents the missile's maximum range capability in the measured tactical environment. The lower strobe acts as a Rmin indicator and represents the minimum range capabilities that the missile possesses under the measured conditions when AIM-9 is selected. Rmax and Rmin are displayed valid for pilot pickle, not missile away.

Range Rate Circle/DSCG Range Rate

Indicates the same information for both AIM-7 and AIM-9 missiles.

Aim Dot

The aim dot provides steering commands to position the aircraft in an optimum missile firing position under given circumstances. Dot position with respect to the center of the scope represents required course change. When the aim dot is centered, the aircraft is flying the correct course.

The aim dot provides three different steering commands (figure 1-26). Only pursuit steering is provided for the caged AIM-9 missile. (1) Collision: to minimize time-to-intercept collision is used at long range. (2) Transition steering: Transition steering starts 2 miles outside Rmax beginning with collision steering and ending at Rmax with lead pursuit steering. (3) Lead pursuit: Inside Rmax, lead pursuit steering is used because it minimizes the missile's post-launch maneuvers.

When the target range is greater than 35,000 feet, and the aircraft rolls to center the aim dot, APQ-120 rate gyro transients make the steering dot calculations invalid and the dot jumps. To make the dot stable, the computer uses the rate gyro outputs it received prior to roll (if they are valid) to calculate a constant target velocity until the fighter roll stabilizes and the transients settle.

Allowable Steering Error (ASE) Circle

In MISSILE mode, the ASE circle depicts the missile's lead/lag launch envelope. It represents the maximum steering error the missile can correct after launch.

For the HEAT caged missile selection, the ASE circle is fixed at 0.2 inches in diameter which represents 1.2° .

When HEAT uncaged is selected, the ASE circle size varies with range. Inside R_{min} and outside R_{max} , its radius is 0.12 inches representing 5° allowable lead/lag. Between R_{min} and R_{max} , the radius expands to 0.6 inches representing 25° allowable lead/lag. When the steering dot is outside of the ASE circle, the circle's radius gradually decreases to 0.12 inches.

Shoot/In Range Lights

The SHOOT lights provide additional indications of valid launch parameters. They illuminate when: (1) The target is between R_{max} and R_{min} . (2) The aim dot is inside the ASE circle. These lights and the IN RANGE light should be used along with current tactical considerations to determine actions to be taken. Flashing operation and high intensity of the SHOOT lights improve daylight visibility awareness. When the instrument panel dimming control is

used for night operation (intensity down) the SHOOT lights are off but the IN RANGE light operates at reduced intensity.

NOTE

Illumination of the shoot lights does not mean all requirements are satisfied for a missile shot. Ensure proper switchology (ie. missile select, master arm, etc) for AIM-9 employment.

Break X

When AIM-9 is selected, at the computed minimum firing range, the SHOOT/IN RANGE lights go OFF and a break X appears on the scope. AIM-9 missile launch is inhibited. The ASE circle and range rate circle are removed when the break X appears. Continuous break X indicates a computer malfunction (see BIT discussion).

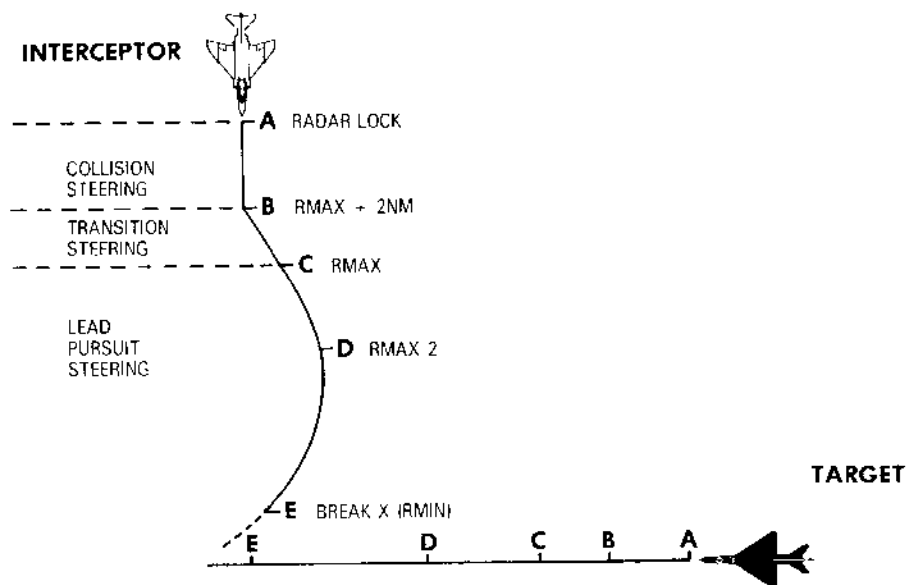
Hold Altitude (HOLD ALT) Light

The HOLD ALT light provides an indication to hold present altitude. The light comes on when:

- Range is greater than the computed snap-up range.
- Altitude is greater than 32,000 feet.
- The target is more than 8000 feet above the fighter.

When the light is ON, the aircraft is flown to correct azimuth error only; the elevation error is ignored. When HOLD ALT light goes OFF at the computed snap-up range, the fighter should snap-up to center the steering dot in elevation.

AIM DOT INTERCEPT COURSES



4E 34-1-1-(3111B)

Figure 1-26

MISSILE DISPLAY (AIM-7)**Rmax and Rmax 2 Strobes**

Rmax represents the missile's maximum range capability against a non-maneuvering target. Maximum range is the lesser of the maximum aerodynamic range or the seeker limit. Maximum aerodynamic range assumes a missile launch at a range which will allow it to intercept the target with a velocity equal to its launch velocity. The maximum seeker range is based on the missile's ability to track a 2 square meter target. The maximum aerodynamic range is compared to the seeker limit and the lesser of the two is presented as Rmax.

For AIM-7 the lower strobe serves as the Rmax 2 indicator and provides a higher confidence against a maneuvering target at long ranges. Rmax2 computation is based upon a maneuvering target which performs a turn in the shortest direction to tail on and then cruise using an 8-g turn up to 20,000 feet MSL, a 6-g turn to 35,000 feet, and 4-g turn above 35,000 feet. Target maneuvering begins at trigger squeeze.

If an AIM-7 missile is launched, the Rmax2 strobe resets to the bottom of the scope and becomes a "missile indicator". As the AIM-7 flies out, the strobe drives up the scope to the target. When the missile indicator strobe reaches the target, impact can be assumed. This gives the aircrew an indication of how long to illuminate the target with the radar. If another AIM-7 is launched, the strobe will indicate the oldest missile until impact or until it reaches the Rmax strobe, and then switch to the next oldest. This will continue until no missiles are left in the air. Up to four missiles can be tracked. Tracking will not occur on further missile launches unless all four of the preceding set have been completed or lockon is broken.

Rmin is not displayed for AIM-7 missiles. Break X will occur when the range is less than Rmin. Rmin is still calculated as the true minimum range of the AIM-7 missile, independent of Rmax. A minimum time of flight dependent on interceptor speed and altitude is determined, then transposed into minimum range as a function of aspect angle, closing rate, and target altitude.

Range Rate Circle/DSCG Range Rate

Indicates the same information for both AIM-7 and AIM-9 missiles.

Aim Dot

See AIM-9 aim dot description.

Allowable Steering Error (ASE) Circle

In MISSILE mode, the ASE circle depicts the missile's lead/lag launch envelope. It represents the maximum steering error the missile can correct after launch while retaining a high P_k .

When radar is selected, the ASE circle size varies with range. Inside Rmin and outside Rmax, its radius is 0.12 inches representing 5° allowable lead/lag. Between Rmin

and Rmax, the radius expands to 0.6 inches representing 25° allowable lead/lag for AIM-7E and 35° for AIM-7F. When the steering dot is outside of the ASE circle, the circle's radius gradually decreases to 0.12 inches.

Shoot/In Range Lights

The SHOOT lights provide additional indications of valid launch parameters. These lights and the IN RANGE light should be used along with current tactical considerations to determine actions to be taken. Flashing operation and high intensity of the SHOOT lights improve daylight visibility awareness. They illuminate when: (1) The target is between Rmax and Rmin. (2) The aim dot is inside the ASE circle. When the instrument panel dimming control is used for night operation (intensity down) the SHOOT lights are off but the IN RANGE light operates at reduced intensity.

NOTE

Illumination of the shoot lights does not mean all requirements are satisfied for a missile shot. Ensure proper switchology (ie. missile tuned, CW-ON master arm, etc.) for AIM-7 employment.

To avoid an AIM-7 launch in the main beam clutter, the SHOOT lights are inhibited when AIM-7 is selected, aspect angle is $90^\circ \pm 9^\circ$, and the elevation angle is lower than 5° above the horizon.

Break X

When AIM-7 is selected, at the computed minimum firing range, the SHOOT/IN RANGE lights go OFF and break X appears on the scope. At this point, the firing interlocks to the missile are opened automatically, which disables the missile launch circuitry if interlocks are IN. The computer interlock may be overridden by selecting interlocks OUT. The ASE circle and range rate are removed when the break X appears. Continuous break X indicates a computer malfunction (see BIT discussion).

Hold Altitude (HOLD ALT) Light

The display parameters are identical to those for AIM-9 selection.

MISSILE FIRING COMPUTATIONS

Signals required for controlling and launching the selected missile are computed and provided to the missile and missile control circuits. Computations performed depend on the type of missile selected. Some signals are computed but not used. These signals are automatically computed and supplied to the selected missile by the FCS computer.

Missile Firing Interlocks

The FCS has several interlocks (figure 1-27) to prevent inadvertent firing of the missiles. These include the normal launch controls, an allowable steering error interlock, two range interlocks, flaps up limit switch (AIM-9), and a tank aboard interlock (AIM-7).

The ASE and range interlocks are computed and controlled by the FCS. The pilot may launch the AIM-7 missiles with these firing interlocks IN or OUT by positioning the INTLK switch to IN or OUT. When the switch is in the IN position, power is removed from the

AIM-7 launch circuits until the IN RANGE and SHOOT lights are ON and the aim dot is inside the ASE circle, unless the interlocks are overridden by the radar mode knob or AOJ operation.

When the INTLK switch is OUT or the system is operating in AOJ, the range and ASE interlocks are bypassed. When the mode knob is at BST, the interlocks are bypassed until

lockon. The forward AIM-7 missiles are also interlocked by the tank aboard relay. This relay prevents firing of the forward missiles with a centerline tank or MER aboard.

Head Aim Command

The FCS computes head aim signals for AIM-7 missiles. The head aim signals point the missile antenna in the same direction as the radar antenna. Since the missile coordinates are based on the physical location of the missile on the aircraft, the appropriate head aim signal depends on the selected missile. The radar antenna position signals are modified to convert them to missile coordinates. Antenna rate and differences between the

(

(

(

(

(

(

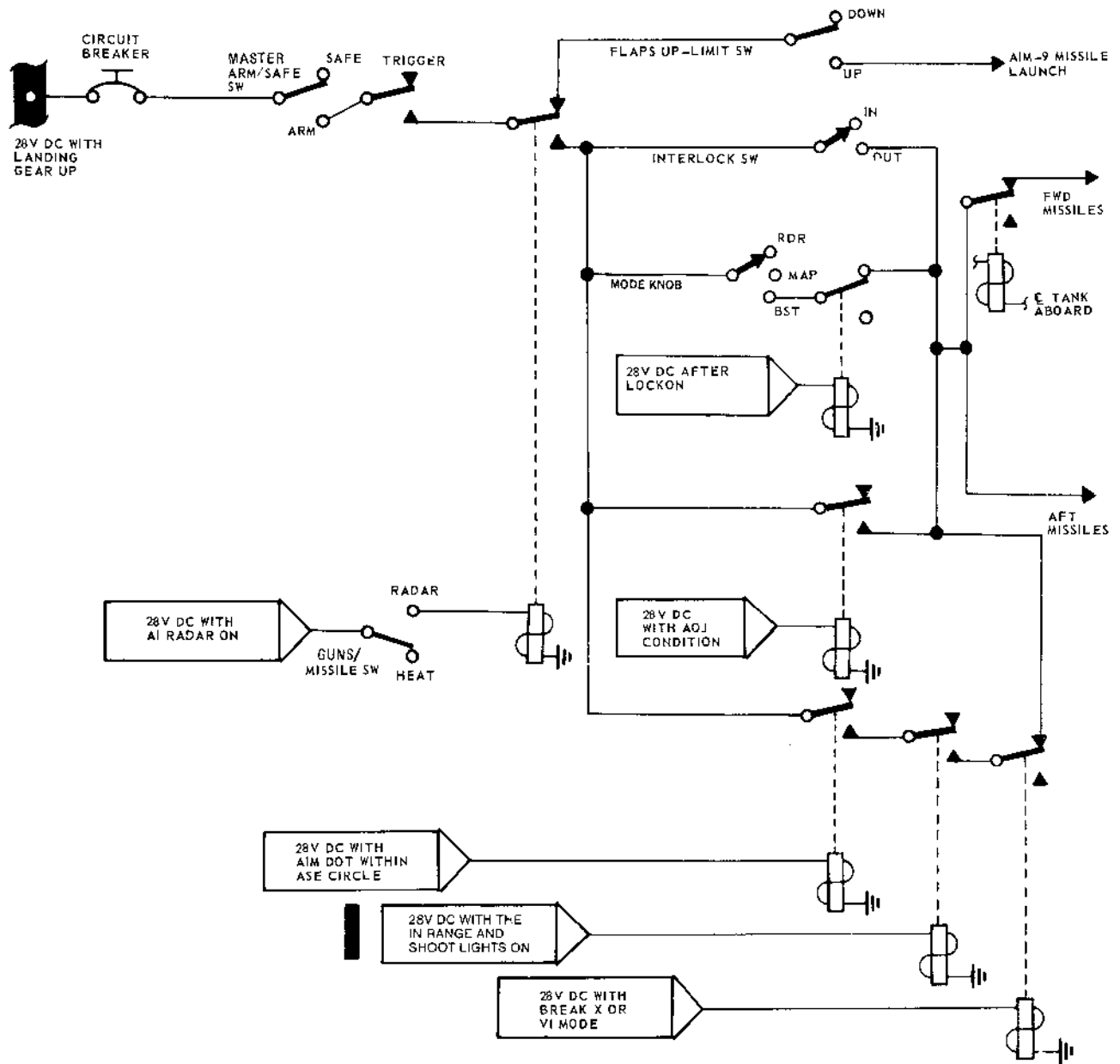
(

(

(



FIRING INTERLOCKS



4E-34-1-1-380C

Figure 1-27

radar antenna and missile antenna axis, missile nose-droop angle, and missile toe-in angle are computed. All four AIM-7 missiles receive the head aim signal when the trigger is pressed but only the missile that has been selected and prepared for launching will use the signal.

Head aiming is accomplished by applying head aim signals in azimuth and elevation to the missile immediately prior to launch. When the missile head hydraulics are activated, the missile antenna is positioned in azimuth and elevation according to the magnitudes and polarities of the head aim signals. After launch, since the missile is gyro stabilized, the missile antenna retains its commanded position. After target lockon, the missile guidance system takes command of the missile antenna in tracking the target.

English Bias

If the aim dot is not centered when the AIM-7 missile is launched, an english bias signal is applied to the missile autopilot to steer the missile back on course. The english bias signals are computed from head aim and lead angle error data from the ACM computed, AOA, and the station position of the selected AIM-7 missile. The head aim, lead angle error, and AOA input signals are summed and applied to the selected AIM-7 missile. The missiles use this command to derive an error signal which produces a body steering command for initial course correction. From wing unlock at launch to 0.6 seconds after umbilical separation, the missile is stabilized by body rate gyro inputs to the wings. Following the 0.6-second delay and until head lock or end of boost occurs, whichever is first, the error signal is used by the missile to correct any residual error (up to 25°) which may have existed at launch. Before OFP P005, the computation is the same for both ACM and LRI conditions of launch.

Roll Command

The missiles mounted in the fuselage are required to roll after launch to achieve the proper flight attitude. The left forward and aft missiles roll counterclockwise and the right forward and aft missiles roll clockwise. Each missile, after launch, rotates 49° with respect to its stowed position. Two roll command voltages of equal amplitude but opposite polarity are developed in the tuning drive unit. The polarity of the voltage indicates to the missile the direction in which it should roll. The voltages are sent directly to the fuselage missiles and stored until time of launch.

AIM-7 Missile Tuning

AIM-7 missile tuning is controlled by a tuning drive which performs the following:

- a. Accepts and processes data from the missile klystron motor limit switch circuit, afc circuit, and speedgate to tune and hold four missile klystrons within the afc sweep capabilities of the missile.
- b. Closes missile select relays in the missile launching circuit as each missile is properly tuned.
- c. Provides a roll command to each fuselage mounted missile.

Before the missile is launched, it must achieve speedgate lockup. To accomplish this, a simulated doppler signal is injected through the missile umbilical, and a rear signal is radiated into the missile rear antenna. The simulated doppler is a signal proportional to range rate and the rear signal is the CW illuminator frequency.

AIM-7 missile tuneup is a Go No-Go check performed on each AIM-7 missile individually and simultaneously to determine if each missile is capable of receiving rf transmissions. The AIM-7 missiles must satisfactorily pass this Go No-Go check before they can be launched. If the simulated doppler and CW frequency signals are present, the missiles will tune. If a missile fails to tune up, it is automatically stepped over during attempted launch. After checking missile turning, it is possible to stop cw transmissions by placing the missile power switch to STBY. This causes the missiles to detune but maintains them in a warmed up status. Reapplication of power tunes the missiles in less than 20 seconds. If the missile power switch is turned OFF, all power, including warm-up power, is removed from the missiles allowing them to *cold soak*. After *cold soaking* (i.e., at altitude) a 5-minute tuneup period should be anticipated. *Cold soaking* is not recommended.

AIM-7 Tuning Status

Missile tuning is controlled by the radar missile power switch on the forward main instrument panel. This switch must be at CW ON to place the cw transmitter in operation and tune the AIM-7 missiles. In STBY, AIM-7 missiles cannot be tuned, but remain in a standby status if previously tuned. When a previously tuned missile is in STBY, the tuning signal to the missile is removed, the missile tuning motor stops operating and holds the position established during tune-up, the RDR lights go OFF, (AIM-7E aboard), and the missile is placed in a standby condition. If the AIM-7F is aboard, the RDR lights remain ON when missile power switch is positioned to STBY. After TO 12P2-2APQ120-537, if the AIM-7F is aboard, the RDR lights go OFF when the missile power switch is positioned to STBY.

The missile status is displayed by the missile tuned indicator lights on the forward main instrument panel. Missile tuning is indicated by illumination of the applicable RDR tuned light. With four tuned missiles aboard, four RDR tuned lights are illuminated. The RDR tuned lights remain ON while the radar missile power switch is in CW ON and the missiles remain tuned. The RDR light must be ON before the respective missile can be included in the firing order. With the AIM-7E aboard, an illuminated RDR light when the missile power switch is not in the CW ON position indicates a malfunction. Missiles aboard these stations are not tuned and may not tune properly when the missile power switch is placed to CW ON. If launched the untuned missile would be ballistic.

The tuned status and condition of the AIM-7 missiles can be continuously monitored while CW power is ON regardless of the selection on the following switches:

- a. Master arm switch.
- b. Guns/missile switch.
- c. Weapon selector knob.

With the guns/missiles switch in RADAR and the master arm switch in ARM, the head-up RADAR light illuminates if at least one tuned missile is aboard (CW power ON). Illumination of the ARM light indicates that the master arm switch is in ARM. If rear missiles are not installed or not tuned and the CL tank is installed, the RADAR head-up light will not illuminate indicating the forward missiles are not ready to fire unless the CL tank is jettisoned.

NOTE

AIM-7 missiles detune and cannot be tuned with the radar mode knob in TV.

The missiles can be tuned with the master arm switch in either SAFE or ARM. The missiles tune on pseudo doppler when master arm is in SAFE.

With master arm in ARM, the missiles tune on simulated doppler. When an RDR light is blinking with the master arm in SAFE, the missile speedgate is attempting to tune on pseudo doppler without success; the pseudo doppler may be faulty or the missile may be faulty. The pilot should attempt missile tune with master arm switch in ARM. If tune is successful with master arm in ARM, the missile may be reliable.

After TO 1F-4-1424, AIM-7 missiles tune on simulated doppler with the master arm switch in SAFE or ARM.

MISSILE SPEEDGATE AND INTERLOCK SELECTION

The AIM-7 missile speedgate searches a narrow spectrum of target doppler frequencies with the aspect knob in any position except WIDE. The speedgate must search and lockon the actual target doppler frequency established between the missile and the target. The narrow speedgate will search slightly above and below (approx. ± 150 knots) the computed target closing rate supplied to the missile at launch. The wide speedgate searches the entire frequency spectrum. During missile boost, and after missile lockon, the centerline frequency of the speedgate spectrum is programmed upward proportional to increasing velocity of the missile. The starting point of the centerline frequency is established by the simulated doppler which represents the computed rate of closure at launch. Wide sweep is automatically selected during HOJ and AOJ. In the radar boresight mode without target lockon, the WSO may select a Vc input corresponding to the attack geometry by positioning the aspect knob. The following table shows the missile speedgate and interlock status during the various radar modes with the interlock switch IN.

RADAR MODE	INTERLOCK STATUS	SPEEDGATE SELECTED
Normal auto track	in	narrow
HOJ	in	wide
AOJ	out	wide
BST with no range track	out	narrow if aspect knob is in NOSE, FWD, TAIL, or AFT
Computer auto acq	in	narrow
Full manual track	in	narrow

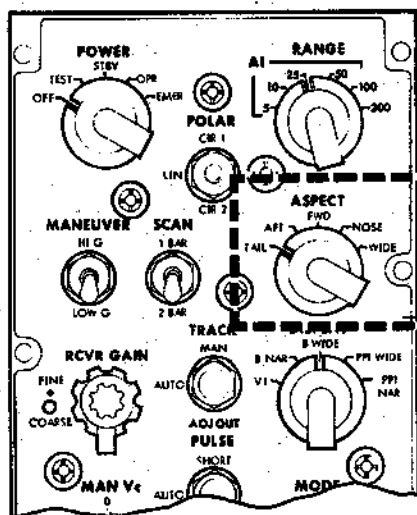
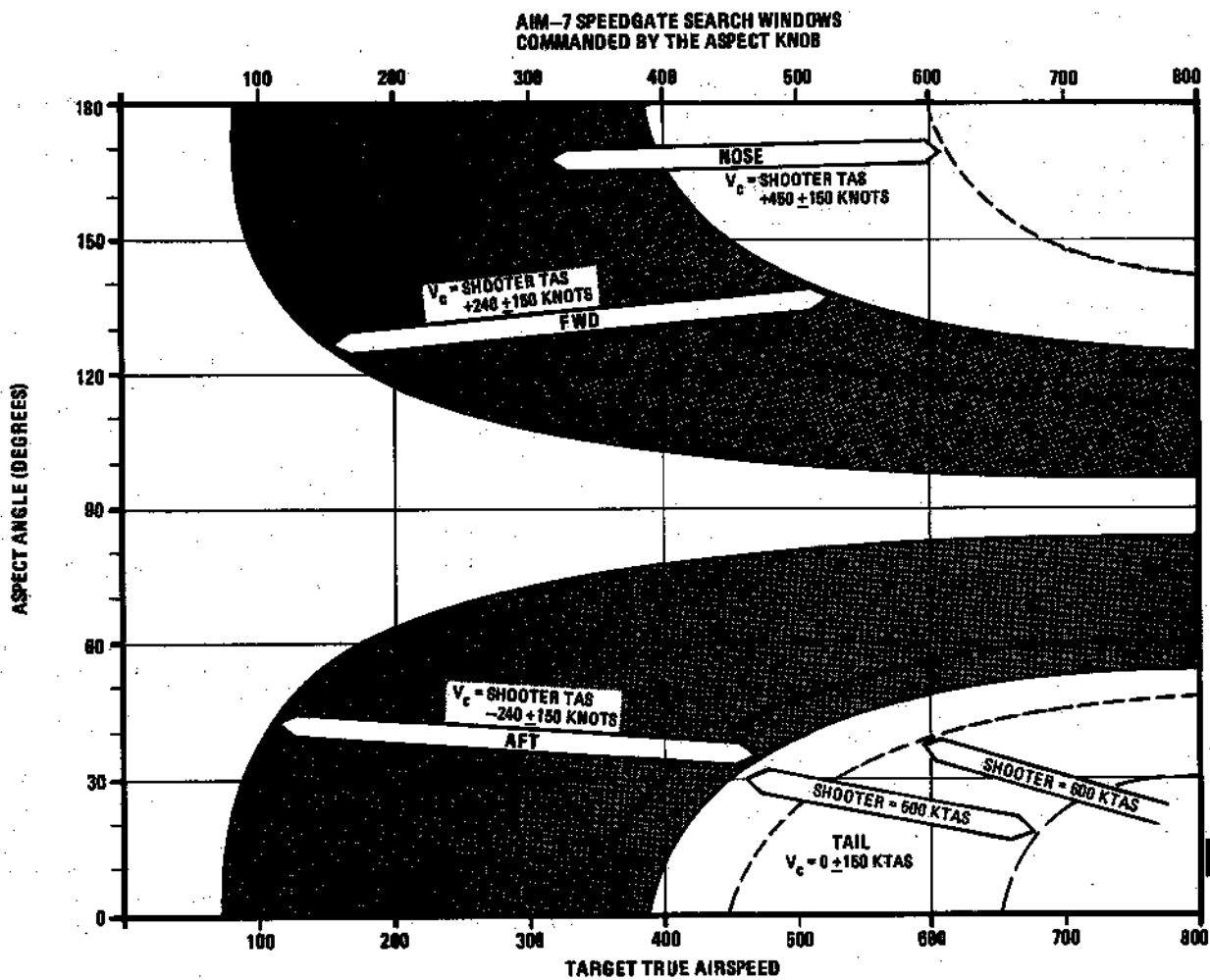
The AIM-7 missile can be successfully launched against a target when the closing velocity is less than 150 knots to an opening velocity of 300 knots. The fire control computer controls the starting time of the AIM-7 speedgate. The speedgate begins its search (at the starting point established by the simulated doppler frequency) and begins a programmed increase proportional to missile acceleration. The missile speed gate is inhibited from narrow sweep until 0.52 second after trigger squeeze.

Aspect Selection

NOTE

- The aspect knob supplies a Vc to the intercept computer only in the BST mode with no radar lockon.
- In DSCG aircraft before OFF P005; with a target locked on and the aspect knob in NOSE, target altitude and aspect angle are alternately displayed in the range rate window. In DVST aircraft, erroneous Vc gap indications will result.
- In DSCG aircraft after OFF P005; with a target locked on and the aspect knob in NOSE, numbers displayed in the range rate window represent target altitude. When the aspect knob is in FWD, numbers displayed in the range rate window represent aspect angle off the target tail. When the aspect knob is in TAIL, numbers displayed in the range rate window represent an approximate target heading. On DVST aircraft, the LRU-1 must be notified that the aircraft has a DVST using the procedures under Radar Turmon in section II. If these procedures are not used, the NOSE, FWD, and TAIL positions of the aspect knob will give erroneous Vc indications.

ASPECT ANGLE SELECTION



ASPECT KNOB

NOTE
THE WIDE POSITION SELECTS THE WIDE MISSILE SPEED GATE. ALL OTHER POSITIONS SELECT THE NARROW MISSILE SPEED GATE. THE V_c VALUES STATED ABOVE ARE FOR BST MODE WITHOUT RADAR LOCKON.

4E-34-1-1 (38)C

Figure 1-28

The ± 150 knot Vc areas covered by the various aspect knob positions are depicted in figure 1-28 in terms of aspect angle and target TAS. The NOSE, FWD, and AFT areas are constant with respect to shooter TAS while the TAIL area varies with shooter TAS.

The NOSE area covers high Vc, high aspect conditions. The AFT area covers low stern aspect attacks on slow targets and high stern aspect attacks on high speed targets. The FWD area covers high frontal aspect attacks on slow-to-medium speed targets and low frontal aspect attacks on high speed targets. The TAIL area is simply closure rates of ± 150 KTAS in the stern.

It takes approximately 1.5 seconds after trigger squeeze until missile launch and another 0.5 second before the speedgate starts sweeping. Therefore, the aspect knob should be positioned according to the conditions predicted for 2 seconds after trigger squeeze.

ALTITUDE SWITCHING, AIM-7E

When the AIM-7 launch command is delivered, the radar inputs altitude information into the missile autopilot circuits. The data is used to preset the AIM-7 autopilot altitude band for optimum missile steering in the environment in which guided flight will occur. The altitude switching signals are computed as a function of ADC altitude and the radar antenna (space stabilized) elevation angle. For the fighter altitude and radar antenna angle conditions shown in figure 1-29, the signals establish an A, B, or C altitude band setting. An altitude band switch-after-boost command may be applied but only during the specific look-down launch conditions shown in the band B region. The switch-after-boost command enables the AIM-7 autopilot to automatically switch down to the lower altitude band A (0 to 32,000 feet) after the missile boost period has elapsed.

NOTE

Altitude switching is a function of fighter altitude and computed target altitude. The STAB switch does not influence altitude switching.

Altitude Switching, AIM-7F

Refer to TO 1F-4C-34-1-2-1.

ALTITUDE SWITCHING

AIRCRAFT ALTITUDE—FEET X1000			
ANTENNA EL (SPACE STAB.)	BAND A	BAND B	BAND C
GREATER THAN +5° UP	0 to 22	22 to 42.5	Above 42.5
WITHIN $\pm 5^\circ$ (CD-ALT.)	0 to 32	32 to 55	Above 55
GREATER THAN -5° DOWN	0 to 32	32 to 63 (32 to 42.5) *	Above 63

* SWITCH AFTER BOOST COMMAND.

4E-34-1-1-(283)

Figure 1-29

RADAR OPERATION (AIR-TO-GROUND)

Radar operation (air-to-ground) includes the AIR-GRD and MAP PPI modes. The radar AIR-GRD mode provides range information for the WRCS DT or DL delivery modes. The MAP mode PPI display is used for offset bomb or target find modes. Scope displays for these modes are shown in figure 1-30.

AIR-TO-GROUND RANGING

The air-to-ground ranging function provides the capability of locking on and automatically tracking a nondiscrete ground target. This is a moving or stationary ground target that does not stand out clearly in the video return and is almost completely obscured by ground clutter. The target is tracked automatically in range only, not in angle. During an air-to-ground attack, the radar antenna is boresighted to the flight path of the aircraft and the aircraft is aimed at the target by using the sight piper as an aiming reference. Target range information is then furnished automatically by the radar set.

The AIR-GRD mode is available only in AI ranges. With the range knob in any AI position and AIR-GRD mode selected, the feedhorn is nutated in search, acquisition and track and short pulse operation is automatically selected.

After lockon, the air-to-ground range track system generates signals that represent target range. These signals are used in the range track system to maintain track and to gate target returns for the AGC. The range signal is also fed to the optical sight range bar and the WRCS bomb release functions. The accuracy of the range information depends on how precisely the aircraft is pointed at the ground target.

Prior to the bombing run, the pilot selects one of the WRCS dive delivery modes, selects the A/G sight mode, and energizes the weapon release controls. The WSO selects the AIR-GRD mode and AI 5 or AI 10-mile range. The radar antenna and the optical sight are now drift stabilized; the piper LOS is parallel with the RBL. The B-sweep is offset downwind from the center of the scope equal to the drift angle.

When the target area has been visually identified, the pilot begins to dive toward the target. When the dive angle is between 10° and 40°, the WSO may begin the air-to-ground lockon procedure. The receiver gain is reduced to eliminate the radar side lobe return, thereby eliminating the altitude line displayed on the B-sweep. The gain should be reduced until the length of the ground return in the B-sweep is as short as possible before the return begins to break up and fade. The fine adjustment knob on the receiver gain control aids in this task. The actual length of the return is a function of the antenna graze angle (aircraft dive angle) and the amount of receiver gain. For a 25° dive angle, the main beam clutter can be reduced to approximately 1/2 mile. In any case, adjust the receiver gain until the smallest amount of clutter is present, or a false track may result. (Initiating lockon in excess of 25,000 feet is possible; however, inside

25,000 feet, maximum range-accuracy is supplied to the WRCS computer.) To initiate lockon, position the acquisition symbol over the return and depress the action switch to half-action. The range strobe appears between the acquisition symbol. Slant range is supplied to the computer when the range strobe is on the scope. Move the hand control to position the range strobe directly on the center of the main beam clutter band, then to obtain radar lockon, press the action switch to full-action.

NOTE

False tracking occurs when the radar has locked on the side lobe clutter instead of the main beam clutter.

When false tracking occurs, the range bar on the optical sight will display a rapid decrease in slant range. The following corrective action should be taken:

- a. Press the action switch to half-action, release.
- b. Adjust the receiver gain.
- c. Position the range strobe in the exact center of the ground return.
- d. Press action switch to full-action, release after the ASE circle is obtained.
- e. Confirm the lockon.

After lockon, range tracking is indicated by the appearance of the ASE circle and the range bar on the sight reticle. The acquisition symbol is removed and the SKIN TRK light illuminates. Slant range can be

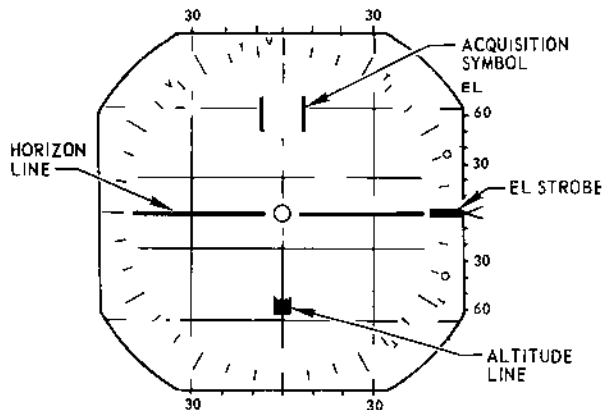
interpolated by the vertical position of the range strobe which moves down the B-sweep display as the range to the target decreases. The ASE circle remains in the center of the scope and fixed in diameter.

Range tracking of the ground return can be rejected by pressing the action switch momentarily to half-action. Lockon can also be broken by a nose-up maneuver where the range rate is increased beyond the range tracking capability of the radar. However, the tracking circuit is operating on memory. If the ground return signal reappears within 5 seconds, normal tracking will automatically be resumed providing the position of the ground return has again been established with the position of the range strobe. When lockon is broken, the ASE circle and the range strobe are removed from the display and the acquisition symbol reappears.

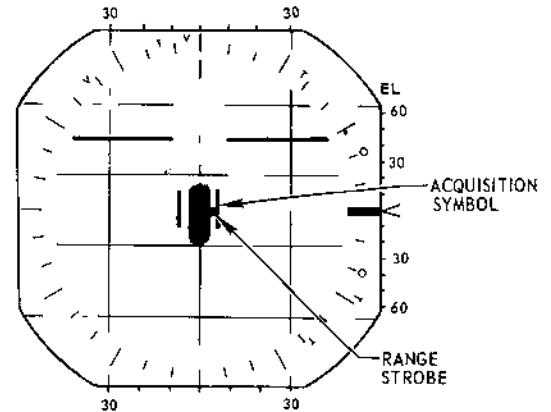
After lockon, the pilot may continue the established dive angle or increase the dive angle to a maximum of 40°. The pilot positions the pipper, and when the pipper is on target, the bomb button is pressed and held until bomb release occurs. When the bomb button is pressed, the radar range and INS pitch/velocities are supplied to the weapons release computer. The WRCS continues to monitor the aircraft position and releases the bomb automatically.

SCOPE DISPLAYS (AIR-TO-GROUND)

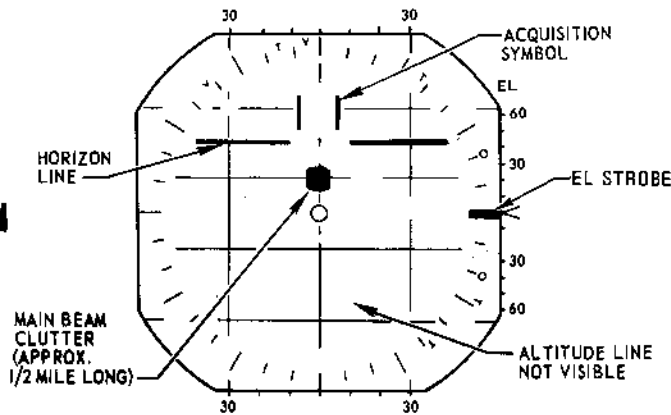
AIR-TO-GROUND MODE



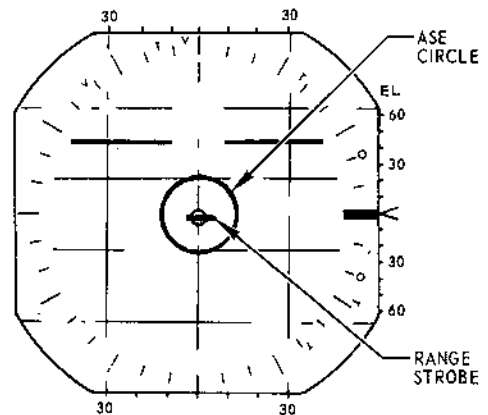
1 Level flight, AIR-GRD mode and AI range selected, receiver gain normal.



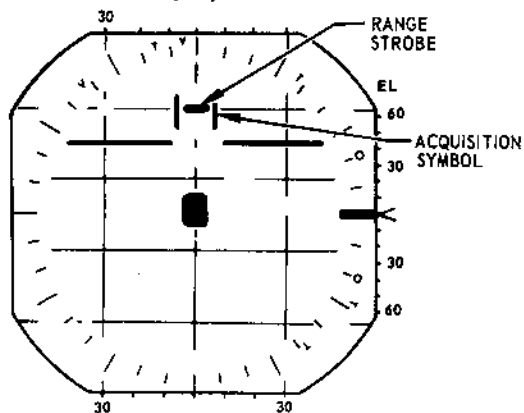
4 Position range strobe in the middle of the main beam clutter.



2 Dive angle greater than 10° , reduce gain control until ground return is slightly visible.



5 Full-Action, ASE circle appears to indicate lock-on.



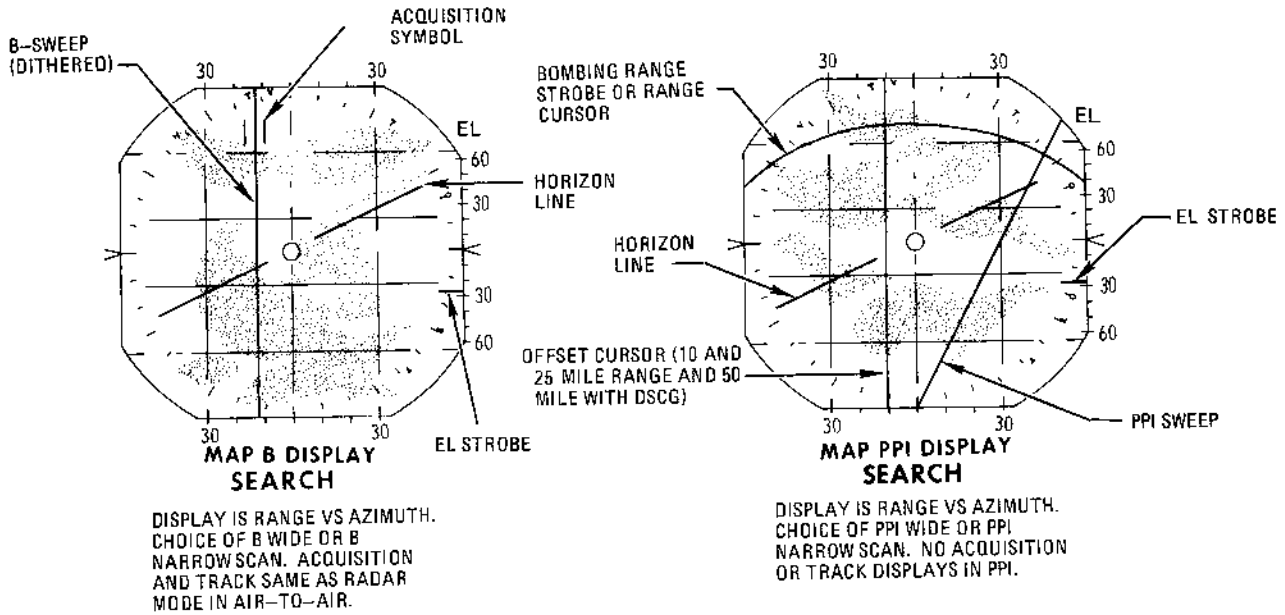
3 Half-Action, range strobe appears in acquisition symbol (unless aircraft drift is present).

4E-34-1-1-(40-1)B

Figure 1-30 (Sheet 1 of 2)

SCOPE DISPLAYS (AIR-TO-GROUND) (Continued)

MAP MODE



4E-34-1-1-(40-2) A

Figure 1-30 (Sheet 2 of 2)

On aircraft 71-237 and up, air-to-ground ranging may be used in CCIP, Rockets, Guns, or Dive Toss modes for weapon delivery. The DMAS takes the slant range from radar lockon and computes instantaneous range to target and altitude above target. It then continuously uses these values to estimate target elevation MSL. The target elevation inserted in the mission interactive list is used to calculate the release point after break lock. The pilot may fly any maneuver in pitch and the DMAS provides lateral steering to the target, compensated for wind and bomb crosstrail, and automatically releases the weapon or weapons when a release solution is reached.

NOTE

The WSO may begin the air-to-ground procedures regardless of aircraft dive angle.

All other air-to-ground ranging procedures remain the same as previously discussed.

MAP MODE (PPI DISPLAY)

The MAP PPI display is provided with the mode knob in MAP and the display knob in PPI WIDE or PPI NAR. (The

notation MAP PPI is used to describe both switch positions). In MAP PPI operation, symbols for mapping and radar bombing are provided. The display is available in all ranges except 5-mile, although some symbols are not present in all ranges. When the radar range knob is in the 5 MI position, the PPI knob position is overridden and the radar operates in the MAP B mode (figure 1-30 sheet 2).

The MAP PPI mode is used for ground mapping, WRCS target find and offset bomb. The MAP PPI scope display consists of the PPI-sweep, the range cursor and the offset cursor, the horizon line, and the elevation strobe. The acquisition symbol does not appear, and the feedhorn does not nutate. The elevation angle of the antenna (look-angle) can be manually set by the thumb wheel on the antenna hand control. Linear polarization of the antenna beam is automatically selected regardless of the polar switch position.

The target range must be interpolated along the length of the sweep line, rather than vertically from the base of the scope. (Note that the range cursor forms an arc indicating the slant range from aircraft to ground. Slant range is measured from the bottom-center of the scope to the range cursor, along the vertical centerline.) The target returns appear with equal intensity regardless of the target range.

This is accomplished by the STC circuit. The STC circuit reduces the receiver gain at the start of each transmitted pulse and increases the receiver gain at a constant rate to recover to the normal gain value at the maximum target range selected. This causes return signals from equal size targets, at various ranges, to appear on the scope with equal intensity.

The PPI display is drift stabilized to provide the aircrew with a view of the aircraft course on the centerline of the scope, rather than aircraft heading. The drift signal used to stabilize the PPI display is supplied by the INS. The antenna is not drift stabilized.

Range Cursor

The range cursor is displayed in MAP PPI and BEACON PPI in all ranges except 5 mile. It is positioned by either the WRCS or by the fixed position of the bombing range strobe adjustment on the radar antenna control panel. The range cursor is used to determine the slant range to the target or IP for target finding and offset bombing.

Offset Cursor

The offset cursor is displayed with the radar mode knob in MAP PPI or BEACON PPI (NAR or WIDE); the delivery mode knob in TGT FIND or OFFSET and the range knob in either AI 10 or 25 (and AI 50 with DSCG); or when the target find switch is in HOLD. The offset cursor is used to establish the azimuth position of the radar IP and/or the target. The intensity of the offset cursor on both scopes is controlled by the offset cursor intensity knob in the rear cockpit on the radar scope panel. The cross track cursor thumb wheel on the cursor control panel is used to manually position the offset cursor in azimuth. The slant range cursor scale is normal for the radar ranges selected.

Range And Offset Cursors

On aircraft 71-237 and up, the range and offset cursors appear at all times under DMAS control except when OFF, DIRECT, or any LABS mode is selected on the delivery mode knob and the sensor aim switch is in INDP or SLVD.

Bombing Range Strobe

The range cursor becomes a bombing range strobe when the delivery mode knob is in any position except OFFSET or TGT FIND and the MAP PPI or BEACON PPI (NAR or WIDE) radar mode is selected. The bombing range strobe must be precisely adjusted (using ground test

equipment) so that the outer edge of the strobe represents a predetermined horizontal range at a given altitude. The bombing range strobe should not be adjusted using the BIT targets on the radar scope unless the resulting range error tolerance can be accepted. The position of the strobe is controlled by the screwdriver adjustment on the antenna hand control panel. The offset cursor is not displayed when the range cursor is performing the function of a bombing range strobe.

On aircraft 71-237 and up, the bombing range strobe is present in all ranges except AI 5 whenever the delivery mode knob is in OFF, DIRECT, or any LABS mode and the sensor aim switch is in INDP or SLVD. If the sensor aim switch is in ARN AIM, normal range and offset cursors are displayed.

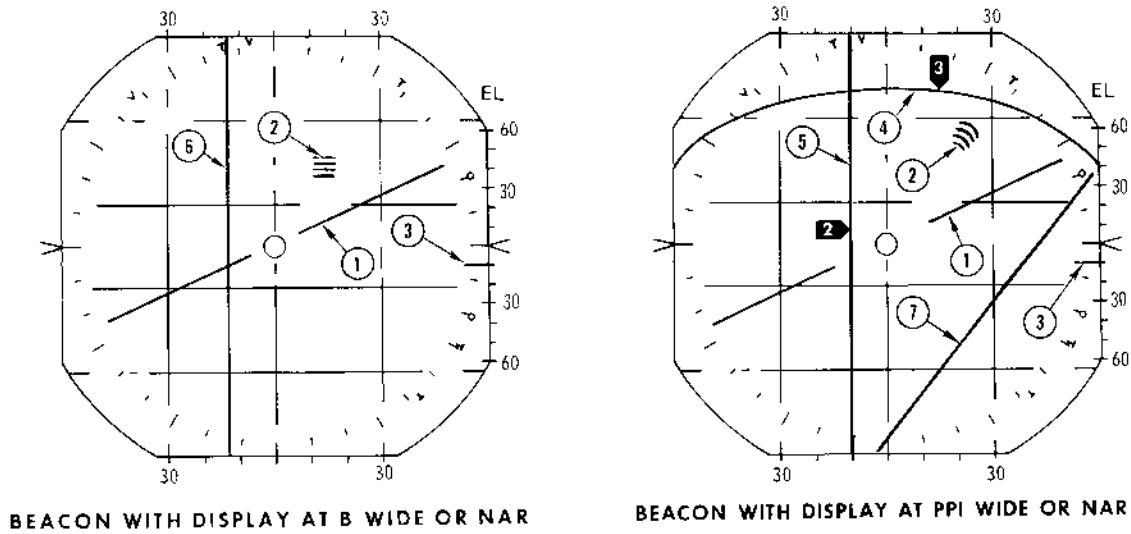
RADAR OPERATION (BEACON MODE)

The beacon mode provides navigation information from ground or airborne transponder units. This information is received in search operation only, and can be displayed in either the B WIDE, PPI WIDE, B NAR, or PPI NAR displays. Lockon capability is removed and CIR 2 is automatically selected in the BEACON mode. The search operation is identical for either display (figure 1-31). The offset cursor and range cursor are displayed when PPI WIDE or PPI NAR is selected, however, acquisition or tracking cannot be accomplished.

The BEACON mode can be used to establish a specific point on the ground where ground clutter makes the identification extremely difficult. Assuming ground forces have placed a transponder in a predetermined position, the WSO places the radar mode knob to BEACON, the display knob to either B WIDE, PPI WIDE, B NAR, or PPI NAR. The radar now transmits a beacon signal and thus triggers the transponder into operation. The transponder then transmits a reciprocal signal at a slightly different frequency back to the aircraft. The beacon frequencies are selected so that the resultant frequency (as processed by the radar rf section) is different from the transmitting and receiving frequencies of the normal radar. This results in only the beacon target being displayed when operating in the BEACON mode. The WSO reduces the radar gain to a point where a clearly defined beacon target is observed. This reduction in gain is possible because of the large amplitude of the beacon return. The large amplitude is due to the beacon target being transmitted at a compatible frequency directly to the aircraft.

With the radar operating in the BEACON PPI mode, the beacon target can be utilized as a radar IP. The IP distances can be inputs into the WRCS for both the offset bomb or target find modes of operation.

SCOPE DISPLAYS (BEACON MODE)



NOTES

1. HORIZON LINE
2. LOCATED BEACON (FIRST MARKER OF BEACON CODE REPRESENTS RANGE TO BEACON)
3. EL STROBE
4. RANGE CURSOR OR BOMBING RANGE STROBE
5. OFFSET CURSOR
6. B-SWEEP
7. PPI SWEEP

1. With 5 MI range selected, PPI-display is switched to MAP-B.
2. Offset cursor is displayed only in 10 and 25 mile (and 50 mile with DSCG) range in MAP-PPI or BEACON - PPI with TGT FIND or OFFSET BOMB selected or HOLD selected on the weapon delivery panel.
3. Range cursor is displayed in MAP-PPI or BEACON PPI modes (except 5 mi). It is positioned by Weapons Computer with TGT FIND or OFFSET BOMB selected or with HOLD selected on weapons delivery panel. At all other times, the range cursor becomes the bombing range strobe and is controlled by manual adjustment of the RANGE STROBE (screwdriver adjustment) on the radar antenna control panel.

Figure 1-31

RADAR OPERATION (VISIDENT MODE)

The visual identification (VI) mode is used for close-in visual observations or for accurate range information in trail formation. After radar lockon is established in the RDR or MAP B modes, the display switch is set to VI. The Rmax and Rmin strobes, acquisition symbols, the HOLD ALT, SHOOT and IN RANGE lights are disabled. Before OFP P005, the break X circuits are also disabled. To launch AIM-7 missiles with the VI mode selected, the interlock switch must be in OUT. After lockon is accomplished and target range is within limits of the range indicator (1.5) miles, a direct readout of range and range rate is provided by the VIS IDENT range indicator in all A/A radar modes. The minimum indication is 600 feet.

Before OFP P005, VI steering provides pure pursuit steering to the target except when range rate exceeds 87 knots and range is less than 6000 feet. In this case the dot indicates a veer-off by a sudden jump providing steering to pass to the right of target until range rate decreases below 67 knots. Steering offsets the elevation LOS by the mea-

sured AOA. When the dot is centered, the fighter is lined up in azimuth with the target, but is offset below the target by the AOA. After OFP P005, the VI provides pure pursuit steering to the target. When the range to the target decreases to less than 1000 feet, the break X will appear as an anti-collision warning to the pilot. The steering dot will continue to display in those conditions.

TV DISPLAY



To prevent damage to the radar set control panel do not select TV on the DSCG mode knob and the radar mode knob at the same time. The TV position on the radar mode knob is not used. AIM-7 missiles detune and cannot be tuned when the radar mode knob is in TV.

The TV picture displayed on the radar scopes is generated by the weapon or TISEO TV camera. Refer to TISEO or AGM-65 Delivery, this section.

LASER TARGET DESIGNATOR (PAVE SPIKE) AN/ASQ-153(V)-3 (BLOCK 36 THRU 45, SELECTED AIRCRAFT)

TDS MISSION

The Electro-Optical (EO) Target Designator System (TDS) consists of the AN/AVQ-23A/B target designator pod carried in the left forward missile well, the WRCS interface electronics, and the cockpit controls (figure 1-32). The TDS supplies laser generated slant range data to the WRCS computer and to a digital readout in the front cockpit. Accurate aircraft derived altitude AGL is also obtained and sent to the WRCS for release computation.

A low light level TV camera is installed in the pod to provide a magnified view of the target on both scopes. The center of the TV field-of-view (FOV) is the laser beam line-of-sight (LOS). Accurate target tracking is aided by inputs from the INS. The camera/laser LOS can be controlled by the WSO through 180° of elevation and 270° roll. A LOS indicator is provided in the front cockpit to inform the pilot of approaching LOS limits. The TV display also includes symbols which indicate system status, LOS elevation angle, and time-to-go (TT_G) to weapon release point (T_O).

Two automatic weapon release modes are available when the delivery mode selection knob is positioned to TGT FIND: WRCS AUTO and ROR (release-on-range), figure 1-33. Both release modes are selectable on the slant range indicator and use laser generated or computed slant range

in the weapon release solution. (Refer to Slant Range Computation, Laser and Computed, in later pages.) The final phase of the bomb run is accomplished with the aid of the TV display and the displayed weapon release cue symbols (laser status), and/or the optical sight. Weapon release occurs when the release signal is generated if the bomb button is pressed. Both modes permit immediate evasive maneuvering after weapon release when delivering laser guided bombs (LGB). The WSO continues to track and illuminate the target until after weapon impact.

The WRCS automatic release mode uses the dive toss equations to produce a release solution and generate a release signal. The WSO must set in a drag coefficient and target elevation on the WRCS panel.

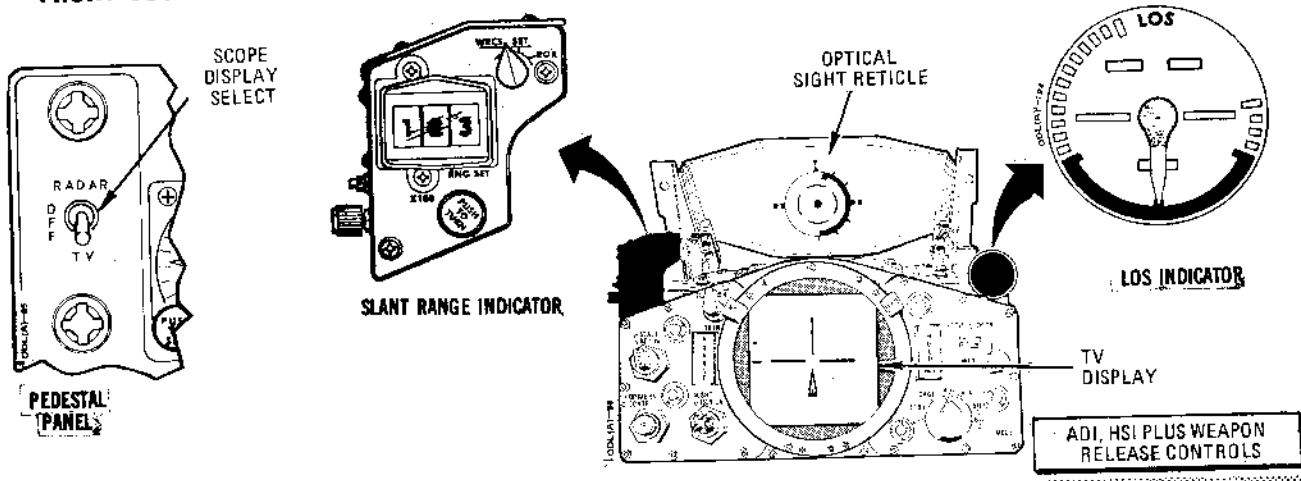
The ROR mode is an automatic release mode which can be used in the event of a WRCS or INS failure. The desired release slant range is set in the slant range indicator. When the slant range to the target equals the preset slant range, weapon release is initiated if the bomb button is pressed. The ROR mode is best suited to the level delivery.

Laser effectiveness is constantly monitored and the status indicated on the TV display. When laser range is not valid, a computed range is automatically selected and used. When the TDS is turned off, all affected aircraft controls function as in aircraft without Pave Spike.

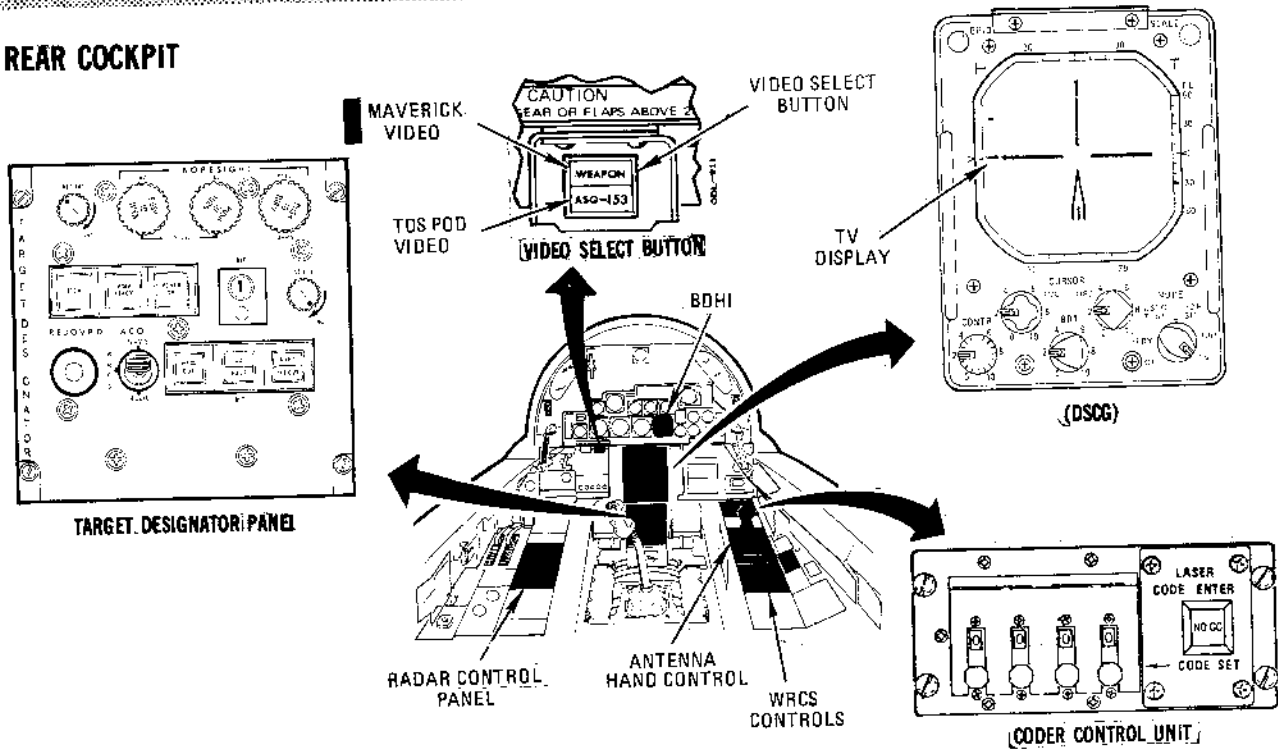
EO TARGET DESIGNATOR SYSTEM

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)

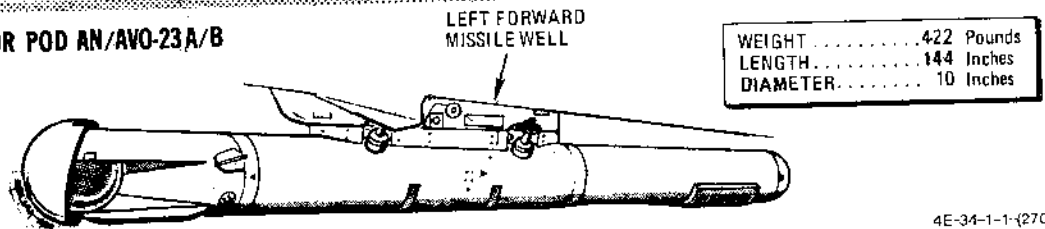
FRONT COCKPIT



REAR COCKPIT



TARGET DESIGNATOR POD AN/AVO-23A/B



4E-34-1-1 (270)B

Figure 1-32

(

(

(

(

(

(

(

(

(

(

PAVE SPIKE DELIVERY MODES

■ (BLOCK 36 THRU 45, SELECTED AIRCRAFT)

NOTE

FOR BEST ACCURACY, N/S AND EW OFFSET VALUES MUST NOT EXCEED 600 (60,000 FT).

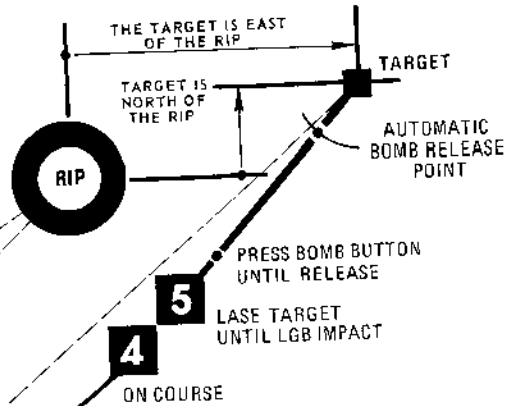
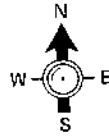
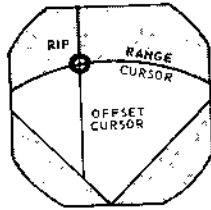
WRCS ACQUISITION MODE

1

WSO Detects RIP return on radar scope MAP PPI.

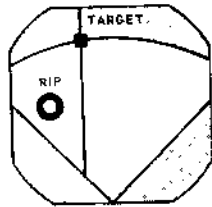
2

WSO Places cursors over the RIP and presses the freeze button.



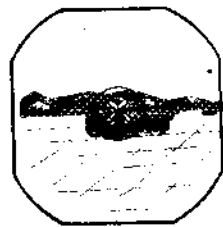
3

WSO presses target insert button. Pilot receives range and steering display and maneuvers to target. Laser and TV LOS slaved to cursor intersection. Set in target altitude MSL.



4

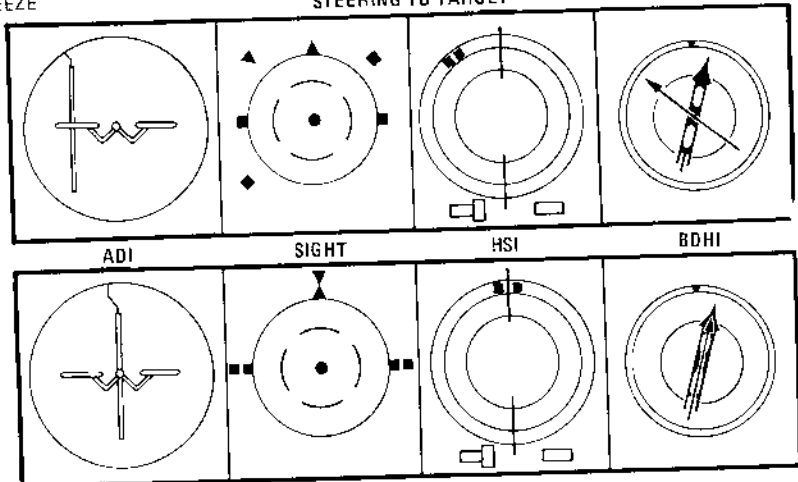
WSO Selects TV and switches from PPI display to B WIDE display. When target is in TV FGV, WSO enters track: TTG and TO cues appear.



5

Start WRCS Auto delivery profile or ROR profile and lase target until LGB impact (see sheet 2).

STEERING TO TARGET



ON COURSE INDICATIONS

- | | |
|--|---|
| <p>Optical Sight:</p> <ol style="list-style-type: none"> 1. Caged zero $^{\circ}$ azimuth 2. Reticle depressed to the boresight line <p>AN/APQ-120 Mode:</p> <ol style="list-style-type: none"> 1. MAP-PPI/TV 2. AI Range <p>WRCS Manual inputs:</p> <p>WRCS Panel</p> <ol style="list-style-type: none"> 1. Target N-S/E-W distance 2. IP or target altitude MSL 3. Release advance 4. Drag coefficient <p>Cursor control panel:</p> <ol style="list-style-type: none"> 5. Freeze signal 6. Target insert signal 7. Cross track signal 8. Along track signal 9. Reset signal | <p>TD Panel inputs:</p> <ol style="list-style-type: none"> 1. WRCS OUT light off 2. Acquisition switch - WRCS 3. LASER READY light on <p>INS Supplies:</p> <ol style="list-style-type: none"> 1. Ground speed 2. Altitude MSL 3. Ground track 4. True heading 5. Aircraft velocity east 6. Aircraft velocity north <p>TDS Supplies:</p> <ol style="list-style-type: none"> 1. Slant range 2. Derived aircraft altitude AGL 3. TV display |
|--|---|

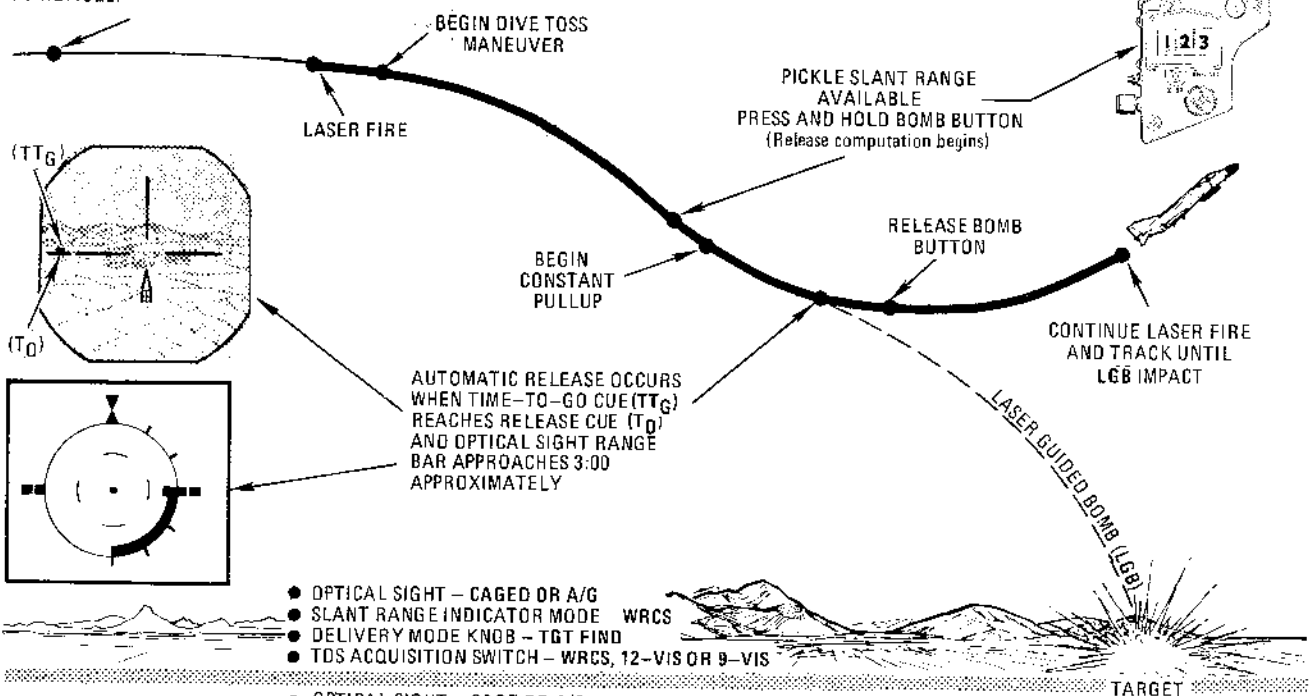
4E-34-1 1-4271-11C

Figure 1-33 (Sheet 1 of 2)

PAVE SPIKE DELIVERY MODES (Continued)

WRCS AUTO RELEASE MODE

WRCS PANEL - SET (Set drag coefficient - CB)
TV DISPLAY AND TDS TRACK MODE SELECTED
USE ANTENNA HAND CONTROL TO POSITION
TV RETICLE.

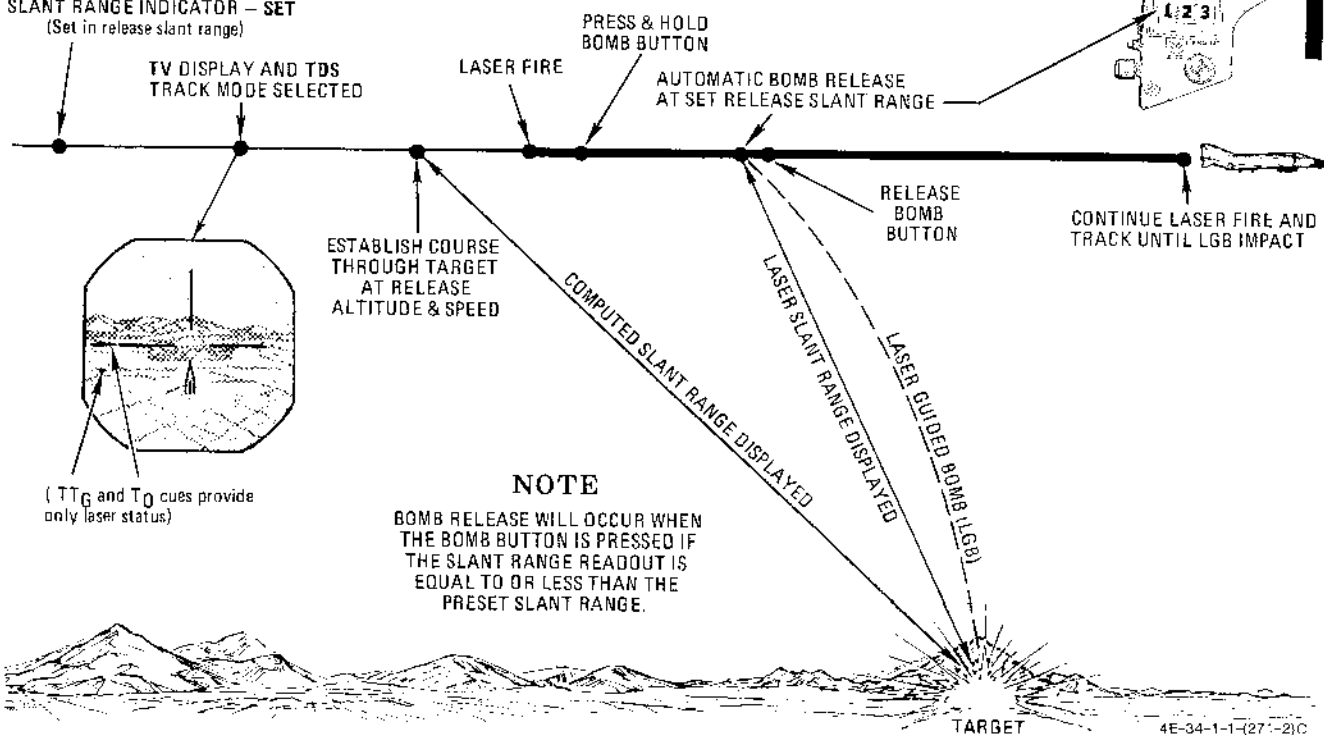


- OPTICAL SIGHT - CAGED OR A/G
- SLANT RANGE INDICATOR MODE - WRCS
- DELIVERY MODE KNOB - TGT FIND
- TDS ACQUISITION SWITCH - WRCS, 12-VIS OR 9-VIS

ROR AUTO RELEASE MODE

SLANT RANGE INDICATOR - SET
(Set in release slant range)

TV DISPLAY AND TDS TRACK MODE SELECTED



- OPTICAL SIGHT - CAGE OR A/G
- SLANT RANGE INDICATOR MODE - ROR
- DELIVERY MODE KNOB - TGT FIND
- TDS ACQUISITION SWITCH - 12-VIS, 9-VIS OR WRCS

NOTE

BOMB RELEASE WILL OCCUR WHEN THE BOMB BUTTON IS PRESSED IF THE SLANT RANGE READOUT IS EQUAL TO OR LESS THAN THE PRESET SLANT RANGE.

4E-34-1-1-(271-2)C

Figure 1-33 (Sheet 2 of 2)

TARGET DESIGNATOR POD, AN/AVQ-23A/B

The AN/AVQ-23A/B target designator pod contains a laser transmitter, TV camera, an optical system, a beam pointing and stabilization system, an environmental control system, and a laser coding system. The performance parameters of these systems are presented in TO 1F-4E-34-1-1-1.

POD STRUCTURE

The nose of the pod has a glass dome which is protected by a visor when the pod is stowed and rolled upward, under the aircraft surface. The visor protects the dome during supersonic flight and flight through rain. The visor contains a heater to minimize icing in the window area. The nose compartment is pressurized with nitrogen and contains a heat exchanger to control humidity and temperature. A plunger-type indicator provides preflight inspection of the nitrogen pressure available.

The nose section is connected to and rolls with the sensor assembly. The sensor assembly is covered by an inner shell. The inner shell is mounted on bearings within the outer shell and driven by a roll drive motor. The outer shell supports the forward mounting lug.

The middle section contains the umbilical plugs, the aft mounting lug, and access doors to the electrical and cooling connections. The aft outer shell covers the laser power supply and the electronics assembly, and can be removed with the pod mounted on the aircraft. A surface heat exchanger is attached to the aft outside surface of the shell. An end cap provides access to the phase change material (PCM) status indicator (an environmental sensor), elapsed time meter, laser pulse counter, and various hydraulic connectors. An overheat condition in the pod is monitored and sent to the OVHT light on the target designator panel.

LASER SYSTEM

The laser system includes a laser transmitter, laser receiver, and the laser coder control unit. The use of the laser coder control unit, laser radiated power, pulse width, and pulse repetition frequency (prf) are presented in TO 1F-4E-34-1-1-1.

The laser transmitter produces a narrow beam of pulsed laser energy. The beam is used for laser guided bomb (LGB) guidance. The pulses are used to measure slant range. The laser pulses are produced in the transmitter by a xenon flashlamp which serves as the pump source for the laser rod.

The laser receiver detects each laser pulse reflected from the target and sends an amplified signal to the range circuits in the laser control electronics. The range circuits provide accurate range to the last target detected in the range window. The range window is set to accept only targets within the range of interest (refer to TO 1F-4E-34-1-1-1). This laser derived slant range is compared with a computed slant range derived from

aircraft system inputs. The laser range is rejected if it appears invalid. The WSO can override this rejection by momentarily pressing the REJOVRD button. Refer to Slant Range Computation in later paragraphs.

The operating status of the laser system is indicated on the TV display. Refer to TV Reticle Display in following paragraphs.

Laser transmitter cooling is accomplished by circulating a coolant (fluorocarbon mixture) through cavities around the flashlamp and laser rod. The heat generated by the laser transmitter is passed to a heat exchanger in the pod nose section. A flow switch in the coolant line protects the transmitter if the coolant is not flowing.

TV CAMERA SYSTEM

The TV image presented on the scope is held relatively constant over a wide range of light levels. The stabilization and beam pointing system keeps the view stabilized during aircraft buffet and always displays the image as if the aircrew were looking forward, outside the aircraft. The TV camera parameters are presented in TO 1F-4E-34-1-1-1.

OPTICAL SYSTEM

The optical system (figure 1-34) couples the laser transmitter, laser receiver, TV camera, TV field-of-view (FOV) selection, TV reticle, and line-of-sight (LOS) beam pointing and stabilization. The TV LOS and laser LOS are boresighted together and pointed by using a gyro-stabilized gimbale mirror. The azimuth movement of the gimbale mirror is $\pm 15^\circ$ without pod head roll. With pod head roll, azimuth coverage is extended to -160° (left) to $+110^\circ$ (right). Elevation coverage of the gimbale mirror is $+15^\circ$ (above FRL) to -160° (below FRL). Refer to AVQ-23A/B LOS Pointing, figure 1-35.

STABILIZATION AND BEAM POINTING SYSTEM

Inputs to the stabilization and beam pointing system are obtained from the aircraft inertial navigation system (INS), the WRCS, and the antenna hand control. During acquisition mode, the system receives LOS positioning commands. During track mode, the system receives rate commands. The rate commands induced by antenna hand control movements permit continuous tracking of an LGB target.

TDS CONTROLS AND INDICATORS

RADAR SCOPE

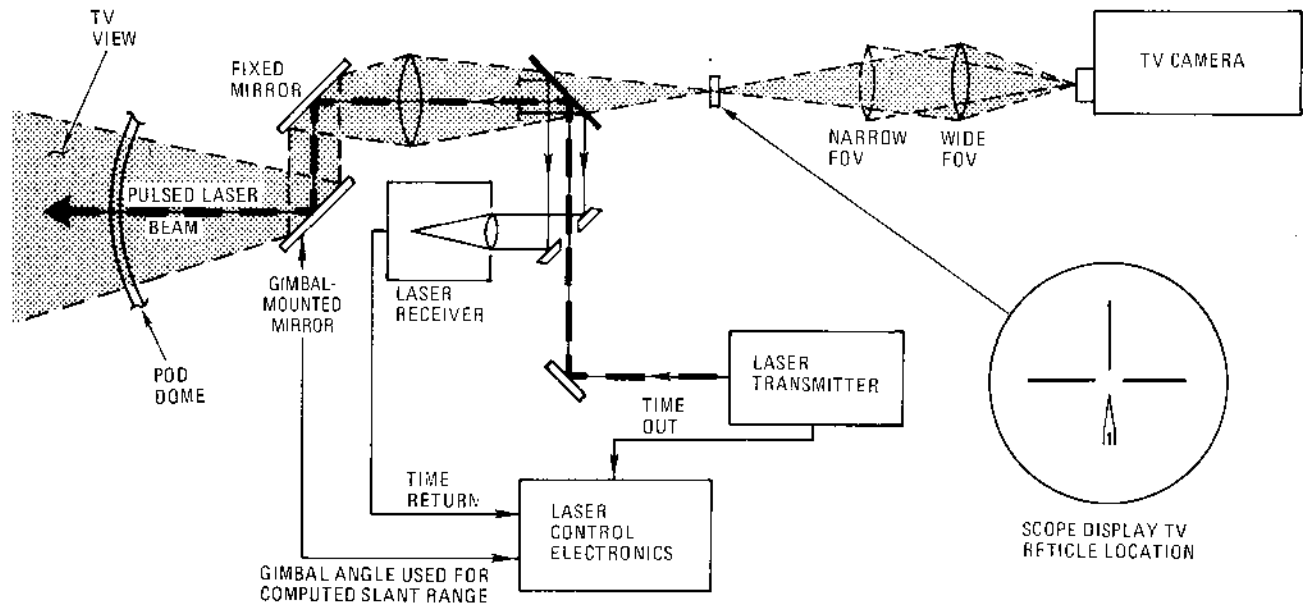
The AN/ASQ-153 EO TDS display is presented on the DSCG scope.

Scope Mode Knob

The DSCG scope mode knob must be in the TV position to obtain EO TDS pod TV video. With the radar power knob in STBY, only the EO weapon or EO TDS pod TV display

PAVE SPIKE OPTICAL SYSTEM

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)



4E-34-1-1-(272)A

Figure 1-34

is available. The RDR position is used when the WRCS is used with the TDS. With the radar power knob in OPR and the radar display knob in MAP, the WSO can switch from TV to a radar display. Pilot scope display selection is provided by a scope display switch on the pedestal panel.

NOTE

On aircraft 71-237 and up, the radar mode knob remains in the STBY position. The RDY/SELECT buttons on the sensor select panel select the system to be displayed on the scope.

Scope Display Switch

The scope display switch (figure 1-32) provides the pilot with a scope display selection: OFF, RADAR or TV, independent of WSO selection. For example: with the radar power knob in OPR position, the pilot may receive the EO weapon or EO TDS TV display (depending on WSO selection on the video select button), while the WSO receives radar MAP-PPI display of WRCS cursor position.

Video Select Button

The video select button (figure 1-32) has two positions that illuminate when selected: WEAPON on the upper half of the button and ASQ-153 on the lower half. The WEAPON position selects the TV display produced by the EO weapon aboard and selected. The ASQ-153 position selects the TV display produced by AVQ-23 target designator pod when the Pave Spike System is operating. The pilot receives the TV display selected by the WSO on the

video select button, providing the pilot has selected TV on the scope display switch.

TDS TV Reticle Display

The TV reticle display (figure 1-36) is produced by the TV camera in the laser designator pod. The TV reticle consists of 3 bars and a resolution wedge. The wedge at the bottom of the reticle contains 3 legs which serve as a TV resolution check in the narrow FOV. If all legs of the wedge are clearly distinguishable, the resolution is considered satisfactory. The center of the reticle is the projected center of the TV and laser LOS. The TV display provides the following:

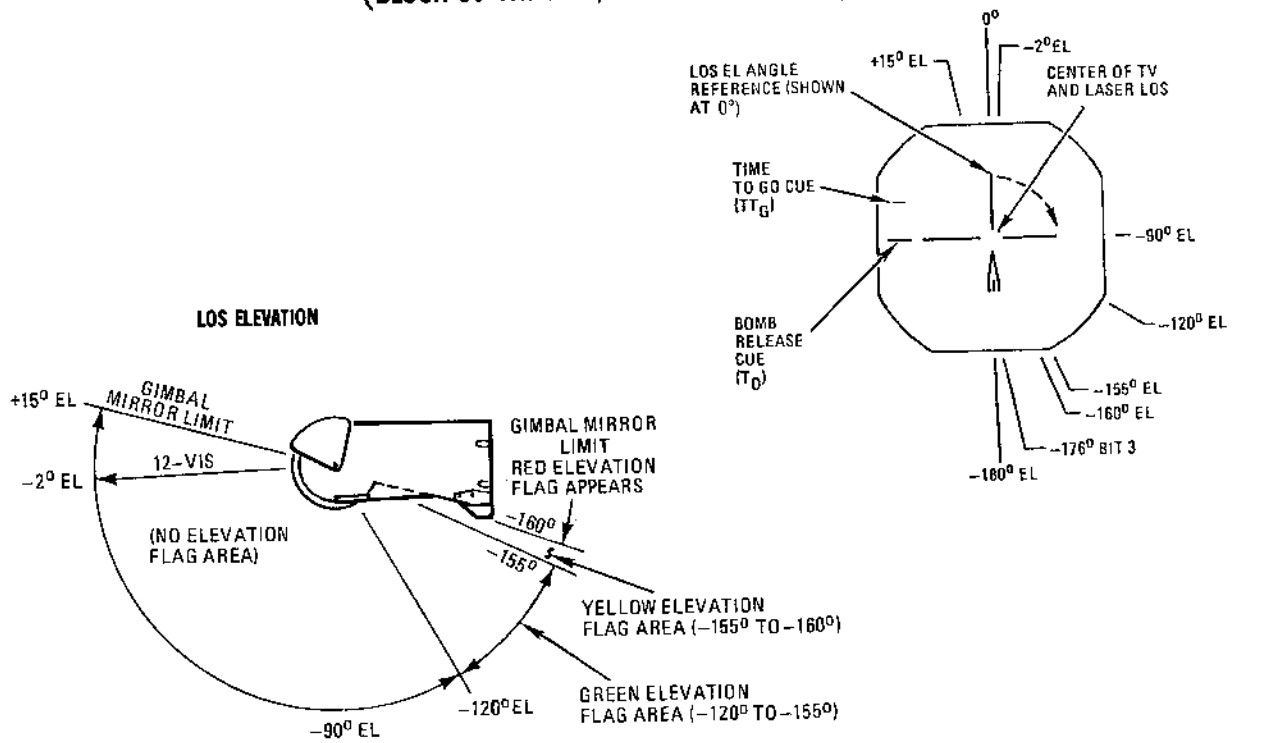
- Laser operating status.
- Time-to-go to weapon release (WRCS auto mode).
- Weapon release cue (WRCS auto mode).
- TV/laser LOS elevation angle.
- Narrow or wide FOV TV picture of the target.

The time-to-go (TT_G) and weapon release (T_O) cues are displayed only during the track mode and indicate the laser operating status as described in figure 1-36. With WRCS auto release mode selected, TT_G moves toward the stationary weapon release cue (T_O) as the release point is approached; automatic weapon release occurs when TT_G reaches T_O .

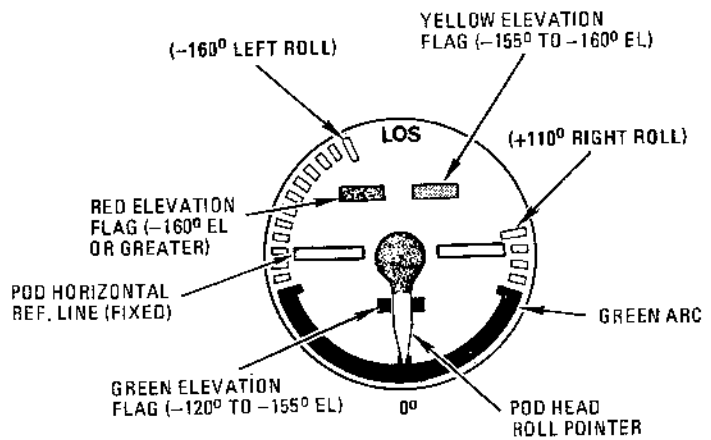
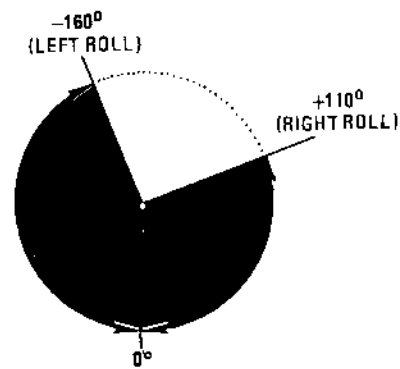
The entire TV reticle rotates to indicate TV/laser LOS elevation angle as illustrated in figure 1-35. Narrow/wide FOV is selected with the FOV button on the antenna hand control (figure 1-40).

PAVE SPIKE LOS POINTING

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)



POD HEAD ROLL (VIEW LOOKING FORWARD)



NOTE

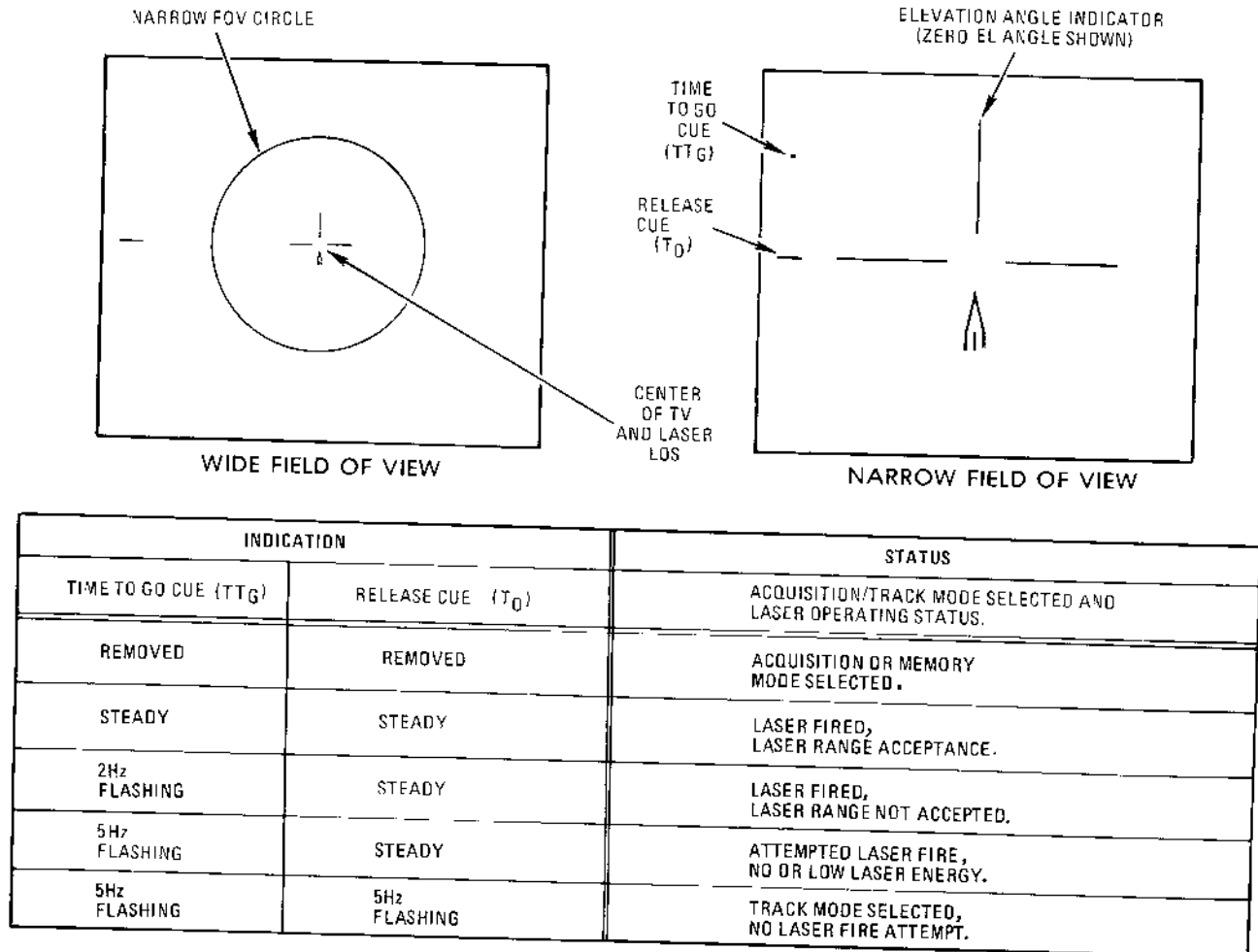
WHEN GREEN ELEVATION FLAG IS UP, POD HEAD ROLL POINTER MUST BE IN GREEN ARC.

4E-34-1-1(268)A

Figure 1-35

PAVE SPIKE TV RETICLE DISPLAY

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)



4E-34-1-1(275)A

Figure 1-36

TARGET DESIGNATOR PANEL, PAVE SPIKE

The target designator panel (figure 1-37) is used to monitor and control the TDS. Operating power to the TDS is available when the radar power knob is in STBY and the TB display is selected.

POWER ON Button

TDS operating power is applied when the POWER ON button is pressed and released. Initial power application illuminates the POWER ON button and the STOW button. Power off is selected by pressing the illuminated POWER ON button. When pressed OFF, the POWER ON light remains illuminated until the TDS pod head is automatically stowed, followed by POWER ON light OFF to indicate that TDS operating power is removed.

STOW Button

Pressing the STOW button alternately stows and unstows the TDS pod head. The pod head is stowed when the STOW button is illuminated. Pressing the illuminated STOW button rolls the pod head to the position selected by the acquisition switch on the TD panel, places the TDS in the acquisition mode, selects the wide FOV, and turns off the STOW button light. The next actuation of the STOW button begins the pod head stow sequence and illuminates the STOW light when completed. The stow sequence includes: rolling the pod head to the stow position, positioning the filter wheel to maximum density, and positioning the visor over the optical window. The stow sequence requires approximately 5 seconds.

The pod head remains in the stow position (160° on the LOS pointer) only while the POWER ON button is

TARGET DESIGNATOR PANEL

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)

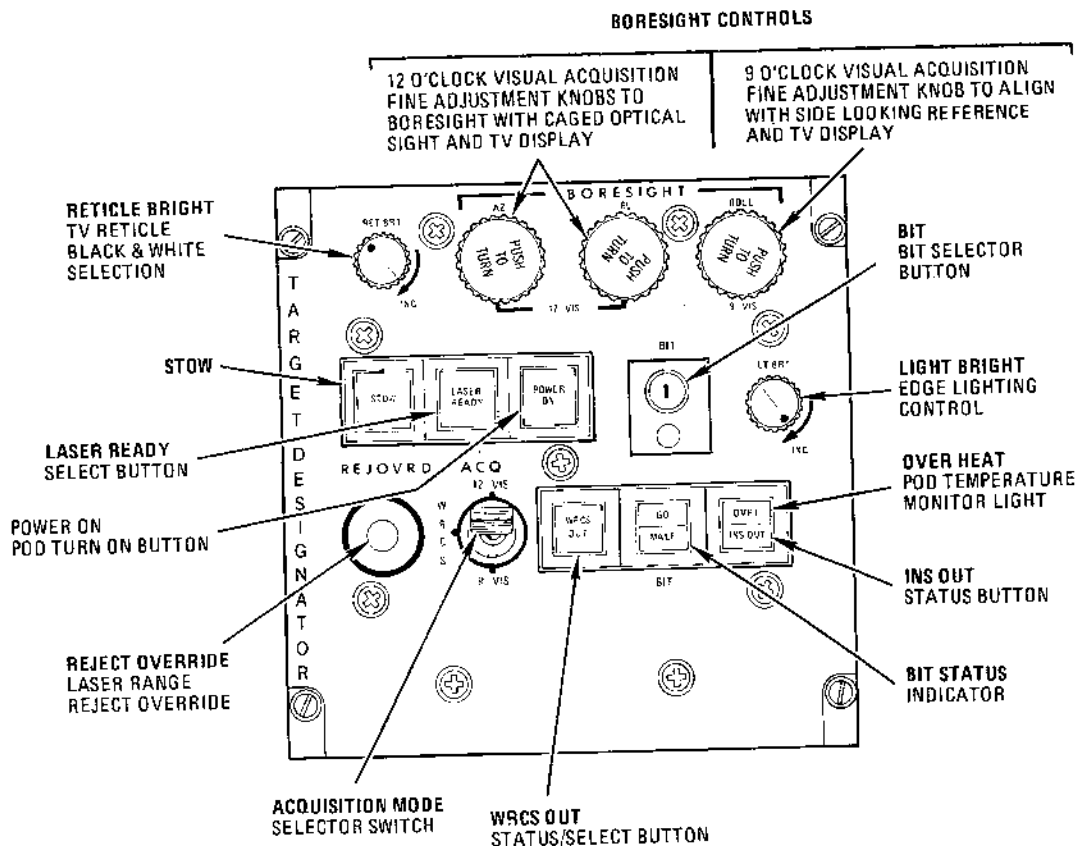


Figure 1-37

illuminated. When the POWER ON light is OFF, the pod head is free to rotate; the visor and filter wheel remain stowed.

LASER READY Button

Laser fire is enabled if LASER READY light illuminates after the button is pressed and released. Laser fire is possible only when the LASER READY light is illuminated. The light remains OFF (after pressed ON) until the fire interlocks are satisfied: nose gear UP and all laser pod systems functioning. Pressing the illuminated LASER READY button turns off the light and disables laser fire.

Acquisition Switch

The ACQ (acquisition) switch has three positions: 12-VIS, WRCS, and 9-VIS.

12-VIS: The 12-VIS (12 o'clock visual) acquisition mode slaves the laser pod LOS parallel to the optical sight piper (2° below FRL).

WRCS: The laser pod LOS is slaved to the intersection of the WRCS cursors if the WRCS OUT light is OFF. If the WRCS OUT light is ON, the 12-VIS acquisition mode is automatically selected.

9-VIS: The 9-VIS (9 o'clock visual) acquisition mode slaves the laser pod LOS to 90° below FRL and rolled 90° left. If the aircraft is equipped with a side-looking sight, it should be adjusted by the pilot.

WRCS OUT Button

Pressing and releasing the WRCS OUT button controls the selection and deselection of the WRCS integration with the TDS. The WRCS is selected and operating when the WRCS OUT light is out. A malfunction in the WRCS or the INS illuminates the WRCS OUT light, automatically deselects the WRCS, and selects the 12-VIS acquisition

mode.

OVHT/INS OUT Button

The OVHT/INS OUT (Overheat/Inertial Navigation System Out) monitors the temperature of the laser pod and controls the selection of INS integration with the TDS. During normal operation, the button is raised (not pressed) and both halves of the button are not illuminated. In this case, the INS is fully integrated with the TDS and can be integrated with the WRCS (if the WRCS OUT light remains OFF when pressed and released).

If the INS fails (INS OUT portion illuminated) the OVHT/INS OUT button can be pressed to remove the INS. When the INS is removed, the WRCS is automatically removed and the WRCS OUT light is illuminated. With INS out, the TDS can be operated by the WSO using the antenna hand control (track mode) for LOS positioning.

The OVHT section of the button illuminates when the laser pod temperature is excessive. The laser pod should be turned off until the cause of the overheat condition is known and corrected.

REJOVRD Button

The REJOVRD (reject override) button provides the WSO with an option to use laser computed slant range after it was rejected by the TDS in favor of computed slant range. Laser derived range is used after the REJOVRD is momentarily depressed and BIT position 1 is selected in the BIT window. Refer to Slant Range Computation.

BIT Button

The BIT (Built-in-test) number displayed in the BIT window advances each time the BIT button is depressed and released. Positions 0, 1, 2, 3, and 4 are selectable. BIT 0 is used to check all lights on the target designator panel. BIT 1 must be selected during normal TDS operation. Each BIT (1 thru 4) is performed when selected and the status of the BIT is displayed on the BIT status indicator: GO/MALF (go/malfunction). The BIT procedures, a description of each BIT functions and malfunction analysis are presented in Section II.

LT BRT Knob

The LT BRT (light brightness) knob controls the intensity of the edge lights on the target designate panel. The LT BRT knob is not functional in BIT 0.

RET BRT Knob

The RET BRT (reticle brightness) knob controls the contrast of the TV reticle from black (fully ccw) to white (fully cw). The WSO should adjust the reticle brightness to achieve maximum contrast between the TV display background and the TV reticle. Once set, reticle brightness remains constant between FOV selections and TV display light levels.

BORESIGHT Knobs

The boresight push-to-turn knobs provide fine adjustment of the TV LOS when operating in the 12-VIS and 9-VIS acquisition modes.

The 12-VIS boresight knobs provide AZ and EL positioning of the TV FOV. Pilot and WSO coordination is required to align the pipper position and TV reticle. The wide FOV should be selected. The pilot should attempt to hold the pipper steady during the boresight procedure and inform the WSO of any off-target movement.

The 9-VIS boresight knob provides pod head roll adjustment. If a side-looking sight is not available, roll should be adjusted until the needle on the LOS indicator points to the 9 o'clock mark.

LINE OF SIGHT (LOS) INDICATOR

The LOS indicator (figure 1-38) provides the pilot with an indication of approaching TDS pod LOS limits. The limits define where TV/laser FOV is obscured and where LOS track may be broken.

LOS Pointer (Head Roll)

The LOS pointer rotates in the direction of pod head roll. Zero pod roll is indicated when the pointer is in the 6 o'clock position. The roll limits, left and right of zero, are shown in figure 1-35, AVQ-23A/B LOS Pointing. The green arc indicates the roll limits that ensure an unobstructed FOV when the green elevation flag is up. The fixed horizontal line displays the pod horizontal reference line.

LOS Elevation Flags

Each elevation flag appears as the LOS elevation angle enters its respective area (shown in figure 1-35). When no flags are UP, laser LOS and TV FOV is unobstructed.

When the green flag is UP, the pilot should maneuver the aircraft to keep the roll pointer within the green arc. FOV is obscured when the green arc pod roll limits are exceeded while the green flag is up. The yellow flag warns of approaching break track limit. The red flag appears when LOS track is broken (or WRCS memory is in progress).

SLANT RANGE INDICATOR (SRI)

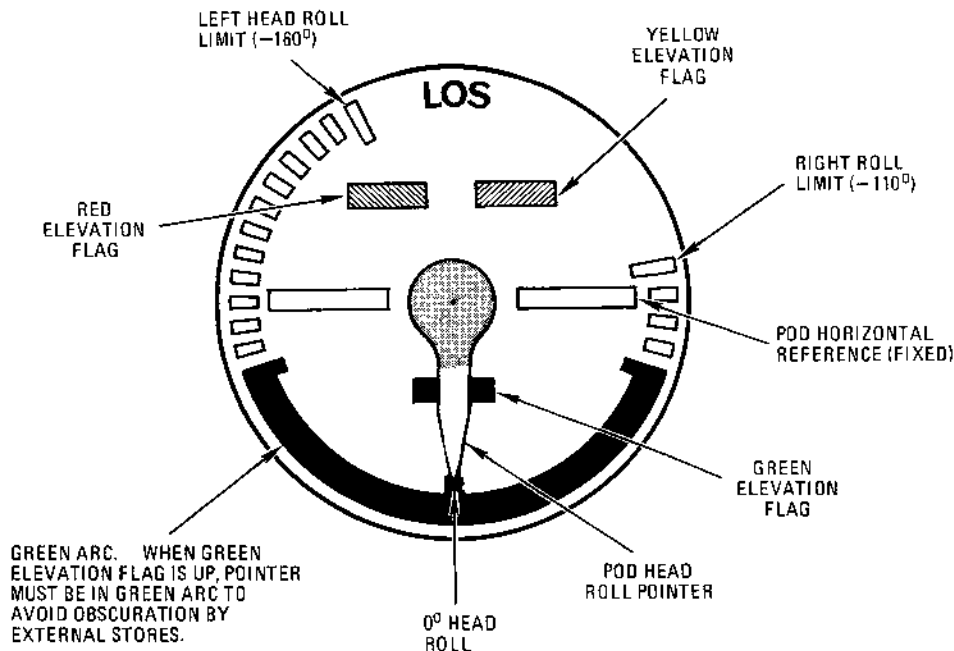
The slant range indicator (figure 1-39) is functional when the TDS is turned on. The indicator provides a 3-digit readout of the slant range (X100 feet) to target. Refer to Slant Range Computation.

TEST Button

While the test button is pressed, the indicator display is checked by displaying 888. If any part of an 8 is missing, the readout unit is defective.

LOS INDICATOR

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)



4E-34-1-1-(269)B

Figure 1-38

BRT Knob

The BRT (brightness) knob adjusts the intensity of the slant range readout.

MODE Knob

The mode knob selects the automatic weapon release mode (WRCS or ROR) and is used to set in the release slant range used with the ROR mode. TGT FIND must be selected on the delivery mode knob and the TDS must be in the track mode to obtain automatic weapon release with the mode knob in WRCS or ROR. The SET position displays the slant range previously set. Set must be selected when changing the ROR slant range.

RNG SET Knob

The range set knob is functional when the mode knob is in SET position. Clockwise rotation of the push-to-turn knob increases the digital display and changes the release slant range used in the ROR automatic release mode.

ANTENNA HAND CONTROL

The antenna hand control (figure 1-40) performs several control functions in the TDS pod when the pod is operating: field-of-view selection, acquisition/track selection, pod LOS control, and laser fire.

TV Field-of-view (FOV) Select Button

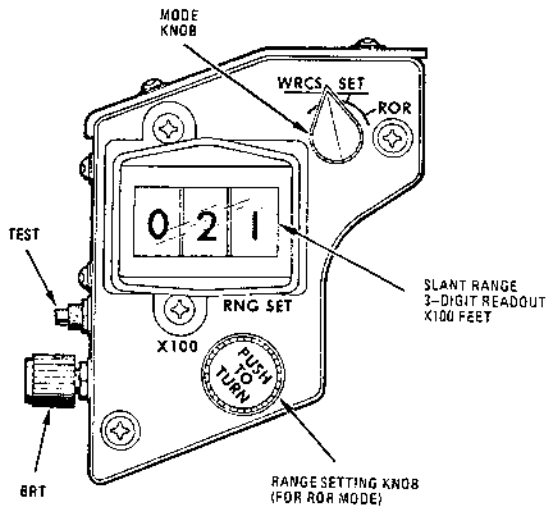
The FOV button (IFF button) is located above the action switch on the antenna hand control. The wide FOV is automatically selected when the TDS pod is turned on. Each depression of the FOV button alternately switches the TV display between the narrow and wide FOV.

Action Switch

Half Action. Prior to TDS pod POWER ON selection, the 12-VIS acquisition mode should be selected. After pod turn on, any acquisition mode can be selected. The acquisition mode is automatically selected when the TDS pod is turned on. Pressing the action switch to half action (HA) and release selects the track mode. The next time HA is selected and released, the acquisition mode is selected. Each HA selection and release alternately switches the TDS between the acquisition and track modes.

SLANT RANGE INDICATOR

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)



4E-34-1-1-2771A

Figure 1-39

Full Action. Pressing the action switch to full action (FA) and release places the TDS pod in the track mode and initiates laser fire. The laser continues to fire while the full action status is maintained. When FA is selected again, the laser stops firing and the track mode is retained. Selecting the HA position terminates laser fire and selects the acquisition mode.

CODER CONTROL UNIT

For additional information on the Coder Control Unit, refer to TO 1F-4E-34-1-1-1.

TDS ASSOCIATED CONTROLS**DELIVERY MODE KNOB**

The **DIRECT** and **TGT FIND** positions are used with the TDS to obtain WRCS integration and weapon release. The **DIRECT** position can be selected during WRCS/TDS track without interrupting the WRCS attack display. Selecting **DIRECT** does not affect TV tracking or laser designation of the target. With **DIRECT** selected, weapon release occurs when the bomb button is pressed. The **TGT FIND** position must be used when automatic weapon release is desired from the WRCS (WRCS auto mode) or the slant range indicator (ROR mode).

NOTE

When WRCS integration with the TDS is not required (WRCS OUT light illuminated), the TDS can be operated with the delivery mode selector in any position, including OFF.

WEAPON DELIVERY PANEL**Target Find Switch**

When using the TDS integrated with the WRCS, the target find switch must be in **NORM**. The **HOLD** position prevents the TDS from being integrated with the WRCS and illuminates the WRCS OUT light.

Range Switch

The position of the range switch has no effect because the release **RANGE** input on the WRCS panel is not accepted when the TDS is integrated with the WRCS.

Activate Switch

When using the TDS, the activate switch must be positioned to **NORM**.

WRCS PANEL

When the TDS is integrated with the WRCS, the following manual inputs are accepted by the WRCS computer (figure 1-41):

- Target distance N/S. (set 000 if IP not used)
- Target distance E/W. (set 000 if IP not used)
- IP altitude MSL (set target altitude MSL if IP is not used)
- Drag coefficient.
- Release advance (if desired).

OPTICAL SIGHT

In the WRCS auto mode, the optical sight range bar moves in conjunction with the TT_g and T_o cues on the TV reticle display. The optical sight range bar moves from the 1 o'clock to 3 o'clock position as the TT_g cue moves toward T_o cue. Weapon release occurs when the sight range bar reaches approximately 3 o'clock and the TT_g cue reaches the T_o cue.

ATTITUDE DIRECTOR INDICATOR

In the WRCS auto mode, the ADI pitch steering bar moves in conjunction with TT_g and T_o cues on the TV reticle display. The pitch steering bar moves from the bottom of the case, and crosses the center of the case when the release cue is generated.

ANTENNA HAND CONTROL

PAVE SPIKE FUNCTIONS

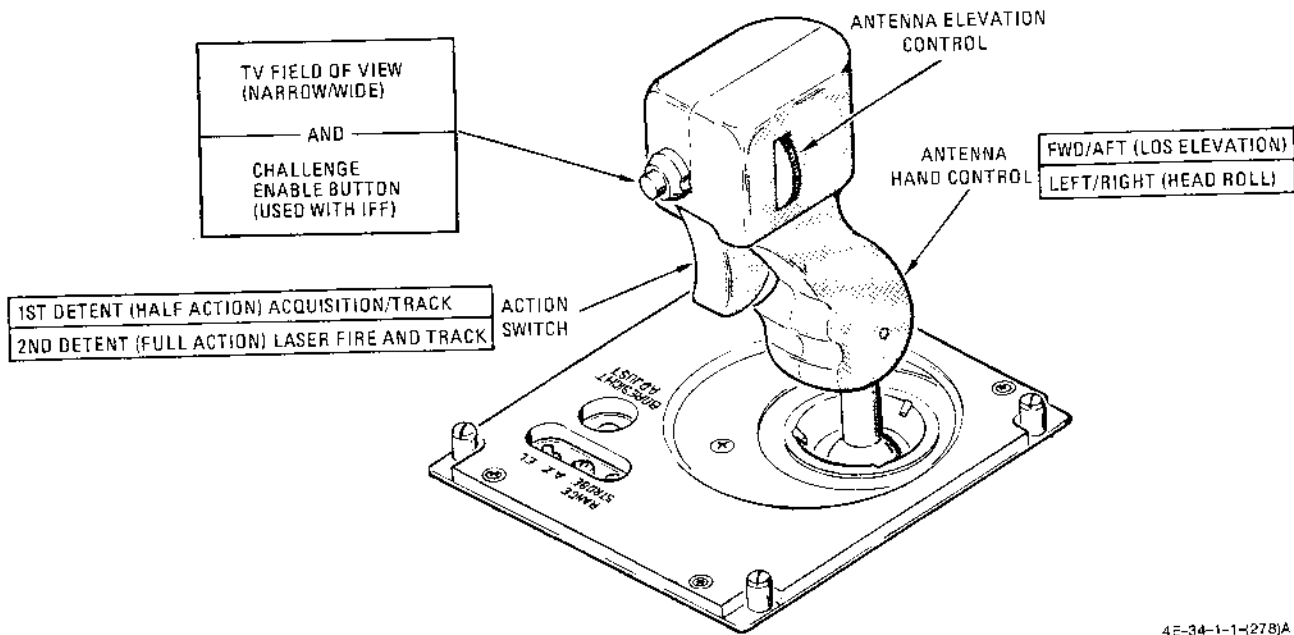


Figure 1-40

4E-34-1-1-(278)A

WRCS/TDS INTEGRATED MODES

The TDS is integrated with the WRCS when the delivery mode knob is in TGT FIND or DIRECT and the WRCS OUT Light on the TD panel is out. The operation of the WRCS is a function of the TDS acquisition mode; WRCS, 12-VIS and 9-VIS. The WRCS acquisition mode is similar to the WRCS TGT FIND mode with the TDS pod LOS slaved to the intersection of the along track and cross track cursors. Weapon release is not possible during any acquisition mode.

The WRCS track mode (with TGT FIND delivery mode and 12-VIS acquisition mode selected) is similar to the WRCS DIVE TOSS delivery mode. Automatic weapon release is computed using the drag coefficient entered by the WSO. TDS pod LOS tracking is assisted by inputs from the INS and maintained by inputs supplied by the WSO through antenna hand control movement.

ACQUISITION MODES

The TDS acquisition mode (figure 1-42) is determined by the position of the ACQ switch on the target designator panel: 9-VIS, 12-VIS, WRCS. The acquisition mode is automatically selected when the TDS is turned on, and manually selected using the action switch on the antenna hand control. Refer to Antenna Hand Control.

9-VIS Acquisition Mode

The 9-VIS acquisition mode requires effective crew coordination in selecting a 9-VIS boresight aim point. The TDS pod LOS is fixed -90° elevation and 90° left head roll. A TV display of the pod LOS is presented on the scope when the TV mode is selected.

12-VIS Acquisition Mode

The 12-VIS acquisition mode requires the use of the LCOSS. The TDS pod LOS is fixed parallel to the caged optical sight. The sight operates as if the DIVE TOSS bombing mode were selected without drift stabilization. A TV display of the pod LOS is displayed on the scope when the TV mode is selected.

WRCS Acquisition Mode

The WRCS acquisition mode requires the operation of the INS and WRCS. The TDS pod LOS is slaved to the intersection of the radar cursors on the radar scope. The system operates as with the TGT FIND mode selected and the radar operating in the A/G mode. A TV display of the pod LOS is displayed on the scope when the DSCG scope mode knob is in TV. Fine adjustment of the pod LOS is controlled by inputs from the WRCS cursor controls. The 12-VIS acquisition mode is automatically selected when either WRCS or INS fails, and when WRCS OUT button is pressed (WRCS OUT button illuminated).

WRCS MANUAL INPUTS

PAVE SPIKE

DELIVERY MODE	TARGET - FT X 100				DRAG COEF-FICIENT	RELEASE	
	N/S DIST	E/W DIST	ALT	RANGE		ADVANCE MILLI-SECOND	RANGE FT X 10 FT X 100
MAX SET	999	999	100	249	9.99	999	999
DIVE TOSS					X	X	
DIVE LAY						X	X
LAYDOWN				X		X	X
OFFSET BOMB	X	X	X			X	X
AGM-45			X			X	
TGT FIND/LABS *	X	X	X			X	X
TGT FIND/WRCS **	X	X	X		X	X	

* TARGET FIND SWITCH IN HOLD AND LABS DELIVERY MODE SELECTED.

** TARGET FIND SWITCH IN NORM, SLANT RANGE INDICATOR MODE KNOB IN WRCS AND TGT FIND DELIVERY MODE SELECTED. FOR BEST ACCURACY, N/S AND E/W OFFSET VALUES MUST NOT EXCEED 600 (60,000 FT).

4E-34-1-1-(276)A

Figure 1-41

NOTE

- The pod LOS is not boresighted with the WRCS cursor intersection; therefore, the TV reticle may not be positioned directly over the target when TV is selected.
- Due to Pave Spike system limitations, for best accuracy the WRCS offset values must not exceed 600 (60,000 feet). Decreased accuracy may be expected at a maximum of 660 (66,000 feet). Beyond 660 (66,000 feet) WRCS offsets will not accurately command pod LOS.

TRACK MODE

The track mode is entered when the WSO selects either full or half action on the antenna hand control and the release cues appear on the TV display. The track mode is required to obtain weapon release and fire the laser. The TDS pod and WRCS receive INS velocity and pitch/roll data to automatically track the target. The WSO uses the antenna hand control to track the target; therefore the PPI radar display must be deselected.

The TDS pod supplies slant range and aircraft altitude data to the WRCS computer for a weapon release solution. The pod uses two methods to compute this data: (1) laser slant range and (2) computed slant range. Refer to Slant Range Computation. Laser slant range is available only in the track mode while the laser is firing.

In the track mode, the WRCS computer operates as in the DIVE TOSS release mode. The WRCS provides azimuth

steering information to the ADI and optical sight, and supplies time-to-release information to the ADI, optical sight and to the TV display. The INS supplies the TDS pod with velocities North/East/Vertical and pitch/roll information. Movements of the antenna hand control adds rate data to the INS input to keep the pod optical center tracking the target.

WRCS Automatic Release

In the WRCS automatic release mode, the weapon release solution is obtained using a drag coefficient which must be set in by the WSO on the WRCS panel. The main difference between the DIVE TOSS and WRCS AUTO delivery mode is that the TDS pod performs the range and altitude calculations instead of the radar.

ROR and Direct Release

In the ROR or DIRECT release mode with the WRCS integrated, the WRCS continues to compute for a release and display TTG; however, the release signal is not accepted. The ROR release signal is available only when the slant range displayed is equal to or less than the slant range set in the slant range indicator, and the TDS is in track. The DIRECT release signal is effective when the TDS is in acquisition or track.

Memory Mode

The memory mode is entered when the pod LOS limits are exceeded, providing the WRCS is integrated and the TDS is in the track mode. The pod computer is updated using INS velocity data. This provides the pod computer with range-to-target information. When the aircraft is maneuvered to within pod LOS limits, the target reappears on the TV displays. The WSO must actuate the action switch to regain the track mode.

SLANT RANGE COMPUTATION

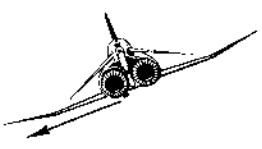

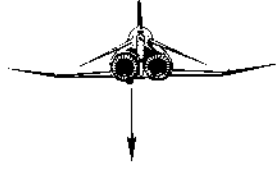
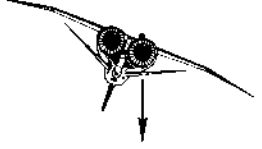
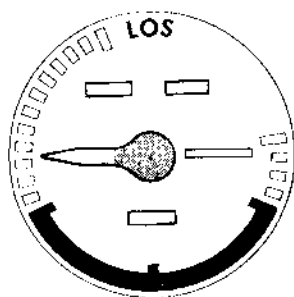
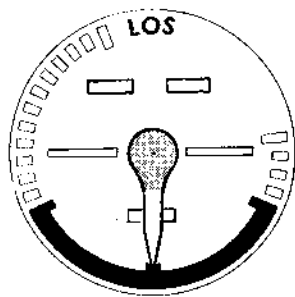
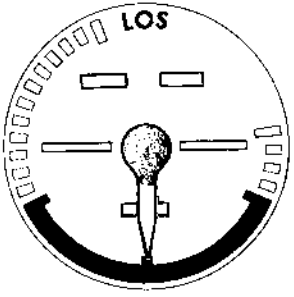
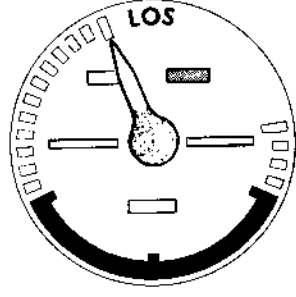
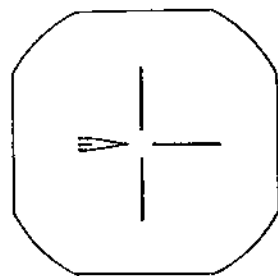
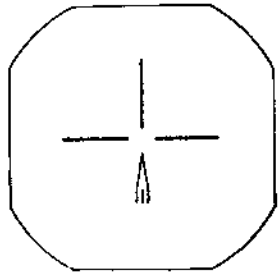
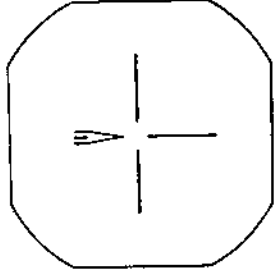
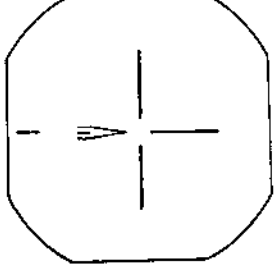
The target designator pod provides slant range to the WRCS and to the slant range indicator. The pod computer uses two methods: (1) laser derived slant range, and (2) computed slant range from data received from various aircraft systems. See figure 1-43. The following describes each method and which one is used.

Laser Slant Range

Laser derived slant range is available only in the track mode while the laser is firing. Valid laser range is indicated on the TV display by steady TTG and T₀ cues. If the TTG cue is flashing, laser range exceeds 20% of the slant range computed using aircraft systems data indicating that the laser range is rejected. The WSO can override this rejection by momentarily pressing the REJOVRD button. Laser reject may occur during a low graze angle at low altitude, or when the wrong target altitude is set in the WRCS panel (including D valve).

PAVE SPIKE ACQUISITION/TRACK MODES

(BLOCK 36 THRU 45, SELECTED AIRCRAFT)

ACQUISITION MODES			TRACK MODE
 <p>9-VIS ACQ MODE LOS CAGED TO SIDE-LOOKING SIGHT.</p>	 <p>12-VIS ACQ MODE LOS CAGED TO CAGED OPTICAL SIGHT.</p>	 <p>WRCS ACQUISITION LOS SLAVED TO INTERSECTION OF WRCS CURSORS. WSO INPUT THROUGH WRCS CURSOR CONTROLS.</p>	 <p>TRACK MODE LOS SLAVED TO ANTENNA HAND CONTROL MOVEMENT</p>
 <p>POD HEAD ROLL - 90°</p>	 <p>POD HEAD ROLL - 0°</p>	 <p>POD HEAD ROLL - 0°</p>	 <p>POD HEAD ROLL - 150°</p>
 <p>LOS ELEVATION - 90°</p>	 <p>LOS ELEVATION - 2°</p>	 <p>LOS ELEVATION - 90°</p>	 <p>LOS ELEVATION - 90°</p>

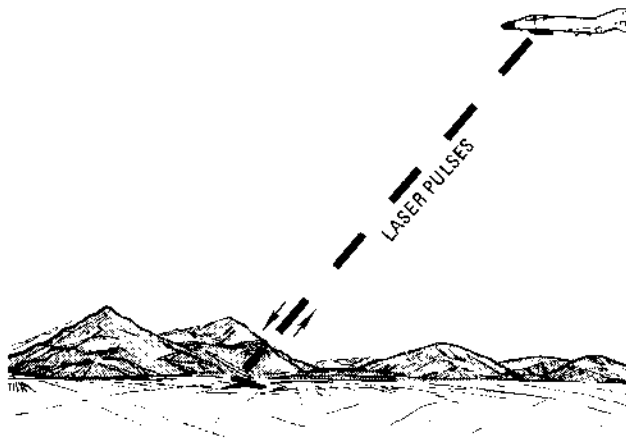
4E-34-1-1-(273)A

Figure 1-42

SLANT RANGE COMPUTATION

LASER DERIVED SLANT RANGE

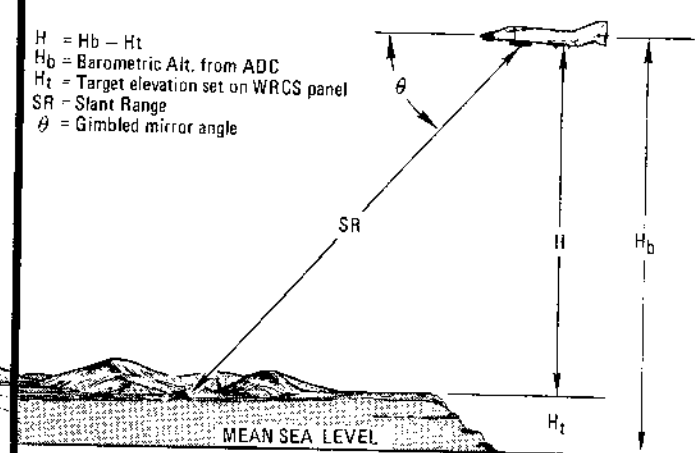
TDS control electronics computes slant range by measuring the time lapse between laser pulse transmission and receive.



COMPUTED SLANT RANGE

Computed slant range derived from aircraft altitude AGL divided by the sine of the TDS gimbed mirror angle: $SR = \frac{H}{\text{Sine } \theta}$

$H = H_b - H_t$
 $H_b = \text{Barometric Alt. from ADC}$
 $H_t = \text{Target elevation set on WRCS panel}$
 $SR = \text{Slant Range}$
 $\theta = \text{Gimbed mirror angle}$



4E-34-1-1-(279)

Figure 1-43

Laser slant range is derived by firing a fixed number of pulses during a fixed time. The number of pulses returned during the fixed time is a function of the distance traveled. This information is used in a simple time and distance equation.

Computed Slant Range

The other method used to compute slant range is accomplished continuously during acquisition and track. The following parameters and sources are used:

- Target elevation set in the WRCS panel.
- Barometric pressure altitude (MSL) of aircraft from the CADC.
- LOS elevation angle from the pod.

WRCS OUT OPERATION

With WRCS OUT, the TDS can be operated independently in a non-integrated mode. The TDS does not interfere with the normal operation of the WRCS, the optical sight, BDHI, HSI, or ADI systems. The WRCS OUT mode is selected during any of the following conditions:

- TDS WRCS OUT button pressed and WRCS OUT light ON.
- TDS INS OUT selected.
- TDS POWER ON button OFF.
- TDS STOW button ON (Pod is stowed).

e Delivery mode knob is in any position except DIRECT or TGT FIND.

f. The target find switch on the weapon delivery panel is in the HOLD position and the delivery mode knob is out of OFF.

TDS track without WRCS is not affected if the INS is operational. Laser fire is not affected when the WRCS or INS is OUT. The memory mode is not available when the WRCS is OUT. If the TV LOS reaches a gimbal limit, the TDS breaks track and enters the 12-VIS (or 9-VIS) mode. Weapon release can be accomplished manually with the DIRECT delivery mode selected, or automatically through the slant range indicator (ROR Mode) with the TGT FIND delivery mode selected. TT_C remains stationary, slightly touching and above T_O .

INS OUT OPERATION

The INS OUT mode is selected by pressing the OVHT/INS OUT BUTTON and the INS OUT portion of the button is illuminated. INS OUT should be selected when an INS failure is noted or the INS is suspected of causing a TDS tracking problem. WRCS OUT is automatically selected when INS OUT is selected.

With INS OUT selected, manual tracking can be accomplished with the antenna hand control. Laser slant range is displayed on the indicator and used to provide automatic weapon release in the ROR delivery mode.

AN/ALE-40 COUNTERMEASURES EQUIPMENT

AN/ALE-40 DISPENSER SET

The AN/ALE-40 countermeasures dispenser set, provides a capability of dispensing RR-170 A/AL chaff cartridges or MJU-7/B infrared flare cartridges, or a combination of both. The system (figure 1-44) consists of a cockpit control unit (CCU) located in the rear cockpit; a programmer, a flare select switch and indicator lights; a dispense button located in both rear and front cockpits; and four chaff dispensers, or a combination of two chaff dispensers and two flare dispensers located on the inboard pylons.

Operation of the AN/ALE-40 is controlled from both the front and rear cockpit. The CCU initiates the various modes of operation. The programmer generates the firing commands in various combinations called bursts and salvos. A salvo is a group of bursts. The pylon mounted dispensers convert the firing commands to individually sequenced firing signals. In the chaff mode of operation, dispensing starts in the left pylon dispenser and transfers the dispensing signals to the right pylon dispenser upon depletion of stores in the left dispenser. In the flare mode of operation, dispensing starts in the right pylon master dispenser and upon depletion of that dispenser's stores, the sequencer switch transfers dispensing signals to the left master dispenser. Flares can be jettisoned from the flare dispensers at the rate of 10 per second by activating the ripple switch.

AN/ALE-40 COCKPIT CONTROL UNIT (CCU)

The cockpit control unit (figure 1-44), installed on the left console of the rear cockpit, consists of a chaff and a flare mode rotary knob, two subtraction counters, two indicator lights, a guarded ripple switch, and a chaff/flare dispense button. The CCU issues dispense and mode signals through the programmer.

Chaff Mode Knob

The chaff mode knob, with placarded positions of OFF, SGL, MULT, and PROG, select the various chaff operating modes. With the flare select switch in the NORMAL position and flaps and speed brakes retracted, the switch position functions are as follows:

OFF	Chaff system inactivated.
SGL	A single burst command supplied to the chaff dispenser whenever either dispense button is pressed.
MULT	One salvo of fire commands supplied to the dispenser through the programmer whenever either dispense switch is pressed.

PROG	A group of salvo fire commands supplied to the dispenser through the programmer whenever either dispense switch is pressed.
------	---

Flare Mode Knob

The flare mode knob, with placarded positions of OFF, SGL, and PROG, select the various flare operating modes. With the flares select switch in the NORMAL position and flaps and speed brakes retracted, the switch position functions are as follows:

OFF	Flare system inactivated.
SGL	A single burst command supplied to the flare dispenser whenever either dispense button is pressed.
PROG	One salvo of fire commands supplied to the dispenser through the programmer whenever either dispense button is pressed.

Chaff and Flare Counters

Two subtraction counters, one each for the chaff and flare system, indicate the quantity of chaff and flare cartridge dispenses remaining, regardless of the mode switch position. When the slave dispenser is set to Chaff Double (CD) the chaff counter should be set to one half the number of chaff cartridges loaded so that the chaff counter matches the number of chaff dispenses remaining.

Chaff and Flare Indicator Lights

Two green indicator lights, one each for the chaff and flare system, illuminate whenever a mode is selected on the respective mode knob.

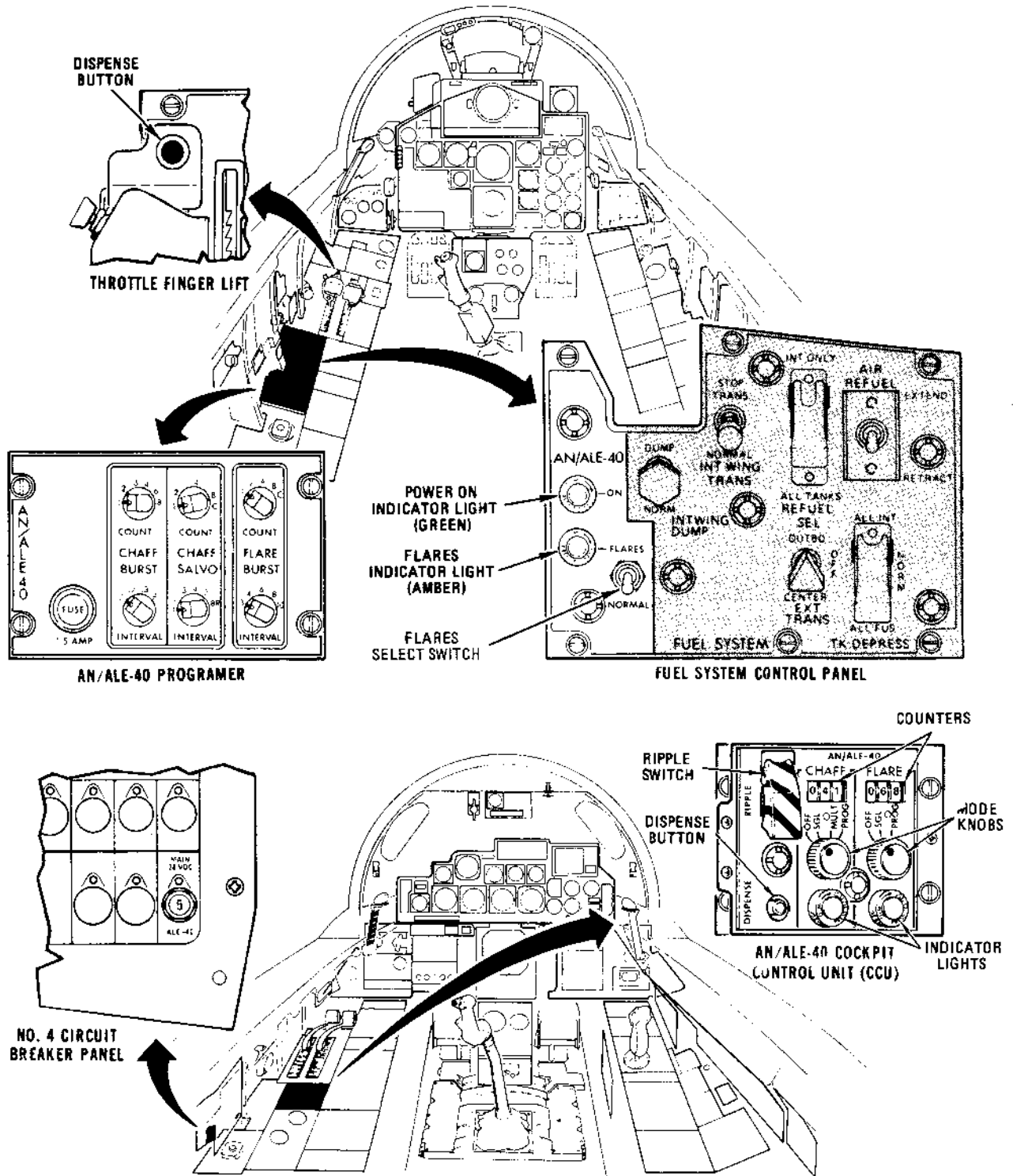
Ripple Switch

The guarded ripple switch, when positioned to ON, initiates flare dispensing regardless of the position of any other switches/knobs in the countermeasures system, provided the flaps and speed brakes are retracted. Flares will be dispensed at the rate of ten per second until both dispensers are empty.

Dispense Button (Rear Cockpit)

The dispense button, when pressed, initiates chaff/flare dispensing as selected by the CCU and AN/ALE-40 programmer provided the flaps and speed brakes are retracted and the chaff/flare mode knobs are in any

AN/ALE-40 CONTROLS & INDICATORS



4E-34-1-1-(281)B

Figure 1-44

position other than OFF.

AN/ALE-40 PROGRAMMER

The programmer (figure 1-44) contains the controls and circuitry used to generate fire commands to the chaff/flare dispensers. The controls and their functions are as follows:

CONTROL	FUNCTION
CHAFF BURST:	
COUNT 1, 2, 3, 4, 6, 8, (units)	Selects the quantity of burst commands per salvo
INTERVAL 1, 2, 3, 4 (seconds)	Selects the time interval between each burst command
CHAFF SALVO:	
COUNT 1, 2, 4, 8, C (continuous)	Selects the number of salvos
INTERVAL 1, 2, 3, 4, 5, 8, R (random)	Selects the time interval (seconds) between each salvo
FLARE BURST:	
COUNT 1, 2, 4, 8, C (continuous)	Selects the quantity of flare bursts
INTERVAL 3, 4, 6, 8, 10 (seconds)	Selects the time interval between each burst command

FLARES SELECT SWITCH

The flares select switch NORMAL position (figure 1-44) arms the countermeasures dispenser system and permits chaff/flares to be dispensed (as scheduled by the CCU and the programmer) by pressing either dispense button. Placing the switch to FLARES affects only the FCP dispense button by bypassing all switches/knobs in the countermeasures system provided the speedbrakes and flaps are retracted. This gives the pilot the capability to dispense a single flare each time he depresses the dispense button. RCP dispense functions are unaffected by the switch position.

FLARES INDICATOR LIGHT

The FLARES amber indicator light, (figure 1-44) illuminates when the flares select switch is positioned in the FLARES position and indicates that flares can be dispensed, provided the flaps and speed brakes are retracted, by pressing the dispense button.

AN/ALE-40 POWER ON INDICATOR LIGHT

The AN/ALE-40 power ON green indicator light (figure 1-44) illuminates whenever the flares select switch is in the NORMAL position and either (or both) of the chaff and flare mode knobs are in any position other than OFF.

DISPENSE BUTTON (FRONT COCKPIT)

The dispense button (figure 1-44), initiates chaff/flare dispensing as selected by the CCU and programmer, provided the flaps and speed brakes are retracted and the flares select switch is in NORMAL.

AN/ALE-40 DISPENSERS

The AN/ALE-40 countermeasures dispenser installation (figure 1-45) consists of two distinct dispenser configurations. The master (outboard) dispenser, installed on the outboard side of the inboard armament pylons, contains the electronics and sequencer switch for both dispensers on each pylon. The slave (inboard) dispenser, installed on the inboard side of the inboard armament pylons, is connected to the master dispenser by an interconnect cable. The aircraft can be configured with four chaff payload modules on all four dispensers or two chaff payload modules on the slave dispensers and two flare payload modules on the master dispensers. Flare payload modules cannot be installed on the slave dispensers.

MASTER DISPENSER ASSEMBLY

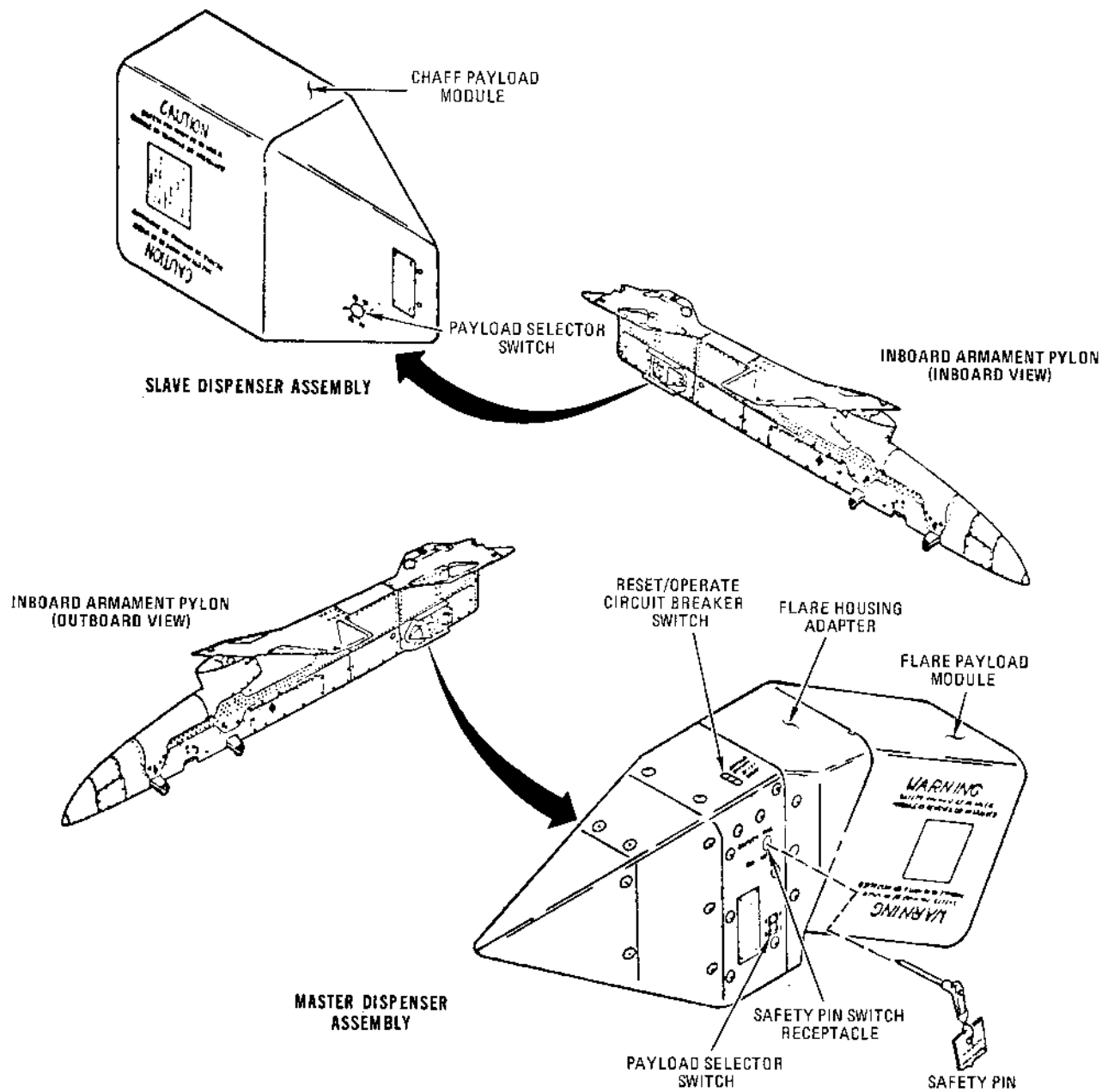
The master dispenser assembly, (figure 1-45) one installed on the outboard side of each inboard armament pylon, contains a sequencer switch, a breech assembly, a RESET/OPERATE circuit breaker switch, a payload control switch, a SAFETY PIN switch with safety pin and warning streamer, and associated electrical circuitry. The sequencer switch converts firing commands to individual firing signals for each pyrotechnic squib in both the master and slave dispensers. The breech assembly provides an interface for mounting the chaff or flare payload module. Insertion of the safety pin into the receptacle removes electrical power to both pylon mounted dispensers. After a full chaff or flare module is loaded, the RESET/OPERATE switch is placed in OPR. The loaded chaff or flare stations will fire in sequence. After flight, if a partial load of chaff or flares remains, the switch should be left in OPR. If the switch is moved to RESET, the empty chaff or flare stations must be stepped through before loaded stations will fire. Payload selector switch positions C (chaff) and F (flare) select only the master dispenser mode of deployment as follows:

C	Selects the chaff mode of deployment for the master dispenser only.
F	Selects the flare mode of deployment for the master dispenser only.

SLAVE DISPENSER ASSEMBLY

The slave dispenser assembly (figure 1-45), one installed on the inboard side of each inboard armament pylon, contains a payload selector switch, a breech assembly and associated electrical circuitry. The payload selector switch

AN/ALE-40 DISPENSERS AND PAYLOAD MODULES



COMPONENT	LENGTH (INCHES)	WIDTH (INCHES)	HEIGHT (INCHES)	WEIGHT (POUNDS)
CHAFF PAYLOAD MODULE	8.2	9.5	4.8	6.3
FLARE PAYLOAD MODULE	8.2	7.5	5.7	7.4
RR-170 A/AL CARTRIDGE	1.0	1.0	8.0	0.41
MJU-7 CARTRIDGE	1.0	2.0	8.0	0.67

4E-34-1-1-(282)A

Figure 1-45

selects the mode of deployment in the master dispenser sequencer as follows:

- CS Selects the chaff single mode of deployment (one chaff cartridge dispensed for each chaff burst command).

- CD Selects the chaff double mode of deployment (two chaff cartridges dispensed simultaneously, one from each dispenser, for each burst command).

The breech assembly provides an interface for mounting the chaff payload mode.

FLARE HOUSING ADAPTER

The flare housing adapter (figure 1-45) is installed on the master dispenser assembly prior to installing the flare payload module. The wedge shaped adapter positions the flare payload module so that the flares will be ejected aft and down from the aircraft. The flare adapter will not mount on the slave dispenser.

CHAFF PAYLOAD MODULE

The chaff payload module, (figure 1-45) with receptacles for 30 RR-170 A/AL cartridges, is secured to the master or slave dispenser breech assembly with four quick release fasteners.

CHAFF CARTRIDGES

The RR-170 A/AL chaff cartridge consists of a basic plastic sleeve, chaff dipoles, and a plastic end cap. During dispensing, the chaff dipoles are ejected from the sleeve, leaving the disposable sleeve and empty squib case. A recess is provided in the cartridge base to accept the chaff pyrotechnic squib.

CHAFF PYROTECHNIC SQUIB

The chaff pyrotechnic squibs are metal encased and electrically fired. Squibs are stored separately from the chaff cartridges and installed immediately prior to use.

WARNING

Accidental discharge of the chaff cartridges can cause injury to personnel or damage to the aircraft. Assure that the master dispenser safety pin is installed at all times during loading, unloading, or maintenance on the system.

FLARE PAYLOAD MODULE

The flare payload module, (figure 1-45) with receptacles for 15 MJU-7 flare cartridges, is installed on the master dispenser only. The flare housing adapter performs the interface.

FLARE CARTRIDGE

The MJU-7 infrared flare cartridge consists of a metal outer sleeve, a flare element, a safing and initiation device and a plastic end cap. A recessed indentation in the cartridge base assures proper flare installation.

FLARE PYROTECHNIC SQUIB

The flare pyrotechnic squibs differ from the chaff squibs in that they are larger in diameter and have an O-ring groove. The squibs are stored separately from the flare cartridges and installed immediately prior to use.

WARNING

Accidental discharge of the flare cartridges can cause injury to personnel or damage to the aircraft. Assure that the master dispenser safety pin is installed at all times during loading, unloading, or maintenance on the system.

)

)

)

)

)

)

)

)

)

)

)



DELIVERY METHODS AIR-TO-GROUND WEAPONS

This portion of the manual discusses the various air-to-ground delivery maneuvers used to deliver ordnance. The type of deliveries available are essentially a function of the avionics equipment sets described in previous pages. The avionics, and the ballistics data provided in these manuals support the basic dive, level, and the loft delivery flight path. The dive and level release maneuvers may be used in most any strike situation against targets of opportunity or preplanned targets of known location. This is equally true for the automatic dive and level delivery modes offered by the weapons release computer avionics. The loft maneuver is used only against targets of known location, and enroute IPs and run-in headings must be accurately determined. This discussion considers no one specific munition, but simply describes the delivery maneuvers with respect to a munition type and the aircraft avionics.

NOTE

For the various types of weapons and the delivery maneuvers, an Error Analysis discussion is available in TO 1F-4C-34-1-2. The analysis shows the expected magnitude of impact error for deviations in release velocity, altitude, pitch or

dive angle, and G-loading.

DIVE DELIVERY CONSIDERATIONS

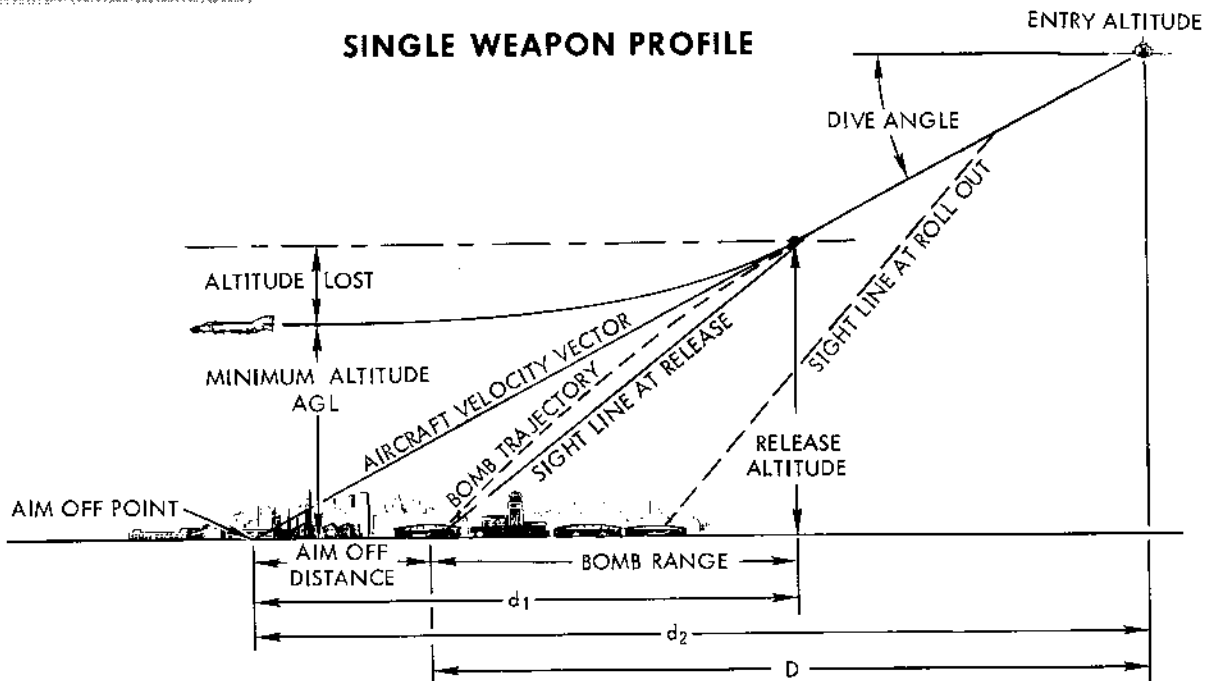
BOMB MUNITIONS

A typical dive delivery profile and associated parameters are shown in figure 1-51. The upper profile demonstrates delivery parameters for a single weapon release. The lower profile, which is simply an extended case of the upper, shows parameters for a multiple weapon release at consistent intervals. Although some of the release parameters for the two profiles are quite different, the flying involved is essentially the same. (Profiles for the automatic (computer) modes are discussed later in this part.)

The optical sight is the primary aiming device for the dive weapon release. The ballistics data provides sight depression values (at the release point) for given dive angles, release altitudes, and release velocities for the specific munition shape. The table sight depression value

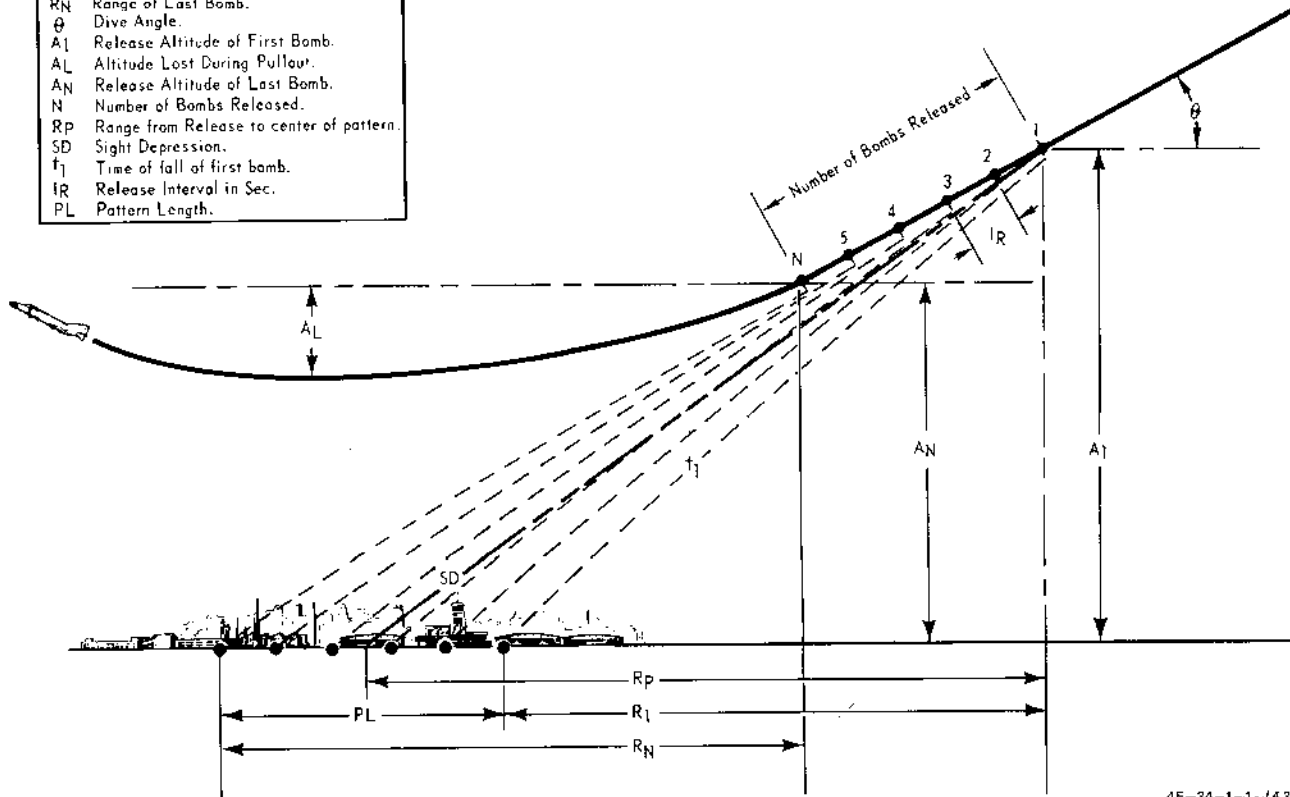
DIVE DELIVERY

SINGLE WEAPON PROFILE



MULTIPLE WEAPONS PROFILE

- | | |
|----------------|--|
| R ₁ | Range of First Bomb. |
| R _N | Range of Last Bomb. |
| θ | Dive Angle. |
| A ₁ | Release Altitude of First Bomb. |
| A _L | Altitude Lost During Pullout. |
| A _N | Release Altitude of Last Bomb. |
| N | Number of Bombs Released. |
| R _P | Range from Release to center of pattern. |
| SD | Sight Depression. |
| t_1 | Time of fall of first bomb. |
| I _R | Release Interval in Sec. |
| PL | Pattern Length. |



4E-34-1-1-(43)

Figure 1-51

is given with respect to aircraft flight path, and an additional correction is applied (added to the table value) for aircraft angle of attack. Other aircraft equipment used in dive bombing is the airspeed indicator to establish release speed, the altimeter to establish release height, and the attitude indicator as a dive angle reference. Charts and tables are provided in TO 1F-4C-34-1-2 to apply speed and altitude instrument error corrections when necessary.

Establishing the roll-in point is the most important phase of a dive bomb pass. This point establishes the ease with which the pilot will achieve the release conditions. For a given entry altitude, the desired dive angle can be achieved with reasonable accuracy by beginning the roll-in at the correct horizontal range from the target. This position may be estimated using the pilot experience or the pilot may attempt to locate a landmark/IP at the appropriate distance (D) from the target (figure 1-51):

$$D = d_2 - (d_1 - \text{Bomb Range})$$

where d_2 and d_1 are horizontal ranges for the entry altitude and release altitude respectively. (These horizontal ranges, d_1 and d_2 , can be extracted from the Dive Angle vs Distance chart in TO 1F-4C-34-1-2.)

At roll out, the aircraft velocity vector (dive angle flight path) should be established on the aim-off point beyond the target a distance (the aim-off distance) equal to ($d_1 - \text{Bomb Range}$). The depressed sight line (pipper) at roll out will be short of the target and as the dive continues, the pipper will track toward the target.

As the pipper reaches the target, release velocity and altitude requirements should be met and the pilot applies the release signal. The wings must be level and normal acceleration (for that dive angle) must be maintained until the bomb (or last bomb) is released. If the dive angle is initially observed to be in error, the pilot may lead or delay release by a few mils in an effort to compensate. (Refer to Error Analysis, TO 1F-4C-34-1-2.)

NOTE

Before the bomb run, neutral rudder trim should be accomplished at or near the planned delivery speed. Since the turn and slip indicator in the rear cockpit is more sensitive, the WSO should assist the pilot by calling the indicator display.

Immediately following release, the pilot initiates recovery from the dive and takes any required evasive action.

Several factors must be considered when determining an indicated release altitude: altitude loss during pullout, minimum aircraft ground clearance, altimeter lag, altimeter position error, and target elevation. For purposes of determining the correct altimeter setting, the altimeter is set according to target pressure reduced to sea level (target altimeter setting). Also, the type of weapon aboard and the associated fuzing requirements is a definite factor in determining release altitude. This is described further in the following paragraphs and in the weapon descriptions.

Ripple Release Bombing

The factors previously stated also apply to a ripple or multiple weapons release mode. The weapons are released along a planned ground track to impact on a target of considerable area. For a diving maneuver, the weapon spread for a given release interval setting is a function of the horizontal component of release velocity, the dive angle, and the change in release altitude between bombs. Additional considerations are listed below (figure 1-51).

- a. Safe escape and dive recovery must be based on the release altitude of the last bomb.
- b. The sight setting or bomb range is computed to place the center of the impact pattern on target.
- c. Wind correction is based on the time-of-fall of the first bomb released.
- d. During the ripple release, a straight line flight path should be maintained; the pipper will pass beyond the target during the ripple release. If a straight line flight path is not observed prior to and during the ripple release, the following adverse conditions can be expected:
 - (1) Increased dive angle.
 - (2) Increased altitude lost during recovery.
 - (3) Reduced pattern length.
 - (4) Reduced G-loading.
 - (5) Possible bomb-to-aircraft collision.

High/Low Drag Bombs

As far as the flying is concerned, there are no particular differences between the dive delivery of high and low drag bombs. Low drag weapons however, essentially maintain the airplane release velocity and depending on the release maneuver, may impact close to a point directly under the delivery airplane. Therefore, careful consideration must be given to tables that provide bomb fragmentation data and minimum release altitude information to ensure that adequate escape conditions exist, especially in low altitude, low angle dive bombing. The high drag weapon on the other hand decelerates rapidly allowing the delivery aircraft considerable trail distance at impact. This in turn allows weapon release at reduced ranges and altitudes. Safe escape and fuze data tables are provided for both weapons so that the aircrew may compensate for the limited regions of operation.

For both high and low drag bombs, wind can be compensated for by releasing with the pipper on the upwind aimpoint; or the crabbing method may be used by releasing with the pipper long/short of a line that passes through the target and is perpendicular to the aircraft ground track. Wind correction factors are available in the Ballistic Tables, TO 1F-4C-34-1-2, for inflight use. Due to the small bomb trail distance of low drag bombs, a crosswind is almost totally corrected for by crabbing the airplane so that the ground track is over the target. For high drag bombs, the airplane ground track must be offset upwind to compensate for the large bomb trail distance. (Refer to section V, Wind Correction, TO 1F-4C-34-1-2.)

ROCKET LAUNCH

The launching of 2.75 inch rocket munitions requires the same considerations with respect to flying the launch dive angle, launch altitude and velocity. Only the DIRECT (nonautomatic) release mode can be used. Mil depression values are provided as a function of these parameters for several gross weights. Escape considerations, however, must include the fact that the launch aircraft is flying toward the rocket impact/frag area, with the possibility of secondary target explosions. The escape data provided for 2.75 inch rockets does not consider terrain avoidance or secondary explosions. Normally, fuze arming data is not a consideration in rocket ordnance deliveries, except when the WDU-4A/A Flechette warhead is aboard. (Refer to TO 1F-4C-34-1-2-1.)

GUN FIRING

The wing mounted gun pod weapons are harmonized by the convergent method which provides maximum projectile density at a range of 2250 feet. This is the most effective range vicinity for pin point targets. (Refer to section IV, Gun Harmonization, TO 1F-4C-34-1-2.) The pilot may therefore spread the projectile pattern for an area target by firing well outside of the harmonization range. Firing parameters of speed, dive angle and angle of attack (as compared to other weapons) have negligible effect on projectile accuracy; slant range from target is the most important factor.

Depending on the type of target, the pilot has the prerogative of firing by one of two ways and the flying involved is slightly different for each. For an area target for example, the pilot may walk the projectiles along an impact corridor. The dive angle is held constant and firing commences as the piper reaches the leading edge of the target area and ceases at the desired point. The flying and the optical picture is essentially the same as the rocket or multiple bomb delivery. This procedure is unacceptable for pinpoint targets since most of the rounds would be totally ineffective. If the pilot fires a 1.0 to 2-second burst for example, the aircraft distance from target (during the burst) closes at rates of 600 to 800 feet per second. The result is that the burst commences at or slightly outside of the given sight depression range, and terminates at a distance inside the given depression range. The actual sight depression range set into the sight is valid essentially for one point in space, and for one round fired at that point. Therefore, the tendency of the piper (and the rounds fired) to move through and beyond the target during the burst must be reversed. One way to accomplish this is to fly the airplane so that the piper comes to a point above and nearly tangent to the upper edge of the target. At the estimated initial firing range, allow the piper to move downward at a smooth rate and commence firing as the piper initially moves into the target image. Cease firing when the piper moves

below and tangent to the lower edge of the target, and immediately initiate the recovery maneuver. The net result is that the pilot is inducing a very slight change (increase) in dive angle throughout the burst duration. There are of course, variations to the procedure which can be applied to suit the individual and his methods of tracking a target. The pilot must exercise caution and avoid target fixation since procedures such as these require more concentration.

For small point targets, the 2-mil piper may aid in determining the desired firing range from target. For example, a vehicle with 6-foot vertical definition and at a range of 2000 feet would fill a combining glass area of

$$\frac{(1000) 6 \text{ ft}}{2000 \text{ ft}} = 3 \text{ mils vertically.}$$

Therefore, the 2-mil piper would cover about 2/3 (vertically) of the target vertical dimension at 2000 feet. For larger (or longer) targets, the 25 and 50-mil diameter reticle images may be used to determine range.

Safe escape considerations when firing the 20mm gun must include terrain avoidance, ricochet, and target explosions.

DIVE TOSS DELIVERY

The dive toss bombing mode employs the WRCS and other aircraft sensors to automatically develop a bomb release solution. Preplanned release parameters are not required; the target may be approached from any direction, airspeed, and dive angle. The bomb is automatically released when the airplane arrives at a point in space that yields the computer trajectory solution for a hit on target. The illustration (figure 1-52, sheet 1) shows the additional avionics equipment used with dive toss, and the corresponding functions performed. Variations of the dive-toss mode such as dive-glide and dive-level (figure 1-41, sheet 2) may be employed to satisfy a multiple weapons release situation. In any case, the equipment used and the parameters involved are the same.

The radar set is operated in the AIR-GRD mode, 5 or 10-mile range, and the antenna is drift stabilized at RBL. The radar supplies slant range information to the WRCS computer and the optical sight. The optical sight piper is used to aim the radar antenna to establish the correct radar range on target. The sight is operated in the air-to-ground mode and the reticle is caged in elevation, parallel to the radar boresight line (depressed 35 mils) and drift stabilized in azimuth. The dive toss bombing mode is selected by placing the delivery mode knob to DIVE TOSS and positioning the weapon selector knob to BOMBS/RIPPLE, TRIPLE, or SINGLE. The only controls

DIVE TOSS BOMBING MODE

SIGHT RETICLE:

1. Drift Stabilized at RBL
2. Roll Deviations

WRCS Manual Inputs:

1. Drag coefficient
2. Release Advance (Multiple weapons)

AN/APQ-120 MODE:

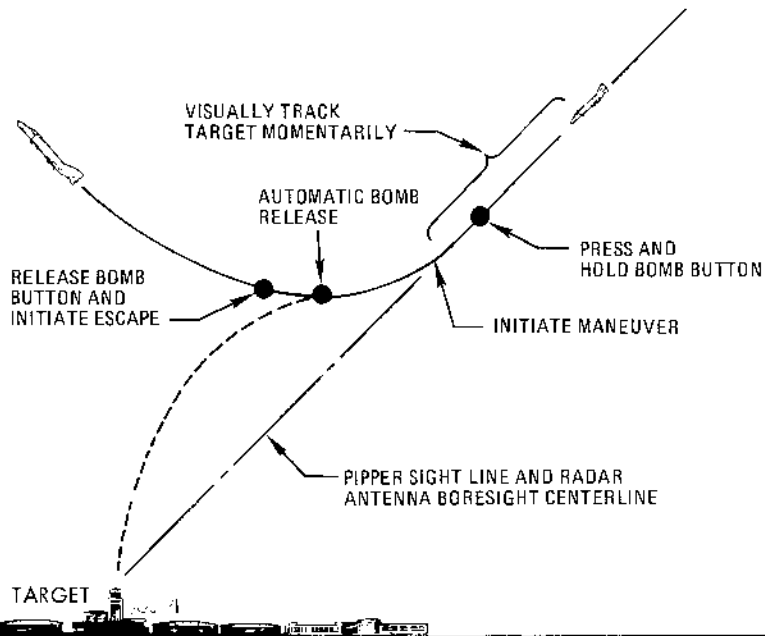
1. A/G
2. 5 or 10 - Mile Range

INS Inputs:

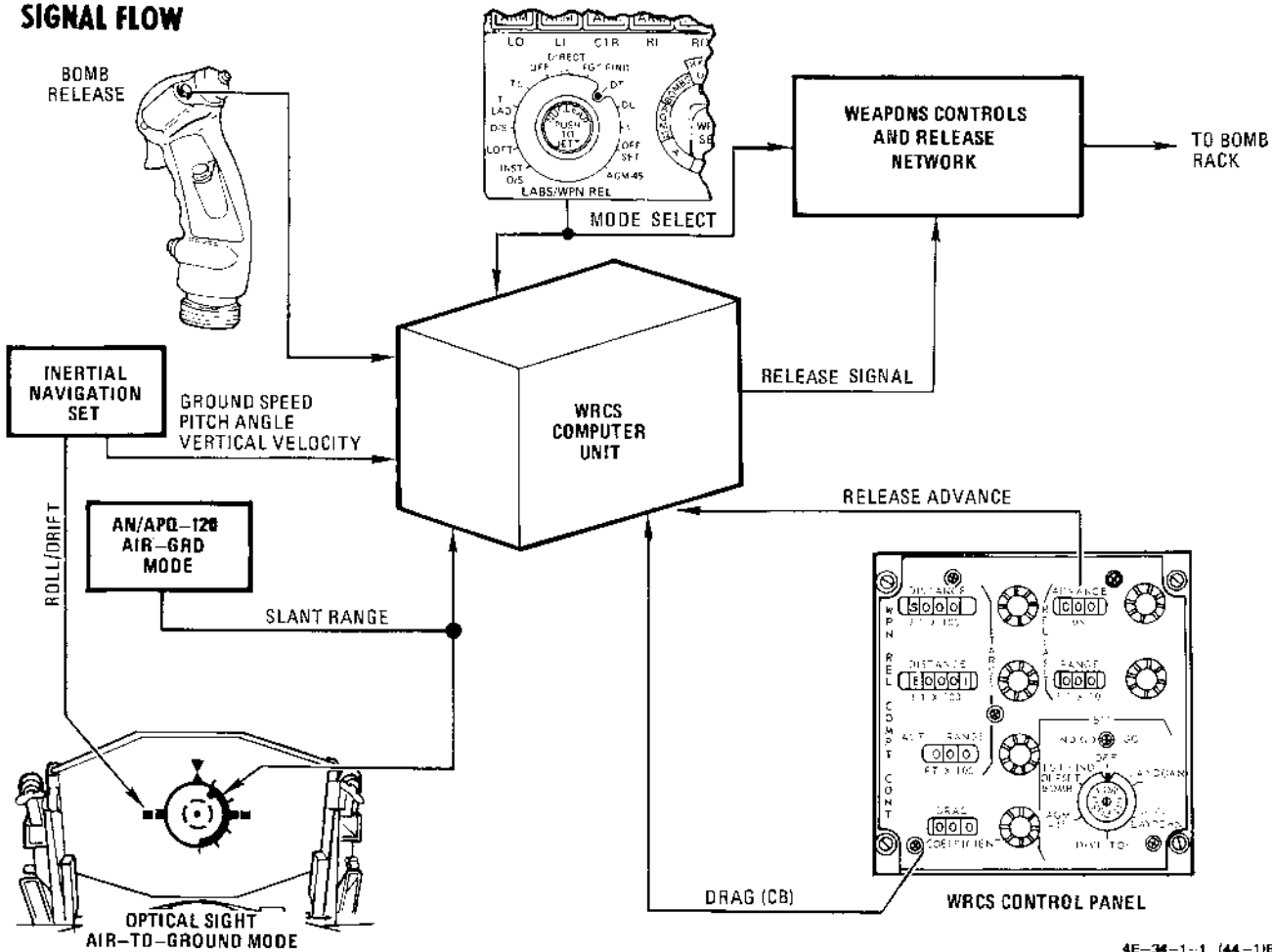
1. Ground Speed
2. Pitch Angle
3. Vertical Velocity

ADI Vertical Pointer:

1. Heading deviations after pickle



SIGNAL FLOW

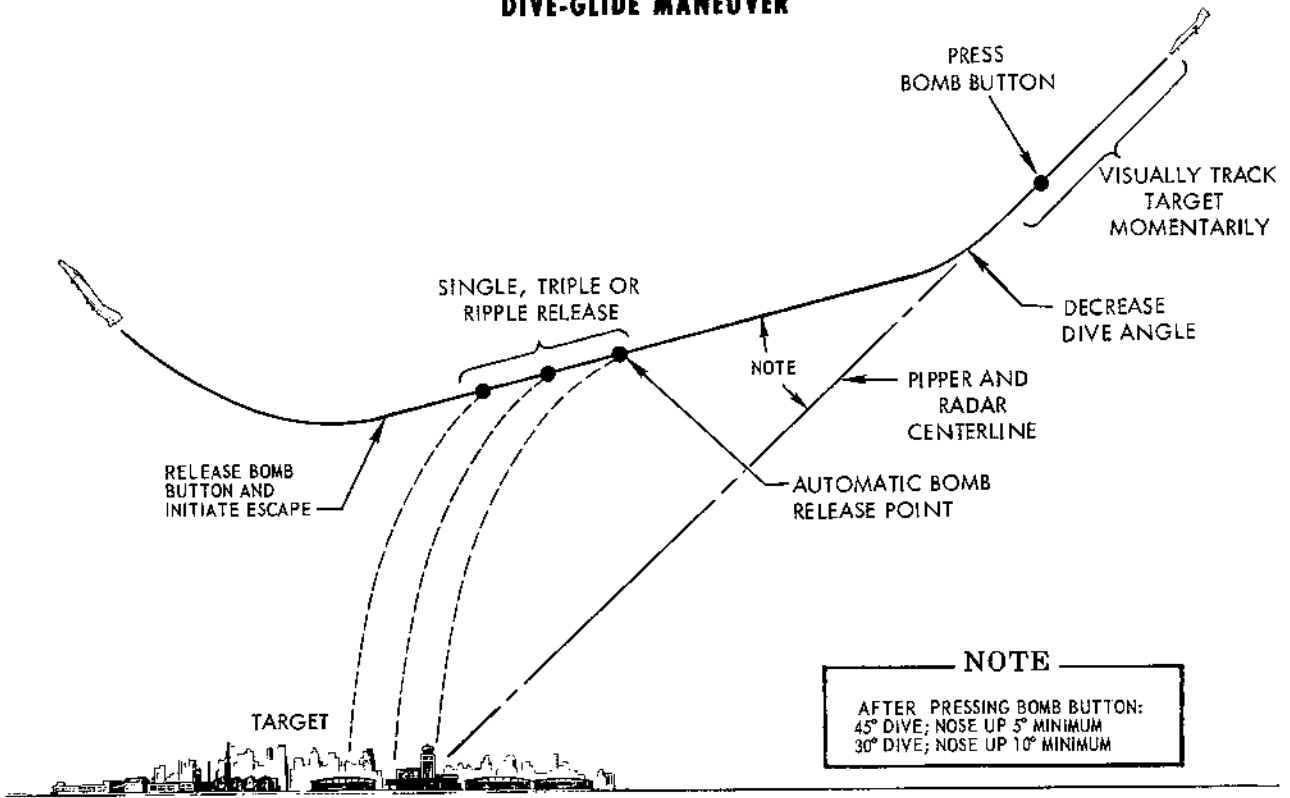


4E-34-1-1 (44-11B)

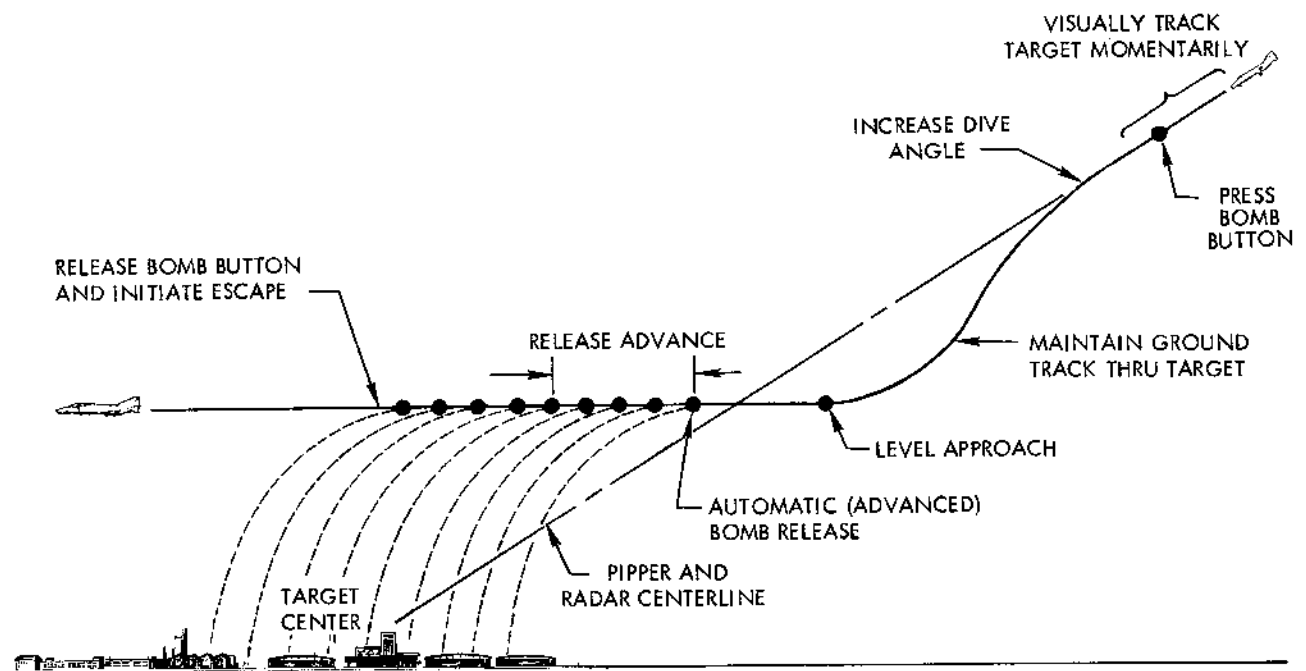
Figure 1-52 (Sheet 1 of 2)

DIVE TOSS BOMBING MODE (Continued)

DIVE-GLIDE MANEUVER



DIVE-LEVEL MANEUVER



1F-4E-34-1-1-(44-21B)

Figure 1-52 (Sheet 2 of 2)

used on the WRCS panel are the drag coefficient control and if required, the release advance control in multiple weapon release situations.

NOTE

Using a radar range greater than 10 mile is not recommended since the position of the ground return line sometimes causes inadvertent side lobe lockon.

After the target area has been visually identified, the pilot begins the dive. The slant range and roll-in altitude is normally about 20 percent greater than the direct delivery to allow time to acquire radar lockon. Target tracking is not required prior to radar lockon; the objective is to maneuver the aircraft and obtain a strong ground return on the radar scope. Lockon must be acquired prior to actuating the bomb button.

NOTE

Refer to Fire Control System Air-To-Ground operations, this section.

With a valid lockon, the pilot maneuvers the aircraft so that the pipper stabilizes on the target with a wings level indication on the roll tabs. This indication ensures that wind drift has been cancelled by an appropriate amount of crab. The drift stabilized pipper indicates the aircraft ground track when wings are level. Wind effect on the bomb after release may be corrected by moving the ground track into the wind. When the pipper is on target (or on the upwind aim point), the pilot presses the bomb button to insert radar range to target into the WRCS computer. With the bomb button held, the pilot begins desired delivery maneuver while maintaining a wings-level ground track projected through the target. Once the radar range input is established in the computer, it is no longer necessary to maintain radar lockon. The range input is resolved with the INS inputs (figure 1-52) to continuously establish the position of the airplane with respect to the target. The release signal is generated when the bomb (computer trajectory) intersects the target.

NOTE

- The crab indicated by a drift stabilized sight should correspond to the drift angle read from the HSI heading and course window. For example: with a 2° crab while holding a steady heading, the sight should jump 35 mils when the sight mode knob is moved from CAGE to A/G.
- If INS drift input is in error, the pilot may select CAGE on the sight mode knob and request the WSO to select DRIFT OUT on the stab switch on the control monitor panel. DRIFT OUT is necessary to keep the pipper and radar antenna aligned.

In the dive toss maneuver, the airplane is continuously rotated until release occurs. In dive-glide, the dive angle is simply reduced and stabilized at some lesser amount. The dive angle should be decreased at least 5° for initial dive angles of 45° or more, and decreased at least 10° for initial dive angles of less than 45°. In any case, the airplane cannot rotate beyond a positive 10° without exceeding WRCS limitations: (WRCS operating limitations are provided in section IV, TO 1F-4C-34-1-2). In the dive-level maneuver, the initial dive angle is increased

and the airplane is flown to a point where a level delivery approach, and subsequent weapon release is completed.

In situations where multiple weapons are released at set intervals (as shown in the dive-level illustration), the release advance control is set to apply the necessary lead time to the release signal. Otherwise, the first release signal would be generated for a hit at target center.

DIVE LAYDOWN

The dive-laydown bombing mode (figure 1-53) is essentially the same as the dive toss mode (dive-level maneuver) with the following exceptions.

- a. The dive laydown bombing mode is used primarily for the delivery of high drag weapons (MK 82, Snakeye, etc.) where bomb range is relatively insensitive to deviations from the preplanned release parameters.
- b. The bomb range is manually set in the release range control on the WRCS panel; the drag coefficient control is not used.
- c. The pilot must fly the planned released true airspeed (or ground speed) and the planned release height above target that will produce the bomb range set in the release range control. Although the release advance function is available, there should be little use for the control.

The dive-laydown bombing mode is selected by placing the delivery mode knob to DL and positioning the weapon selector knob to either RKTS & DISP (for dispensers only) or BOMBS. The only controls used on the WRCS panel are the release range control and if required, the release advance control. The value placed on the release range control is the horizontal bomb range for a given release altitude AGL and release true airspeed obtained from the bombing tables.

The initial portion or target tracking phase of the delivery is identical to the dive toss bombing mode, pressing the bomb button establishes, the radar slant range and enables the INS groundspeed and pitch inputs to the WRCS computer. These inputs are necessary to compute the horizontal range to the target with respect to the initial range established at pickle. When the aircraft reaches the range set in the release range control, the WRCS automatically supplies a release signal to the weapons release circuits.

LEVEL DELIVERY CONSIDERATIONS

The level delivery is simply an extension or a special case of low angle dive bombing where the dive angle is zero. The delivery is used in situations where the aircrew wishes to release close to the target and at the lower delivery altitudes. Using the DIRECT or WRCS level modes, the pilot may release weapons for a single point target or release multiple weapons at a planned interval to cover an area target (figure 1-54). Gun and rocket munitions are normally not used during a level delivery unless the target has adequate vertical definition. The approach to the target is performed at a constant altitude with wings level, and at a stabilized airspeed. After bomb release, the aircraft may continue the approach course and speed or

perform the required evasive maneuver. The most sensitive parameters that affect bombing accuracy are the release altitude above target and pitch attitude.

HIGH/LOW DRAG WEAPONS, LEVEL DELIVERY

The high drag versions of GP bombs and CBU dispensers and the fire bomb weapons afford the best low altitude/close-in release capabilities. Some of these munitions can be delivered at altitudes of 50 and 100 feet. However, when weapon and fuze functioning time periods, terrain avoidance or frag envelope data must be observed, the release altitudes must be increased accordingly. Therefore a rather wide range of release altitudes are provided in the level delivery ballistics tables, especially for stores such as leaflet and flare dispensers.

WARNING

When missions involve the high/low drag selectivity option of M117R or MK 82 Snakeye bombs, the warnings and notes listed in TO 1F-4C-34-1-2 for those weapons must be carefully observed.

For missions involving a given number of high drag weapons released in train (figure 1-54), the pattern length is a function of the number of weapons released, the interval setting and the aircraft velocity. The sight depression values are based on the distance between an impact point in the center of the pattern and the release point of the first weapon. This distributes the pattern evenly along the desired target area.

DIVE LAYDOWN DELIVERY

SIGHT RETICLE:

1. Drift Stabilized at RBL
2. Roll Deviations

RADAR Mode:

1. A/G
2. 5 or 10-Mile Range

WRCS Manual Inputs:

1. Release Range
2. Release Advance

INS Supplies:

1. Groundspeed
2. Pitch Angle
3. Vertical Velocity

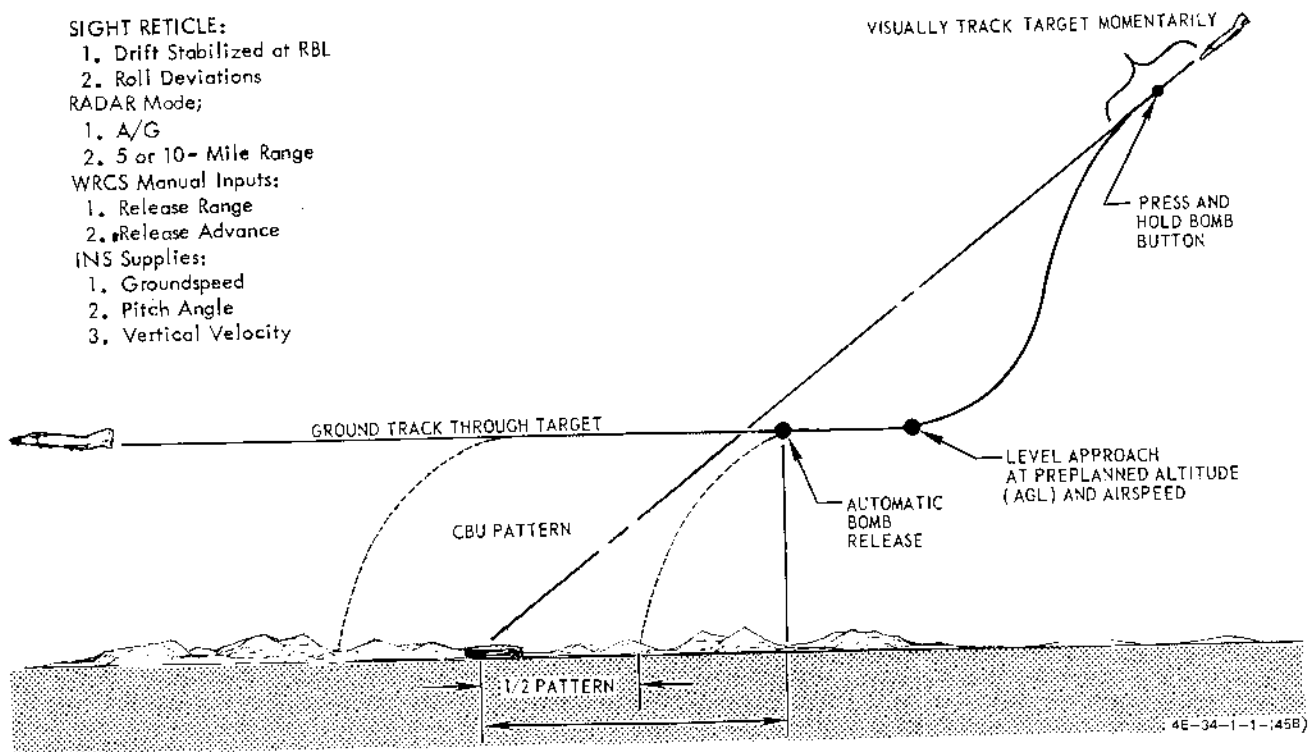


Figure 1-53

WARNING

For live weapons, do not fly over or near burst area after detonation until all fragments are on the ground because aircraft damage can result from flying debris. Consult Maximum Fragmentation Envelopes, TO 1F-4C-34-1-2. During level delivery training missions, at least 20-second spacing between aircraft must be observed when inert or sand filled bombs are released. Observing the 20-second spacing prevents a bomb-to-aircraft collision in the event a bomb releases low drag and ricochets into the air after impact.

The level of delivery of low drag bombs that are fuzed to detonate at impact normally involves the release of only a single weapon. The minimum release altitudes can be as low as 500 feet, provided a climbing military power escape maneuver is flown immediately after release. The escape tables list those weapons that are frag-critical and shows the minimal release altitudes and required escape conditions for each. If release altitudes are increased as the level escape tables show, multiple low drag weapons can be released at set intervals using a level escape.

LAYDOWN DELIVERY

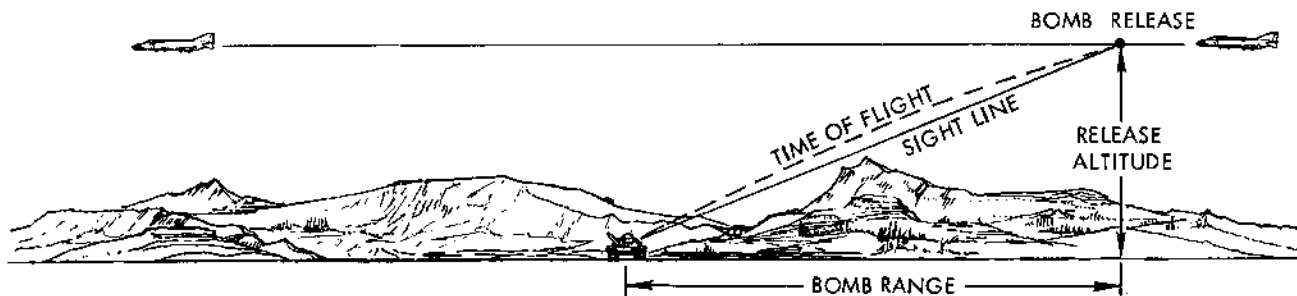
The LAYDOWN selection on the delivery mode knob provides the automatic, computer release of bomb or dispenser munitions in the low altitude laydown environment. In this mode, the depressed optical sight (or an IP) is used to establish the target range input. The equipment used and the required parameters are shown in figure 1-55.

During mission planning, a desirable sight depression angle for the planned release altitude and target range is chosen from the sight depression chart. A correction for angle of attack is not necessary. The resulting range from the aircraft to target is established and entered in the target range control (placarded ALT RANGE) on the WRCS panel. (The light under the ALT RANGE placard will illuminate when LAYDOWN is selected.) The horizontal bomb range for the selected release altitude and airspeed is obtained from the bombing table and entered in the release range control on the WRCS panel. For the CBU delivery or a ripple release, one-half of the pattern length may be added to the value placed in the range control; placing the center of impact on-target.

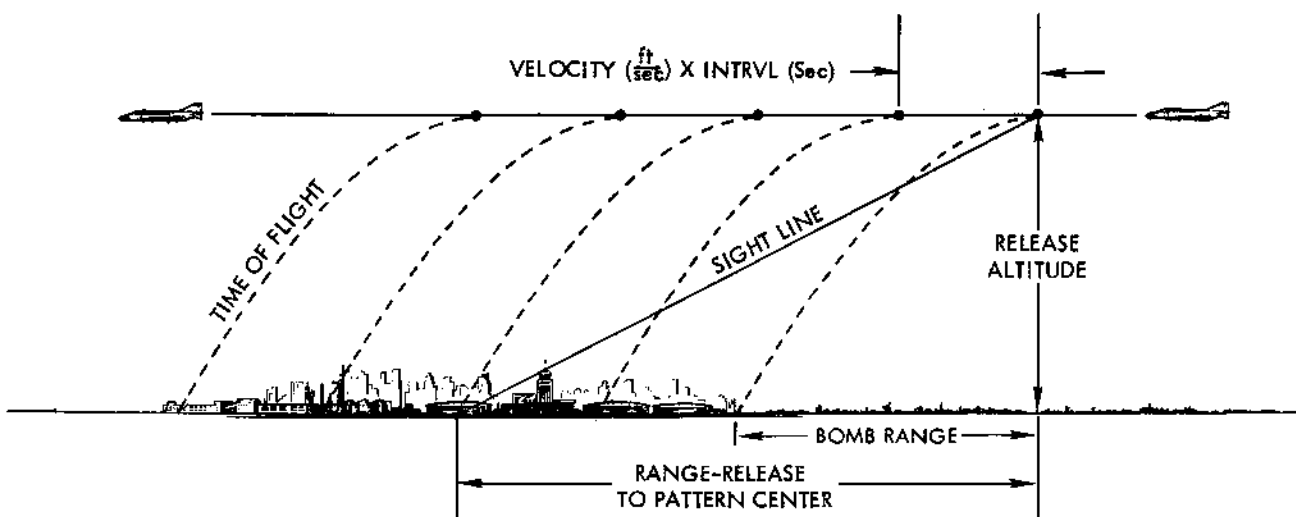
The approach to the target is flown at the planned altitude above target and planned true airspeed (or ground-speed that produces the established bomb range). When the piper LOS is on-target, the bomb button is pressed and

LEVEL DELIVERY

SINGLE WEAPON PROFILE



MULTIPLE WEAPONS PROFILE



4E-34-1-1-(48)

Figure 1-54

LAYDOWN DELIVERY

OPTICAL SIGHT:

1. Drift and Pitch Stabilized
2. Manual Reticle depression
3. Head-up roll deviation

INS Supplies:

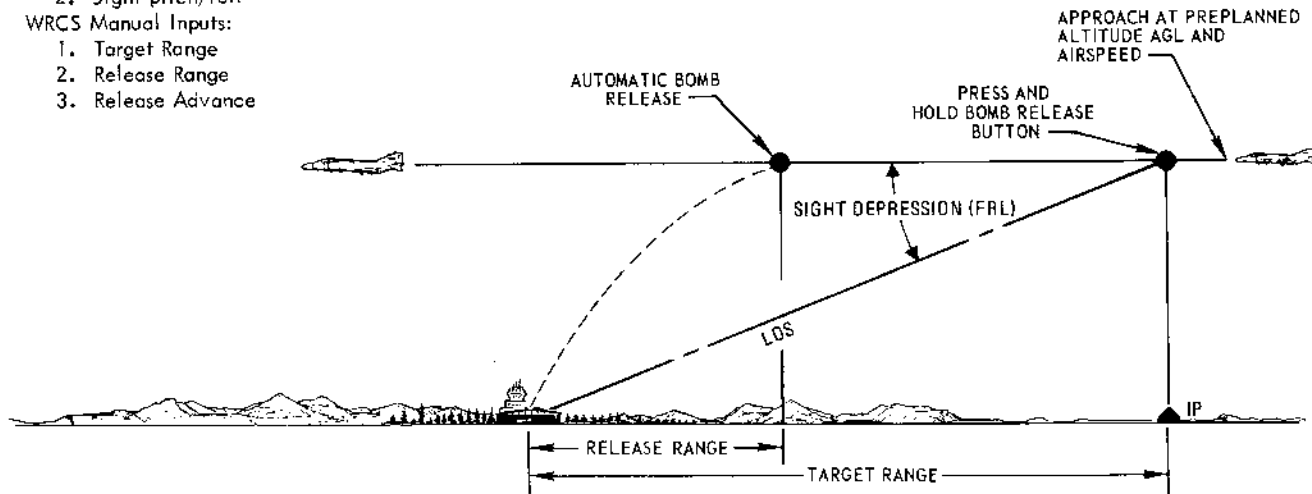
1. Groundspeed
2. Sight pitch/roll

WRCS Manual Inputs:

1. Target Range
2. Release Range
3. Release Advance

Note

An IP may be used to establish the target range if the optical sight is not used.



4E-34-1-1-(47)

Figure 1-55

held until bomb release. When the bomb button is pressed, the target range and INS ground speed are established for the computer. The computer then continually calculates the airplane distance traveled from the target range point. When the airplane has traveled the target range distance minus the release range distance, the release signal is generated.

OFFSET BOMB DELIVERY

The offset bomb mode provides an all weather (blind bombing), high and low altitude, level bombing capability. The automatic bombing mode uses the complete navigational facilities of the WRCS, the INS, and the radar set in both visual (VFR) or nonvisual (IFR) flight environments. The offset bomb mode is selected by placing the delivery mode knob to OFFSET and positioning the weapon select knob to either BOMBS or RKTS & DISP (for dispensers only). The INS must be operational for all WRCS modes.

IDENTIFICATION POINT, RADAR OR VISUAL

In visual delivery situations, the aircrew must locate a visual IP (VIP) and fly directly over the VIP to establish an aircraft position fix with respect to the target. If the radar is not used, the VIP can be approached from any direction. The VIP must be selected at a distance from target that is within the limits of the target distance

counters on the computer control panel. The square (IP selection) area in figure 1-56 shows the limits and demonstrates how the target range distance values (from IP) are obtained.

In an IFR delivery situation, the same distance constraints apply to the selection of a radar IP (RIP). However, the RIP must be radar definable. In this case, the radar set and cursor controls are used to establish the aircraft fix with respect to the target. The aircraft need not be flown directly over the RIP; the RIP may be offset an amount equal to the radar range selection. The selected radar range then, generally defines an approach corridor with respect to the selected RIP. This is also true of the VIP situation if the radar is to be used to initially locate the IP area.

Between the two IP methods (VIP or RIP), the visual situation is expected to be the most accurate. This is due to the inherent ranging tolerance error of the radar, and any cursor position error in establishing the exact location of the RIP with respect to the aircraft. Other factors affecting accuracy, and which the aircrew can control to some degree, are stated as follows:

- a. Choose an IP as close to the target as possible so that navigation time and distances (after target insert) are as small as possible.
- b. Try to approach the IP and target area so that after target insert, minimal maneuvering is required to get on-track to the target.

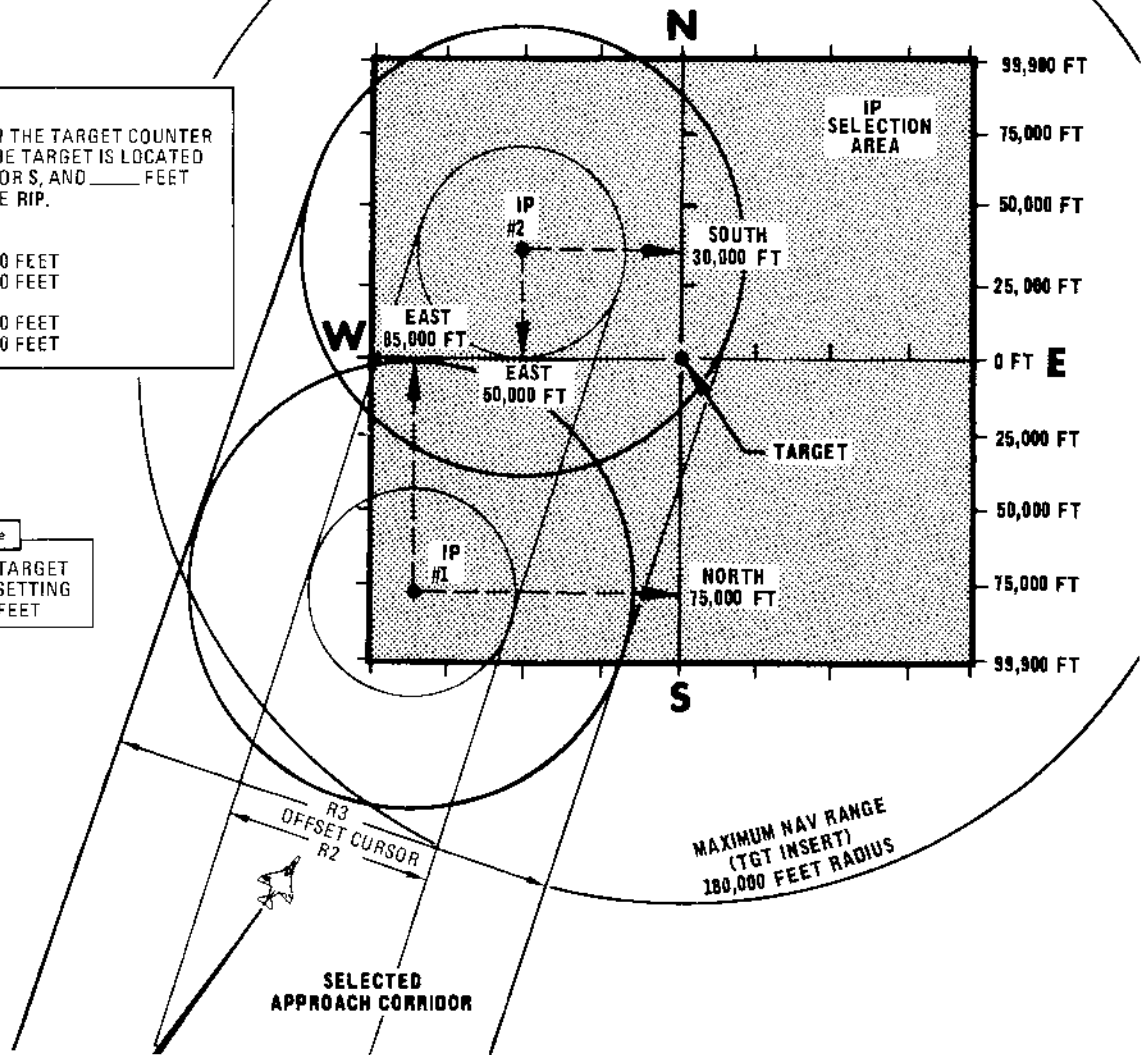
IP SELECTION AREA

EXAMPLE:
 TO ESTABLISH THE TARGET COUNTER SETTING: THE TARGET IS LOCATED _____ FEET N OR S, AND _____ FEET E OR W OF THE RIP.

IP #1
 NORTH: 75,000 FEET
 EAST: 85,000 FEET

IP #2
 SOUTH: 30,000 FEET
 EAST: 50,000 FEET

Note
 MAXIMUM TARGET DISTANCE SETTING
 99,900 FEET



4E-34-1-1-(48)

Figure 1-56

With a VIP or RIP procedure, the distance counters are set with a value that represents target position with respect to the IP, and not the converse. For example, the target is located a number of feet north or south of the IP, and the target is located a number of feet east or west of the IP. When the target presents an identifiable radar return and is used as the RIP, the target range readout controls must be set to zero, and the target altitude (instead of IP altitude) must be set in the ALT RANGE readout control.

CAUTION

When a value is inserted on the target alt range counter other than 000, do not select the target find or offset bomb mode unless (a) the aircraft altitude MSL is greater than the value (times 100)

or (b) the aircrew is performing the target find/offset bomb BIT check as presented in section II. This is necessary to prevent possible damage to the pitch servo in the WRCS computer.

In terrain situations where the known radar IP is actually higher than the required approach altitude, the aircrew can avoid (through correct planning) any equipment damage mentioned in the caution above. Using the following method, the mission planner determines a reciprocal altitude/range counter setting with respect to the planned approach altitude.

- a. Determine the approach altitude above MSL.
- b. Determine the difference between approach altitude and the (higher) radar IP altitude (MSL).
- c. Subtract the value of step (b) from the approach

altitude of step (a); place this amount on the ALT RANGE counter. This establishes an IP altitude and position which is as much below approach as the actual IP altitude is above approach, and the radar range to either point is the same.

d. During the mission, the pilot must fly the planned approach altitude during freeze and target insert operations to assure that correct range data is available for the computer.

The navigation portion of the offset bomb problem is accomplished through the INS inputs, the manual inputs through the computer control panel, radar range, (RIP method), and by WSO manipulations of the cursor control panel. The INS supplies the following vector inputs to the computer.

- a. Aircraft groundspeed.
- b. The velocity vectors: north-south, east-west.
- c. Aircraft altitude MSL (standard day).
- d. Ground track.
- e. Aircraft heading.

The computer uses these signals in conjunction with the MAP-PPI radar and the inputs from the cursor control panel to generate the following signals and displays:

- a. The target tracking position of the range cursor and the offset cursor displayed on both radar scopes.
- b. Horizontal ground range to the target is displayed on the HSI and BDHI instruments if the respective mode selector switches are in NAV COMP.
- c. Steering angle of the target is displayed on the HSI, BDHI, ADI instruments, and the optical sight.
- d. The bomb release signal is generated and routed to the weapons release circuit to release the bomb.

Figure 1-57 sheet 1 shows the radar offset bomb method using an RIP, and the required inputs from other avionics sets. Figure 1-57 sheet 2 shows the visual IP method and again, the required inputs from other avionics are listed.

OFFSET RADAR IP

When using a radar IP, the offset bomb run begins when the RIP is identified on the scope. The WSO positions the range cursor below the RIP return by moving the along-track control on the cursor control panel. The cross-track cursor control is used to position the offset cursor over the RIP radar return. When the RIP return reaches the intersection of the cursors, the WSO presses the freeze button. Pressing the freeze button adds the INS drift and ground speed inputs to start cursor automatic RIP tracking. After final refinement over the RIP, the WSO presses the target insert button. This adds the target offset distances entered on the WRCS panel, starts cursor automatic target tracking, and provides steering and DME to the target. The cursor controls can be operated any time prior to target insert to update (touch-up) their position over the RIP. If the target can be defined on the radar scope, the cursor controls can be operated after target insert to update on the target provided the RIP altitude is nearly the same as the target altitude. When there is a difference between the RIP and target altitude, the target

pressure altitude (or target elevation MSL) should be placed in the ALT RANGE readout control prior to updating on the target.

If the mission becomes visual and the pilot establishes visual contact with the RIP, then the aircrew may transition to the VIP method. The WSO presses the reset button, and when the aircraft is directly over the RIP, the freeze and target insert controls are pressed simultaneously to resume target tracking.

After target insert, the drift stabilized MAP-PPI radar display can be used as the primary steering instrument by flying to center the offset cursor at the ZERO azimuth position. Also, after target insert, the radar should be switched to a minimum range to further increase bombing accuracy. (Before using the scope display as the primary steering instrument, the aircrew must establish the ZERO azimuth position of the offset cursor by performing the WRCS BIT check.)

The final portion of the bomb run is performed at the planned release speed altitude above target AGL. The release altitude is normally between 50 to 1000 feet; however, the release altitude can be as high as 50,000 feet if the bomb range does not exceed the release range control setting on the WRCS panel (X10 or X100). The bomb button must be pressed before the aircraft reaches the release range. The bomb button can be released and pressed again (prior to bomb release) without aborting the offset bomb run. The computer applies the bomb release signal when the distance to the target, minus the bomb release range equals zero. Steering information to the target continues to be supplied after release. Another run on the same target can be accomplished by flying the steering instruments and pressing the bomb button prior to the bomb release point. However, this method increases the navigation range which correspondingly decreases bombing accuracy.

WARNING

If the bomb button is pressed (and held) after the bomb release range is passed, the bomb will release at a point beyond the target equal to the preset bomb range.

VISUAL IP

The VIP method is procedurally the same as the RIP method as previously described. The aircrew must visually acquire and fly directly over the IP, and the freeze and target insert button are pressed simultaneously at that point. The radar and cursors may be used optionally to provide an additional steering device, particularly if the IP and target are several miles apart. The VIP method is illustrated in figure 1-58 sheet 2.

TARGET FIND MODE

With TGT FIND selected, all operating procedures and steering displays described for offset bomb are identical. The aircrew may employ either a radar or visual IP method, or a combination of the two. The difference is that

a bomb release signal cannot be generated, and therefore, a release range value need not be established. The WSO may operate the target find mode exclusively from the rear cockpit by selecting target find HOLD on the weapon delivery panel; the delivery mode knob in the front cockpit may remain off.

)

)

)

)

)

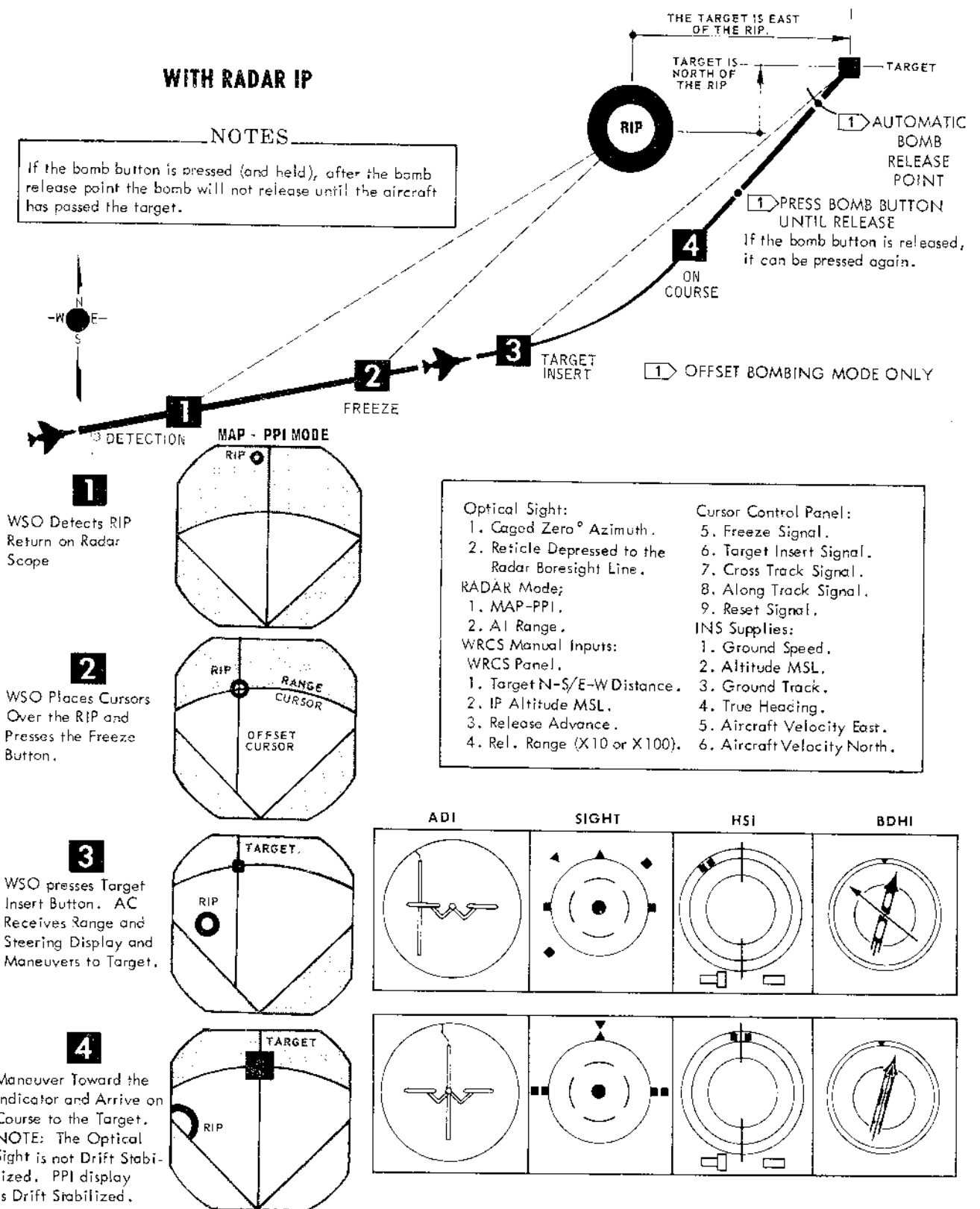
)

)

)

)

OFFSET BOMB MODE AND TARGET FIND

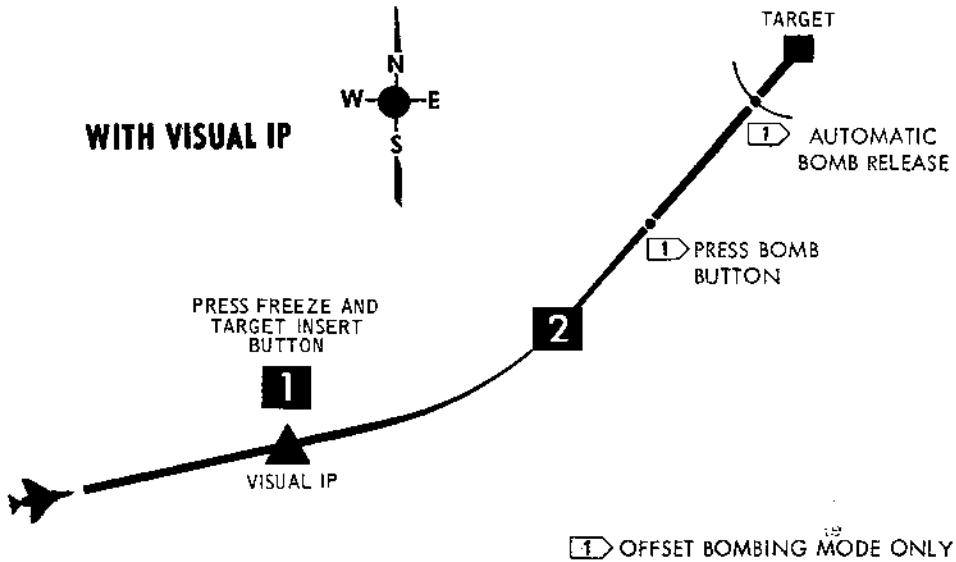


4E-34-1-1-149-11A

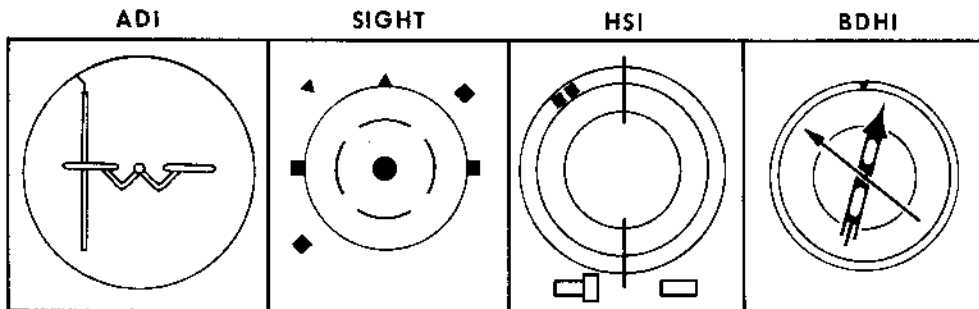
Figure 1-57 (Sheet 1 of 2)

OFFSET BOMB MODE & TGT FIND (Continued)

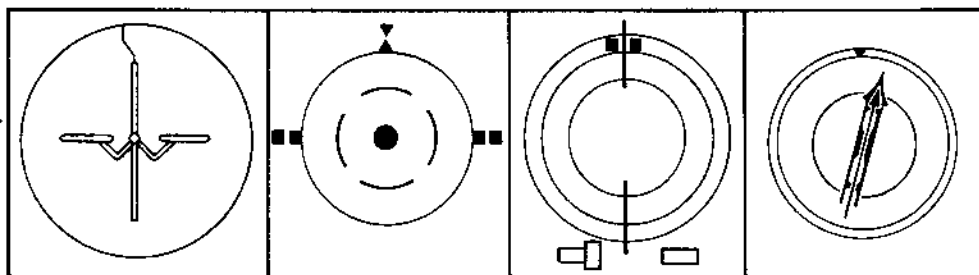
- Optical Sight:**
1. Reticle caged to the Radar Boresight Line.
- RADAR Mode**
1. Not Required
- WRCS Manual Inputs:**
- WRCS Panel
1. Target N-S/E-W Distance
 2. Release Advance.
 3. Rel. Range (X10 or X100).
- Cursor Control Panel**
4. Freeze Signal.
 5. Target Insert Signal.
 6. Reset Signal.
- INS Supplies:**
1. Ground Speed.
 2. Altitude MSL.
 3. Ground Track.
 4. True Heading.
 5. Aircraft Velocity East.
 6. Aircraft Velocity North.



1
Press Freeze and Target Insert Button when Aircraft is over IP. Steering Information is Displayed.



2
Maneuver Toward the indicator and Arrive on Course to the Target. Note: The Optical Sight is not Drift Stabilized.



NOTE

When over the target, the roll tabs rotate and the distance counters begin increasing in value displayed.

Figure 1-57 (Sheet 2 of 2)

WARNING

In Pave Spike aircraft, weapon release is possible in the target find mode. Therefore, no practice bomb runs will be accomplished in the target find mode with the master arm switch in ARM and aircraft stations selected. Refer to Electro-Optical Target Designator System AN/ASQ-153(V)-3, this section.

The target find mode may be used as an aid to update the navigation computer using the radar or visual IP method. Set the north/south and east/west target distance counters for any convenient target with reference to an IP. The target is the location where INS updating occurs. Position the update switch to SET and dial the latitude and longitude coordinates of the same target in the navigation computer control panel. The cursor controls (or visual flyover) procedure may be used to establish a computer fix on the IP. The freeze and target insert operations are completed and the pilot maneuvers toward the target. As the aircraft approaches the target, place and hold the INS update switch in the FIX position. When the BDHI DME reads zero and the bearing needle swings through 90°, release the update switch to the normal position.

STEERING INSTRUMENTS, OFFSET BOMB AND TARGET FIND

The steering devices available to the pilot are shown throughout figure 1-58. The specific functions of the BDHI and HSI instruments are shown on sheet 1. A sample steering presentation involving the ADI instrument is provided on sheet 2. The optical sight roll tabs provide a head-up display of the same data presented on the ADI vertical pointer.

NOTE

ADI steering is disabled if the weapon selector knob is on AGM-45.

LOFT BOMBING

The purpose of loft bombing (figure 1-59) is to provide a release capability of multiple GP bombs with a minimum of aircraft exposure time to ground fire and without a target fly-over.

The delivery must be planned against targets of known location so that all approach distances can be determined. With a given number of bombs, the impact pattern data and the pullup-to-target range is obtained using data from the ballistics tables. The range of the first and last bombs establishes the pattern length and spread, and also establishes the distance from target where pullup begins. Then using target maps, the pilot must select an IP at or relatively close to the pullup range. This establishes the approach true course, and the distance between IP and pullup for a planned run-in velocity establishes the pullup timer (T_1) setting.

During the approach to the IP, the pilot flies to establish the run-in altitude, course (or crabbed course), and the constant run-in velocity. The approach velocity is established with no further throttle changes throughout the entire maneuver; the maneuver is flown at constant power from IP to release.

Directly over the IP, the pilot presses and holds the bomb button. This initiates T_1 and the pullup timer begins countdown. Bomb button power also illuminates the pullup light, and moves the horizontal and vertical pointers of the ADI over the center of the sphere. The vertical pointer indicates yaw/roll flight deviations and the horizontal pointer shows deviations from 1G flight. The movement of the pointers indicates that the ARBCS has properly switched into the LOFT bombing function. At the end of the total time interval, pullup voltage is applied to the tone generator producing a continuous audible tone and the pullup light goes OFF. These are direct indications to begin pullup and the pilot begins rotation into the pullup maneuver. As the timer circuits close, voltage is applied to one side of the low and high angle release switches, which are not yet energized. Relays in the flight director bombing computer are energized to start the G programmer. The ADI horizontal pointer now indicates G error based on 4G obtained in 2 seconds; the horizontal pointer deflects upward unless the pilot begins pullup.

When the aircraft reaches the preset pitch attitude, the release switch closes and the power, previously applied at pullup, becomes the release signal. As release voltage is applied, the tone generator is deenergized, and voltage is removed from the timer to reset the timer and allow the pullup light to illuminate. Bombs are released until the stations selected are empty or until the bomb button is released.

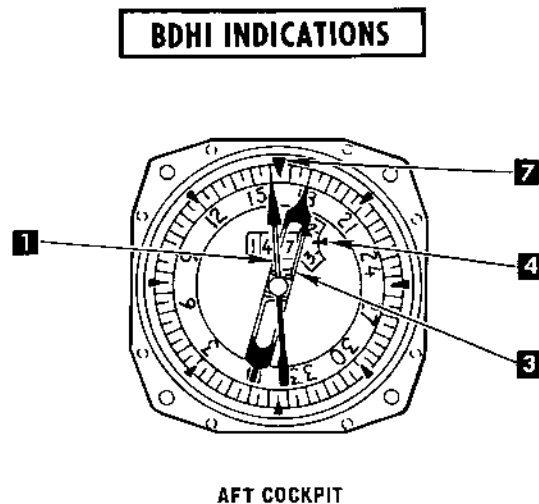
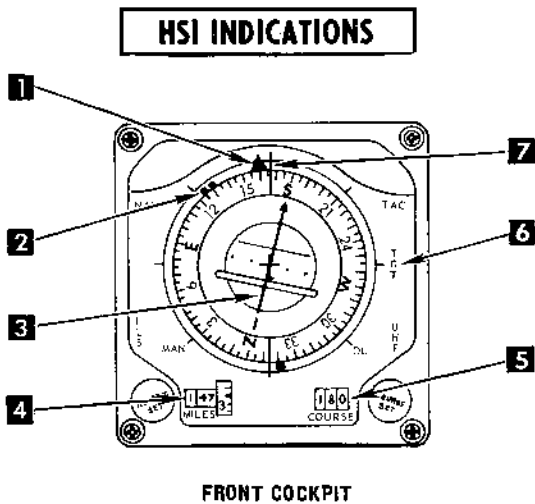
When the pilot releases the bomb button, all bombing voltage is removed and the ADI horizontal pointer returns to the selected nav mode functions, and the pullup light goes OFF.

NOTE

During the LOFT mode, once the bomb button is pressed, it must remain pressed until final bomb release. If the bomb button is released before the first bomb is released, a lockout relay is energized and the run cannot be continued by pressing the bomb button. To overcome the relay, the delivery mode knob must be positioned out of the LOFT function and then returned to LOFT.

The LADD bombing mode can be used to perform the loft bomb delivery. This is accomplished by selecting the LADD mode on the delivery mode knob and setting the pullup-to-release time (from the bombing tables) on the release timer. The release signal is generated by the release timer. The horizontal needle on the ADI sphere will program 3.5G in 1.5 seconds (not 4G in 2 seconds as for the loft mode) until approximately 38° pitch attitude is achieved. Therefore, the ADI cannot be used above 38° when the LADD mode is used to accomplish the loft delivery; the aircraft accelerometer must be used to maintain pullup acceleration after the 38° point.

OFFSET BOMB & TARGET FIND MODES



- 1** Bearing Pointer: Indicates the magnetic bearing to the target as computed by the WRCS computer and controlled by the NS/EW target distance counter.
- 2** Heading Marker: Indicates the magnetic heading to the target as computed by the nav computer and controlled by NS/EW target distance counter.
- 3** Course Arrow: Indicates the magnetic course of the aircraft (ground track), computed by the nav computer; same as Course Window.
- 4** Range Indicator: Indicates the horizontal distance (not slant range) to the target in nautical miles.
- 5** Course Window: Same as Course Arrow.
- 6** TGT Mode Light: Illuminates when the Target Insert button is pushed on (if the instrument lights are ON).
- 7** Lubber Line: Indicates the magnetic heading of the aircraft.

NOTE

When the aircraft is on magnetic course to the target, the Bearing Pointer and the Course Arrow are aligned, and the Heading Marker is aligned with the top of the Lubber Line.

- 1** No. 1 Needle: Same as the Bearing Pointer on HSI.
- 2** NA
- 3** No. 2 Needle: Same as the Course Arrow on the HSI.
- 4** Range Indicator: Same as the Range Indicator on the HSI.
- 5** NA
- 6** NA
- 7** Top Index: Same as the top Lubber Line on the HSI.

NOTE

When the aircraft is on the magnetic course to the target, the No. 1 Needle is aligned with the No. 2 Needle.

OFFSET BOMB & TARGET FIND MODES (Continued)

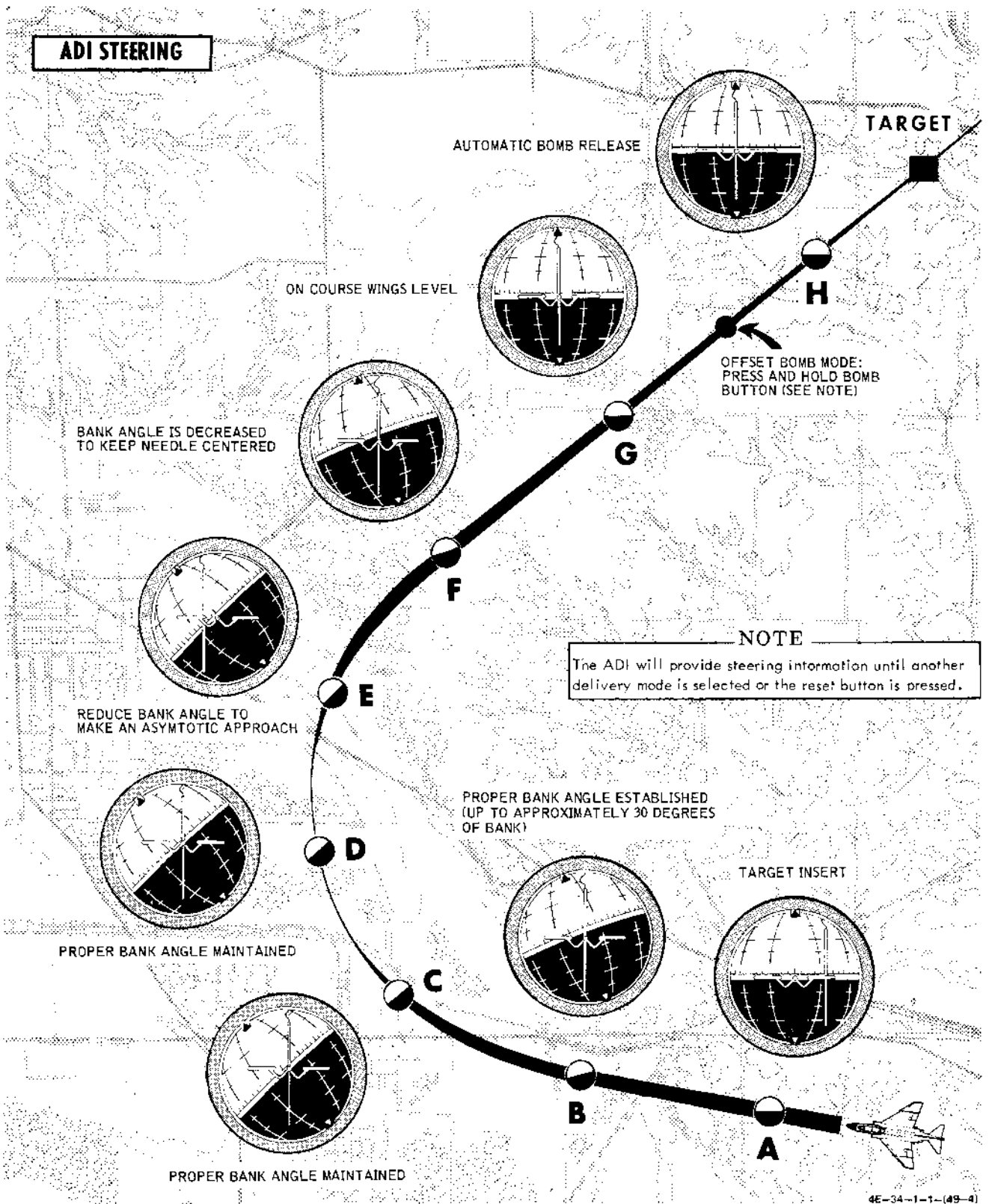


Figure 1-58 (Sheet 2 of 2)

LOFT BOMBING

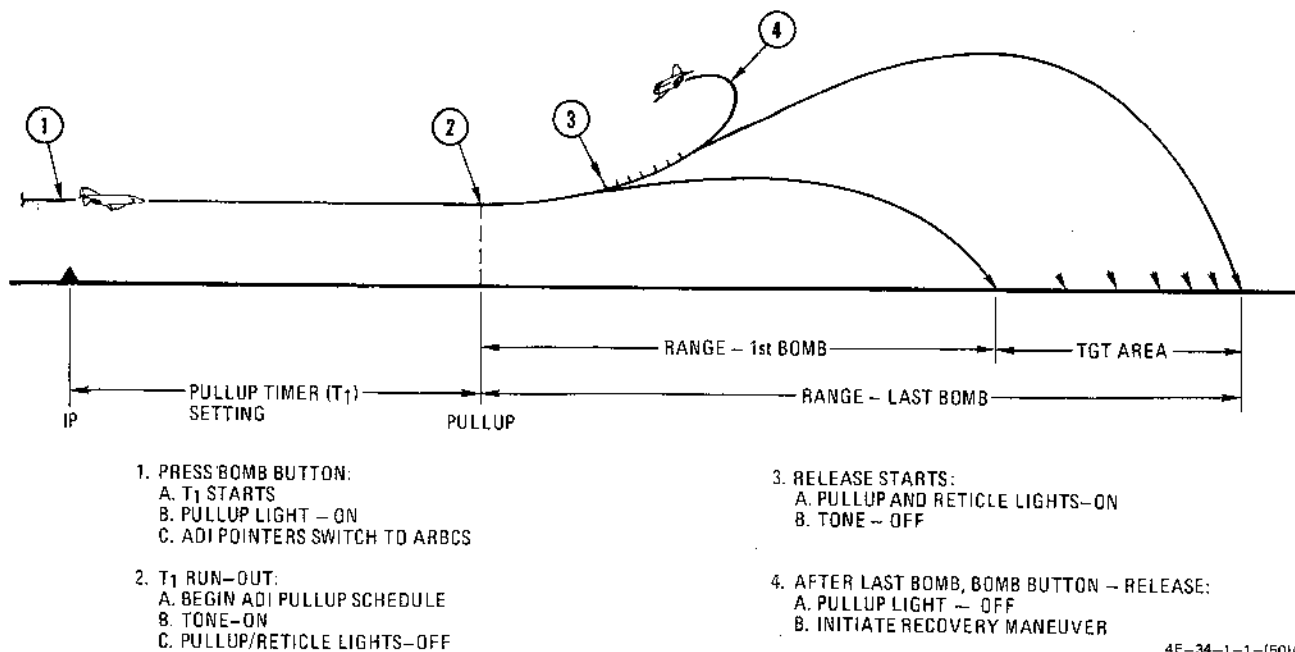


Figure 1-59

WRCS/LABS DELIVERY

The weapon delivery panel provides the capability of selecting and using the navigational functions of the target find mode while flying any one of the available LABS deliveries. The target find radar or visual IP methods may be used as the situation requires. In this case, the WRCS system is being used to deliver an ARBCS activate signal at the proper range from target and along any ground track projected directly through the target. With the activate signal, the ARBCS is placed in operation and target find steering is available before and after the activate point. In the example maneuver shown here (figure 1-60) the LADD/target find mode is considered using and offset IP.

The pilot selects TIMED LADD, and energizes the appropriate release and arming switches for the type of weapon aboard. The flight director instruments are placed in the nav. comp. operating mode, and the optical sight is operated in the A/G mode. On the weapon delivery panel, the WSO must select HOLD on the target find switch; the HOLD position selects the WRCS target find mode of operation.

The WRCS computer control panel is set as it normally would be for offset bomb operations. The only difference is that the release range (R_R) counter must be set with a number representing range from pullup to burst, which is quoted in the appropriate LADD ballistics table. Assume that the ballistics table range (R_B) is quoted at 14,000 feet.

This is the range at which the WRCS system delivers a signal activating the LADD system. The aircrew should allow for a small amount of lead time at pullup. The lead time compensates for any delay in reaction time, and allows time for the AN/AJB-7 to activate into the LADD mode. A feasible lead interval is 1 second, which is placed on the pullup timer (T₁ interval, figure 1-60). Therefore, the R_R setting on the WRCS control panel is

$$R_R = R_B + V_A (1.69) T_1$$

where:

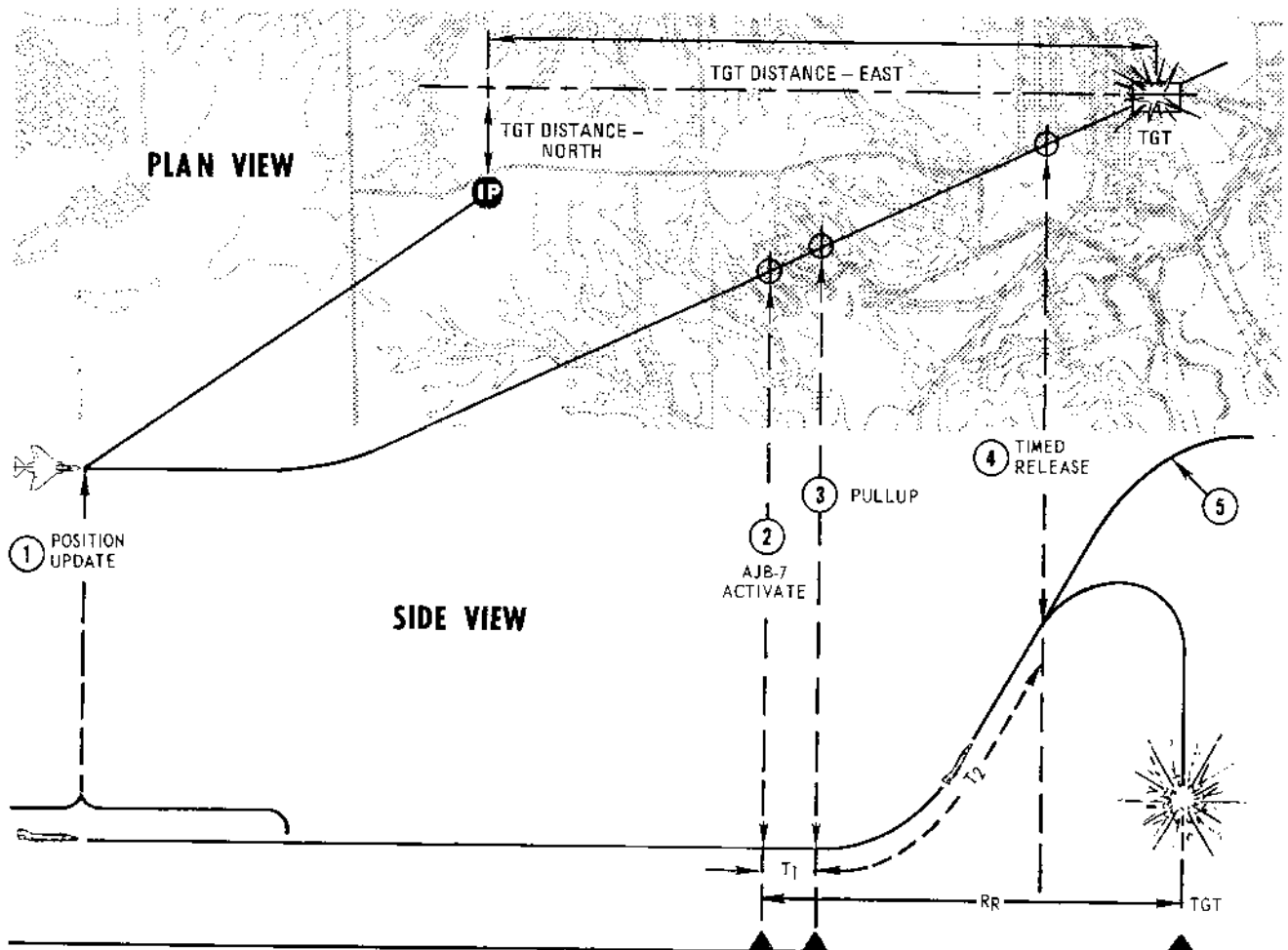
R_B is the bombing table range;
V_A is approach velocity in knots;
T₁ is the desired lead time.

For a 1.0 second T₁ interval and 550 KTAS approach, the R_R setting would be 14,900 feet. In the R_R counter, the WSO would place 149 on the dial and energize the range switch to (X100) on the weapon delivery panel. The WSO sets the T₂ interval on the release timer.

NOTE

- The selection of 1.0 second for a lead interval is only intended as an example here. Whatever the setting is, it should be as small as possible since chances of distance error at the pullup point are increased with longer T₁ intervals. Also, the activate tone is triggered at the activate point, regardless of the value placed on the pullup

WRCS/LADD DELIVERY



① POSITION UPDATE

1. WSO positions WRCS cursors over IP and presses FRZ control.
2. WSO presses TGT INS control, steering displayed on HSI, ADI, reticle, and BDHI. AC steers to null azimuth indicators.
3. WSO selects ACTIVATE after cursors and steering devices complete transition to target.

② AJB-7 ACTIVATION (R_R)

1. Activate tone sounds (0.38 sec. beep) and T_1 time starts. ($T_1 = 1.0$ sec. lead-in time.)
2. ADI pointers centered.
3. Pullup light on.
4. AC starts pullup.

NOTES

- Bomb button signal may be delivered anytime during $T_1 + T_2$.
- All other steering instruments (except ADI) continue WRCS steering.

③ PULLUP

1. AT $T_1 = 0$, pullup light off.
2. Reticle light off.
3. Steady tone on.
4. T_2 time starts.
5. ADI pointers:
Horizontal - LADD acceleration flight path.
Vertical - yaw/roll error.
6. Bomb button signal must be delivered before $T_2 = 0$.

④ RELEASE

1. AT $T_2 = 0$, release occurs.
2. Pullup and reticle light on.
3. Tone off.
4. ADI vertical pointer out of view.

⑤ RELEASE BOMB BUTTON

1. Pullup light off.
2. ADI vertical pointer-WRCS steering.
3. ADI Horizontal pointer out of view
4. WRCS Steering continues, initiate maneuver recovery.

4E-34-1-1 (511A)

Figure 1-60

timer. The tone may be used both as an activate signal and a pullup warning signal only if the pullup timer is set on a low value. Finally, if T_1 is set to zero, the 0.38 second activate tone occurs directly at the pullup point.

- With the range switch on (X100), the (X10) factor on the release range counter has no meaning. The range switch is also functional in any WRCS mode that requires an R_R setting.
- For the WRCS/LABS modes, any release advance (R_A) setting on the WRCS panel advances the activate point by the amount set into the counter. Normally, the counter should be set on zero. However, an R_A setting may be used to apply a tailwind correction or to apply a reaction time correction during the TGT FIND/DIRECT mode.

As figure 1-60 indicates, the pilot approaches the target area using normal target find (or offset bomb) procedures. The aircrew may select the target as the IP, use an offset IP, or a visual IP fly-over procedure may be used depending on the nature of the target and weather conditions. Once the target insert function is performed, the WSO places the activate switch to ON. Note that if the activate switch is placed ON before target insert, the LADD system could energize prematurely. (At target insert, the WRCS range servos position out to the aircraft range from target. If the servos pass through the R_R setting, the AN/AJB-7 system could activate at that instant.)

When the aircraft reaches the AN/AJB-7 activation range (14,900 feet in this case), a signal from the WRCS triggers the activate tone and starts the pullup time (T_1). At this point, the ADI needles switch into the AJB-7 mode, but the remaining steering devices continue indicating target find steering. The activate tone lasts about 1/3 second, which means that the pilot has about 2/3 second

remaining to react and begin pullup as the T_2 interval (release timer) begins.

The bomb button may be pressed anytime during ($T_1 + T_2$) interval; AN/AJB-7 activation occurs automatically and independently of the bomb button when reaching the set R_R range. However, if the pickle signal is delivered before reaching the activation range, the AN/AJB-7 sequence will begin immediately. Also, if the pilot inadvertently releases the bomb button during ($T_1 + T_2$) interval, the signal may be reapplied before T_2 run-out without aborting the run. The lock-out relays are bypassed in the WRCS/AJB-7 modes.

NOTE

The 1/3-second activate tone mentioned here is available only in the WRCS/LABS delivery modes. If the AGM-45 is to be delivered using the WRCS/LOFT mode, the pullup activate tone is not available.

The pullup-to-release portion of the LADD maneuver is flown as figure 1-60 indicates. Aircrews may easily equate these procedures to any other LABS maneuver. With a LOFT or O/S mode selected for example, release occurs through the AN/AJB-7 gyro rather than the release timer. The R_R counter is set as a function of the desired pullup distance from target, which would be nearly zero in an O/S mode and conceivably as much as 30,000 feet in a LOFT mode. Also, with the R_R counter set for a known bomb range, the pilot can select DIRECT and apply the release signal when the activate tone sounds. In this case, the aircrew has a DIRECT/TGT FIND release mode.

After bomb release, the WRCS target find mode continues to function and the pilot may reattack, provided that the navigation range of the WRCS is not exceeded (30 nautical miles). Otherwise, the system is completely recycled by placing the activate switch to NORM and by pressing the reset button on the cursor control panel. The AN/AJB-7 system recycles automatically at bomb release.

AGM-65 DELIVERY

The AGM-65A and -65B are TV guided (AGM-65D is IR guided), rocket-propelled air-to-surface missiles. Primary targets are tanks, armored personnel carriers, field fortifications, reinforced buildings etc., which the aircrew must

visually acquire before proceeding with missile launch preparations. In all cases, missile video acquisition must be accomplished prior to missile launch. With all cockpit controls properly set, the television display in both cockpits shows a TV picture which is provided by the television camera in the weapons. The missile system is employed only on DSCG aircraft.

(

(

(

(

(

(

(

(

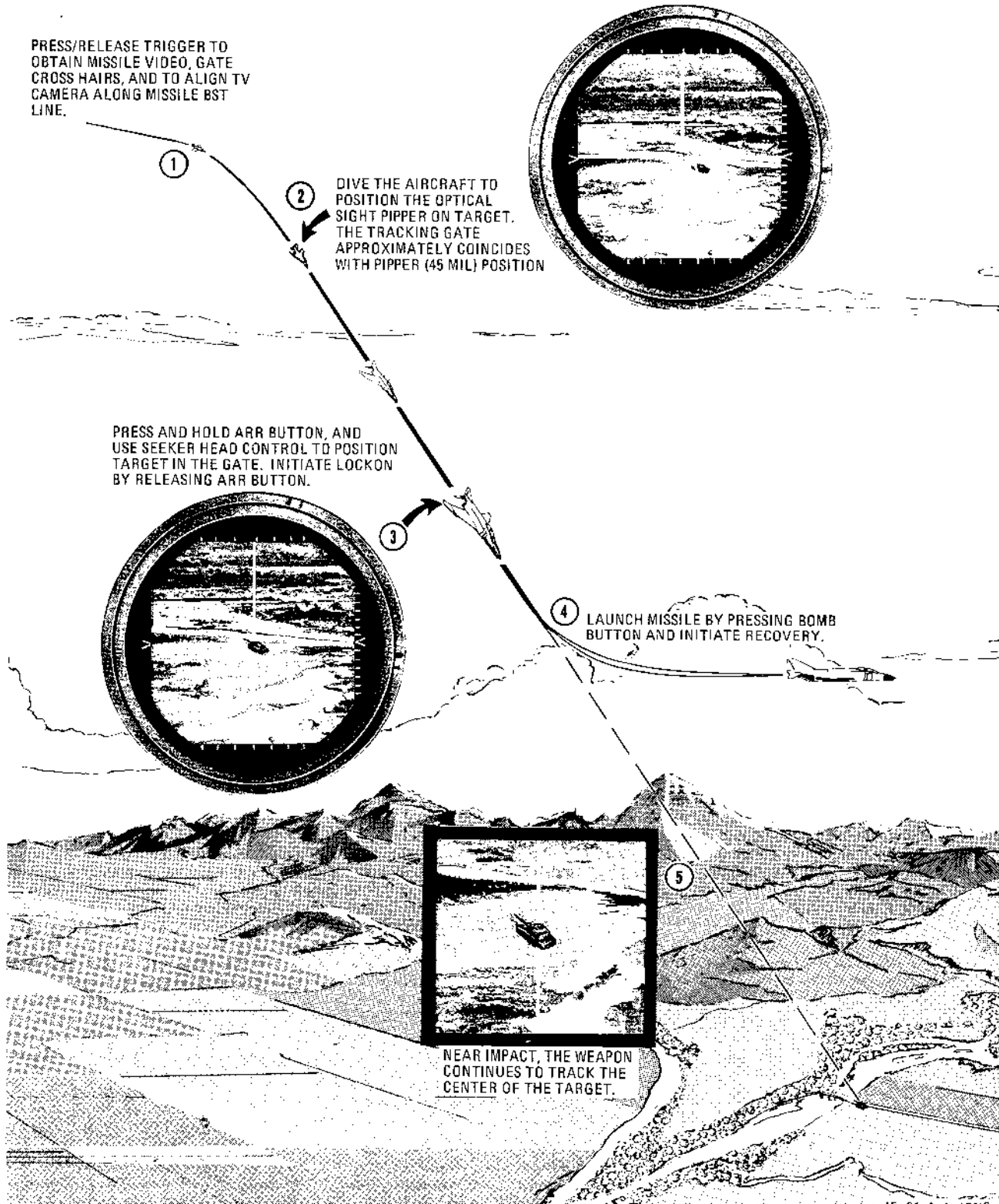
(

(

(

AGM-65 DELIVERY

DSCG AIRCRAFT (AGM-65A DISPLAY SHOWN)



4E-34-1-1 (53)C

Figure 1-62

Three missiles are suspended from each LAU-88/A, -88A/A launcher, which is suspended from the inboard armament pylons.

With all controls properly set, pressing and releasing either trigger removes (jettisons) the protective dome cover on the first missile, mechanically uncages the seeker head, and electrically aligns the seeker head to the missile boresight (approximately 10 mils below RBL). The tracking gates appear on the video display. With the seeker aligned, the TV display should approximately coincide with the view which appears in optical sight. (The optical sight is manually depressed approximately 45 mils. On individual aircraft, the sight depression angle will probably vary.) The aircrew can separately adjust the TV display on each of the radar scopes for contrast and brightness. Either crewman may select the tracking mode so that the seeker tracks a black-on-white target, a white-on-black target, or the switch may be left in the automatic mode. This effects the target tracking characteristics of the missile, but has no effect on the video display. After a sufficient check of the video is performed, the missile can be returned to a mechanical cage condition by deselecting and then reselecting the station; the scope goes blank and remains in this condition until the trigger is actuated again.

Operating in a DIRECT delivery mode, the pilot dives the aircraft to place the optical sight piper on target (figure 1-62). When the target is identified on the scope video, the pilot presses and holds the ARR button. The ARR button enables the seeker head control on the left console. Using the seeker control, the pilot positions the video so that the target image is centered in the tracking gate. (AGM-65A and 65B display differences are described in later paragraphs. Refer to TV Display.) If the target image is too small, the pilot must close with the target. With the target centered in the gate, the pilot initiates lockon by releasing the ARR button. If the target fills one-half the tracking gate area (both ways) and the AGM-65A crosshairs are steady on target, lockon has occurred. The AGM-65B or AGM-65D has a good lockon if the pointing cross is not flashing. The WSO has the same control of the seeker head by initiating half action and using the antenna hand control to center the target in the gate. Lockon is accomplished by releasing the half action, or by initiating full action.

After target lock on is confirmed, the missile is launched by pressing either bomb button. An approximate 1.0-second time delay occurs between the bomb button signal and missile launch. During this time, the missile internal power supply is activated and the rocket motor is ignited. The bomb button must be held pressed for approximately 1.0 second for missile launch. If the bomb button is pressed for less than 1.0 second (short pickle), the rocket motor will not ignite and missile video will remain on the display. If video is still present when an immediate second depression of the bomb button is made, a successful launch may result. A second pass should not be attempted with a missile that failed to launch (for any reason). After a missile is successfully launched, the radar scope goes blank and the next missile on that station is selected.

LAUNCH SEQUENCE

With both stations selected, all missiles on the left wing station are launched (outboard to inboard) before the launch sequence is transferred to the right wing station. To transfer the release signal to the right station while a missile is present on the left station, the left inboard station must be deselected. The missile reject (manual sequence) switch on the pedestal may be used to deselect a missile and select the next missile in the release sequence on that station. This switch, however, does not sequence from one wing station to another. In order to reselect a missile after having been deselected through the sequence switch, the station select button must be cycled.

It is possible, through contrary to proper procedure, for the aircrew to launch an AGM-65 before the ready light (amber station ARM light) comes ON since the light circuit is a timing device only and not a launch interlock. Activating the missile (pressing the trigger) prior to completion of gyro warmup may result in sever damage to the guidance unit. If the gyro is not up to speed on activation, the display will probably jiggle and target identification may be difficult. This situation is precluded by checking the amber station ARM light is ON before pressing the trigger, assuming no malfunction of the guidance or video systems.

AGM-65 CONTROLS

The controls necessary for missile prelaunch and launch operations are shown in figure 1-63. As soon as the aircraft bus system is energized, environmental power is available to vidicon heaters in all missiles aboard. The environmental conditioning is continuous with no control action necessary from the cockpit. When missiles are stored in cold temperatures (0°F or below), they should remain with environmental power ON up to 10 minutes before beginning any missile control functions.

Delivery Mode Knob

Only the DIRECT release mode is used for the AGM-65 missile. This places the bomb button directly in the release relay network, and closes a portion of the station ARM (amber) light circuit.

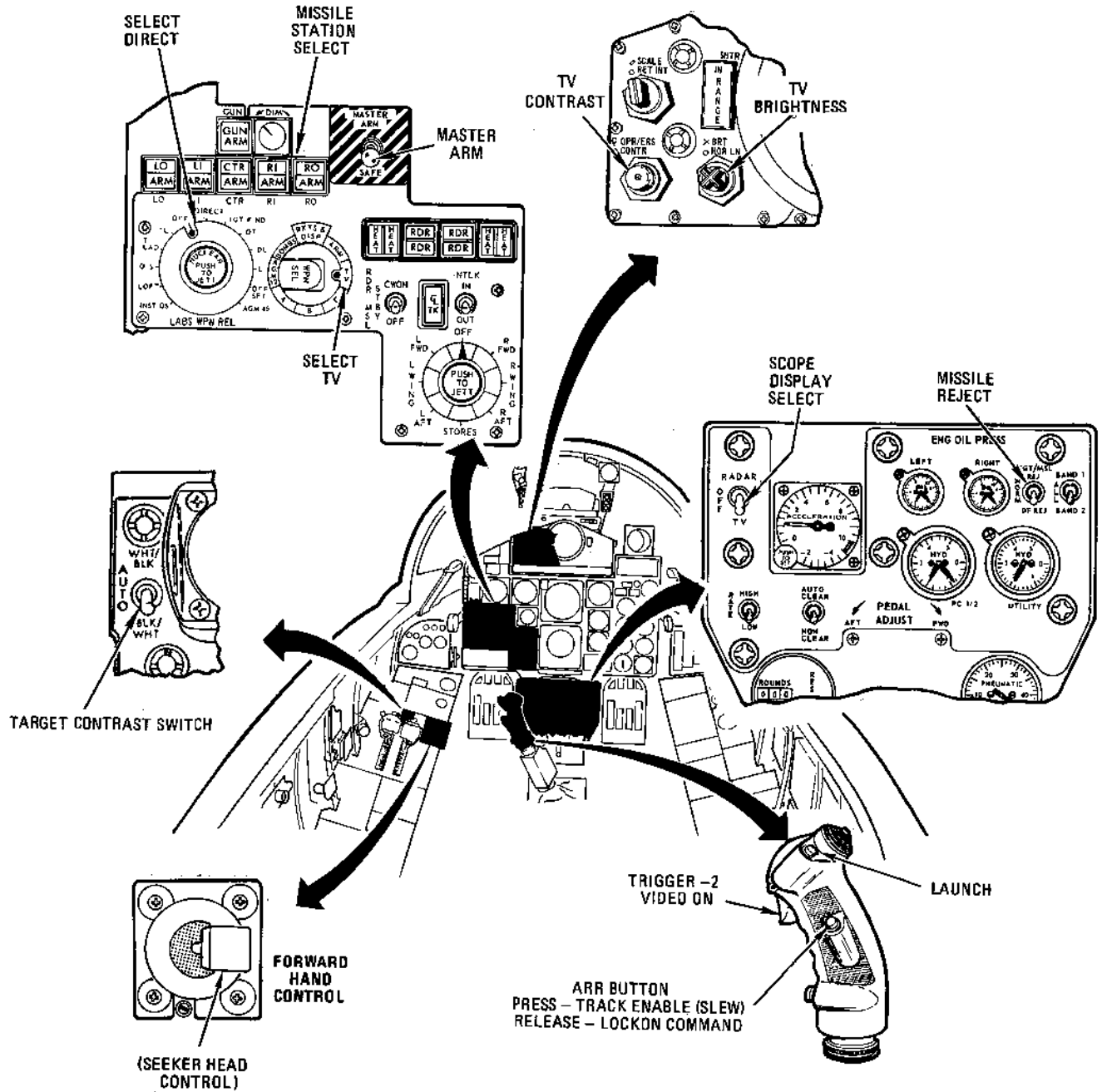
Weapon Select Knob

The TV position of the weapon select knob applies power to the station select circuits and places the trigger in the TV weapon network. To get trigger transfer, the CAGE signal must not be present. Weapon select voltage is also applied to the TGT/MSL reject switch. In each launcher, the missile gyro power supplies are energized which initiates seeker gyro run-up in all missiles aboard. A 3 minute period must be observed for gyro run-up before video and uncaging signals are applied. A timer in the launcher signals the completion of the 3 minute period by closing the station select ARM (amber) light circuit.

AGM-65 MISSILE CONTROLS

BLOCK 36 (67-343) THRU 48 (71-236)

FRONT COCKPIT



4E-34-1-1-(54-11C

Figure 1-63 (Sheet 1 of 3)

AGM-65 MISSILE CONTROLS (Continued)

BLOCK 48 (71-237) AND UP

FRONT COCKPIT

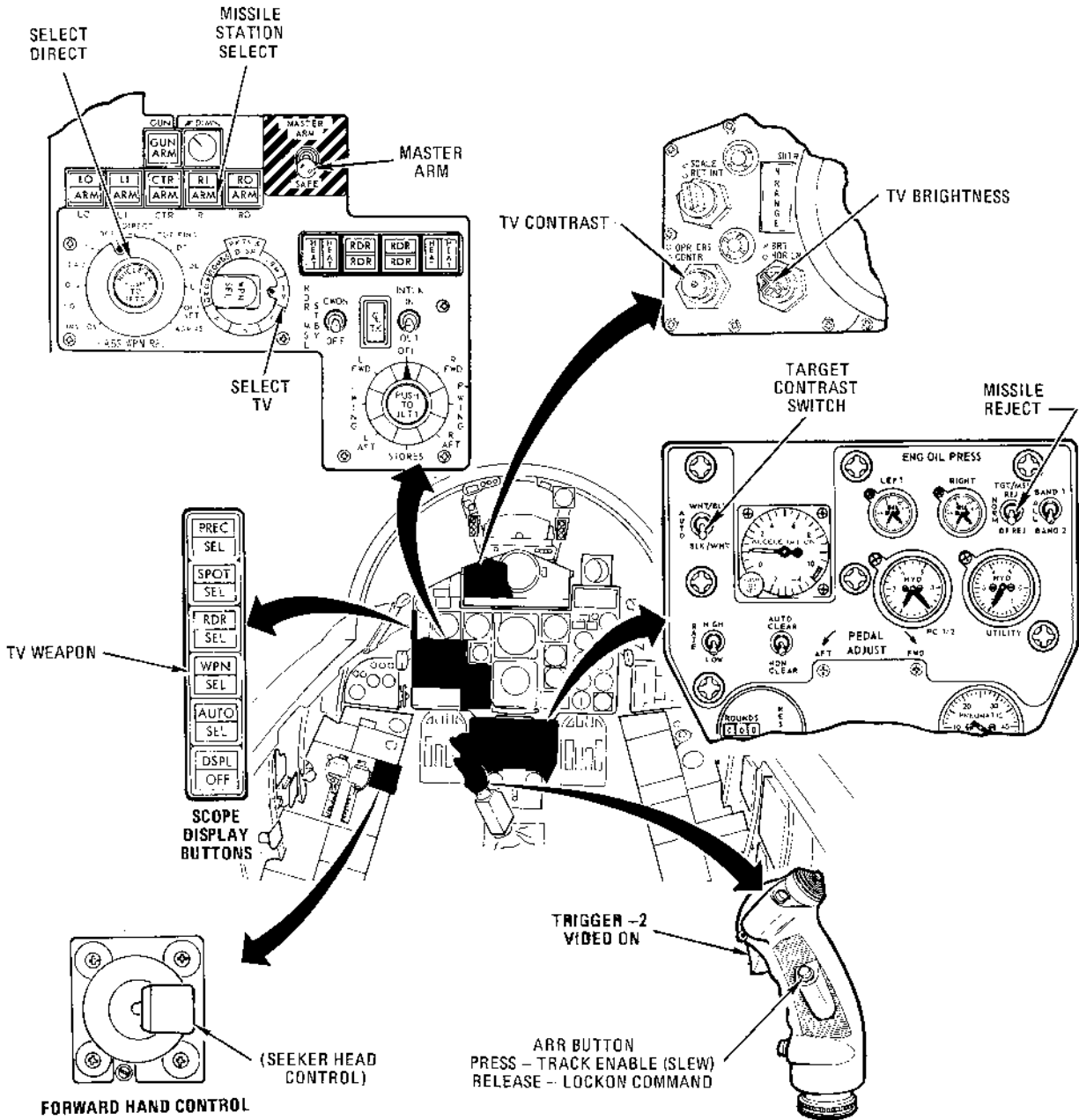
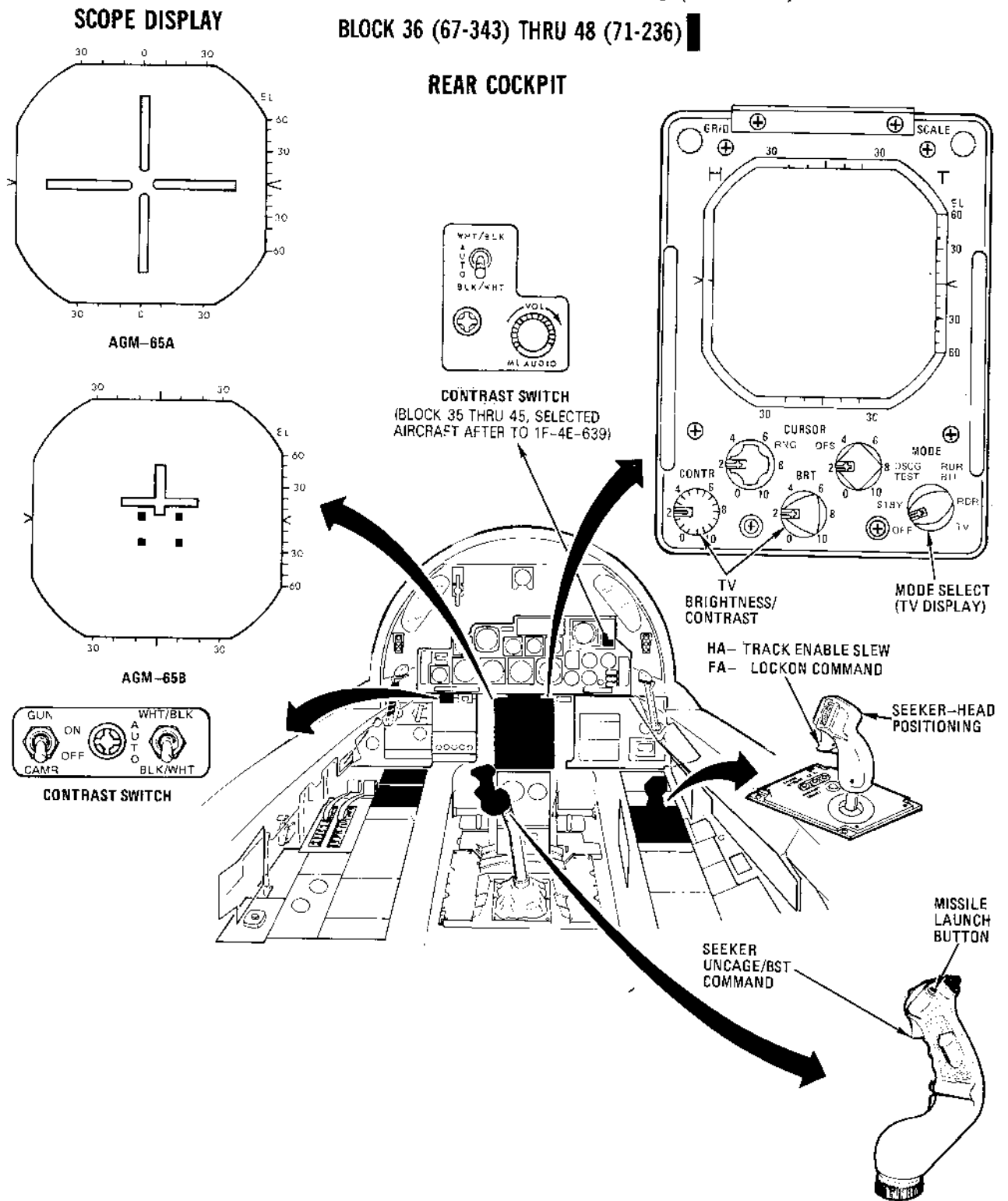


Figure 1-63 (Sheet 2 of 3)

AGM-65 MISSILE CONTROLS (Continued)

BLOCK 36 (67-343) THRU 48 (71-236)



4E-34-1-1-(54-3)E

Figure 1-63 (Sheet 3 of 3)

CAUTION

- Weapon seeker gyro damage can occur if the weapon selector TV position is selected during ground operation.
- Failure to allow 3 minutes for the seeker head gyro to spin up to operating speed (indicated by amber station ARM light) may result in severe damage to the guidance unit.
- Do not operate the TGM (65A), (65B) (training missile) in excess of 40 minutes in the TV mode (weapon select TV or ARM) or in excess of 30 minutes in the full power mode (video present). Do not operate the TGM in excess of 15 minutes during ground operation (weapon select in TV mode).

Station Select Buttons

The station select buttons (LI or RI) energize the station select relays for the missile station to be fired. The station green light illuminates immediately as the button is pressed. Squeezing either trigger will now provide weapon video. With DIRECT selected, the pilot may momentarily select master ARM and observe the station ARM light illumination indicating the 3-minute timer has completed. Even though the missile video may be energized through the trigger with master arm in SAFE, the ARM position should be selected momentarily to check the timer-complete indication of the station ARM light.

Trigger

Prior to squeezing the trigger, the seeker head is mechanically caged with a protective dome covering the seeker head. With the weapon and the station selected, squeezing the front or rear trigger removes (jettisons) the protective dome on the seeker head of the first missile in the release sequence, electrically aligns the seeker head to missile boresight (or in DMAS aircraft, aligns seeker to Pave Tack FLIR LOS if in slave mode) and energizes the vidicon. Subsequent activation of the trigger realigns the AGM-65A/B to boresight or changes the AGM-65D seeker FOV. The optical system of the AGM-65D missile possesses a dual field of view capability: wide and narrow. At activation, the AGM-65D seeker comes up in wide field of view. Subsequent activations of the trigger switch will switch the field of view alternately between wide and narrow. Pressing the trigger switch while in track mode will cause any AGM-65 missile to break lock and electrically align to boresight.

TV Display

CAUTION

To prevent damage to the radar set control panel, do not select TV on the DSCG mode knob and the radar mode knob at the same time. The TV position on the radar mode knob is not used. AIM-7 missiles detune and cannot be tuned when the radar mode knob is in TV.

In block 36 (67-343) thru 48 (71-236), the TV display is energized by placing the scope display select switch (on the

pedestal panel) to TV (figure 1-63, sheet 1). In the rear cockpit, placing the DSCG mode select knob to TV energizes the TV display (figure 1-63, sheet 3).

In block 48 (71-237) and up, the pilot may energize the TV display by pressing the WPN SEL scope display button (figure 1-63, sheet 2). These buttons also provide the selection of TISEO (PREC and SPOT) video, the radar (RDR) display, or deenergizes the scope (DISPL OFF) completely. The AUTO button may be pressed to obtain weapon video provided the WSO has a TV display selected. However, pressing AUTO inhibits pilot control over seeker head (slew) positioning. In the rear cockpit the TV display is selected on the sensor select panel. Refer to TO 1F-4E-34-1-1-2.

AGM-65A and AGM-65B Display

The AGM-65A and AGM-65B are identical in appearance, flight characteristics, and in warhead capability. The essential differences are in the apparent image magnification displayed on the scope in the cockpits and in electronically generated reference symbology. The apparent image magnification of the AGM-65B is approximately twice that of the AGM-65A. The only reference symbols displayed on the scope by AGM-65A missiles are vertical and horizontal crosshairs, each a single white line running through the center of the display. A gap in the central portion of these lines delineates the vertical and horizontal boundaries of the tracking window. The tracking window is defined as that portion of the displayed video that the missile video tracker will attempt to lock on and track when given the appropriate command. With AGM-65B missiles, the tracking window is delineated by four small white squares called background gates (figure 1-63, sheet 3). With both AGM-65A and AGM-65B missiles, the tracking window will accommodate itself to the apparent size of the target as range decreases. The AGM-65B displays two additional scope symbols: a large white square (called the scene magnification identifier) in the upper left hand corner; and a white cross (called the gimbal angle indicator, or pointing cross) which indicates the relative bearing between the boresight line of the missile and the line of sight of the missile optics. Due to rounding of the corners of the missile field-of-view by the edge of the scope, the scene magnification identifier may not be displayed in its entirety.

AGM-65D Infrared Display

The AGM-65D seeker creates a black and white image of the thermal scene viewed by the missile optics. An object that is warmer than its surroundings will appear white against a dark background. AGM-65D video symbology consists of vertical and horizontal crosshairs, a pointing cross, narrow field of view (NFOV) markers (four), and seeker depression markers (three). The function and action of the crosshairs of the AGM-65D display are identical to the crosshairs of the AGM-65A display. The function and action of the pointing cross are identical to the pointing cross of the AGM-65B display. The NFOV markers are four L shaped brackets that indicate the portion of the wide field of view (WFOV) that will be expanded to fill the display when NFOV is selected. The seeker depression markers are short horizontal bars intersecting the lower limbs of the vertical crosshair. They provide a means of estimating the angle of depression of the line of sight of

the missile optics. This line of sight is indicated by the position of the pointing cross above or below the center of display. The spacing of the bars represents 5 degree increments in elevation. The AGM-65D symbology may be displayed in either white (target contrast switch in WHT/BLK position) or black (target contrast switch in BLK/WHT position).

ARR Button/Action Switch

Pressing and holding the ARR button permits the pilot to position the seeker head in the missile using the seeker head control. Releasing the ARR button causes the seeker head to lockon and track the target, and enables missile launch. The WSO has the same capability by using the action switch half-action position and using the hand control to position the target image. Lockon is accomplished by momentarily selecting full action, or by releasing the half-action position. The ARR button in the front cockpit takes precedence over the action switch if the two are activated at the same time.

CAUTION

- Pointing the guidance unit toward the sun while operating in the track mode will result in burned vidicon damage to the guidance unit.

AGM-65D missile seekers are capable of being boresighted to the line of sight of an independent acquisition aid. This may be the gunsight piper or another electro-optical system. In aircraft that do

not have a dedicated boresight switch, the ARR button is used in a sequential operation with the AUTO position of the target contrast switch to accomplish boresighting. This procedure is described under target contrast switch operation.

Missile Reject Switch

The reject switch on the pedestal panel is a three position switch spring loaded to the center (NORM) position. This is actually a manual sequencing switch used to deselect the present missile while automatically selecting the next missile in the release sequence on that station. To select the next missile in sequence, the switch is momentarily positioned to the TGT/MSL REJ position. (The DF REJ position has no function.) A missile rejected in this manner may be reselected by momentarily interrupting station select voltage.

Target Contrast Switch (AGM-65A and AGM-65B)

The target contrast switch effects the target tracking characteristics of the missile, but has no effect on the scope video. The WHT/BLK position causes the missile to track a light target against a dark background. The BLK/WHT causes the missile to track a dark target against a light background. The AUTO (OFF) position of the switch selects an automatic tracking mode. If the aircrew positions the contrast switch incorrectly (opposite to the actual contrast conditions), the missile may lockon the target shadow, or may not lockon at all. The aircrew member who is positioning the tracking gate has control of the contrast switch, regardless of the contrast switch position in the other cockpit.

Target Contrast Switch (AGM-65D)

The BLK/WHT position of the target contrast switch enables the AGM-65D seeker to track a cold target seen against a warm background. The WHT/BLK position enables the AGM-65D seeker to track a hot target on a cold background. With AGM-65D missiles, the AUTO position has no effect on target contrast selection. This position is used to initiate the boresight memory function which is performed as follows: The missile is activated and commanded to track an infrared radiating target that can be identified visually in the combining glass. When lockon is confirmed, the aircraft is flown to superimpose the gun-sight piper. The target contrast switch is then placed in AUTO position and the ARR button pressed and released. After the above operation has been performed, any subsequent electrical align command to that missile will drive the seeker of the missile to the line of sight of the chosen acquisition aid. The LAU-88A/A launcher possesses a boresight memory function that is independent of and has priority over the AGM-65D missile boresight memory. An LAU-88A/A launcher with at least one AGM-65D aboard is capable of providing boresight memory for all Maverick missiles on that launcher, provided the AGM-65D is the activated missile. The boresight memory correction to the align position of the seeker will remain available to the remaining missiles on that launcher after the priority AGM-65D is launched until the station is deselected.

Optical Sight Controls

With the TV weapon selected, the DIRECT delivery mode selected, and A/G selected on the sight mode knob, the sight reticle is manually depressed from the fuselage reference line using the reticle depression knob. The proper reticle depression for this system is initially 45 mils.

Bomb Release Button

With the release controls set and the missile locked on, the bomb release button in either cockpit is pressed to launch the missile. The bomb button is pressed and held until after missile launch (video blank). Launch occurs in approximately 1 second. After launch, the next missile in release sequence is selected; the pilot may eject the dome cover and obtain video by squeezing the trigger.

AGM-45 DELIVERY

A single AGM-45 missile may be carried on each wing station. The air-to-ground passive missile is designed to home on and destroy radiating radar transmitters. The missile is suspended and launched from the LAU-34/A launcher.

The mission begins when the pilot energizes the radio receiving functions of the missile. When the missile rf receiver detects a radar source, an audible tone signal is heard over the intercom system. The ADI horizontal and vertical pointers indicate target azimuth and elevation position with respect to missile boresight (missile look angle). By centering the vertical pointer, the pilot flies the aircraft directly toward the target, continually removing any azimuth error. Then by centering the horizontal pointer, the pilot homes on the target in elevation. The pilot should attempt to steer out all azimuth errors while maintaining a safe altitude and determining the proper firing envelope by use of an elevation boresight (dip check)

or some other preplanned means. Then the intended delivery maneuver is initiated and the missile is fired. After rocket motor boost, an unmodified missile coasts to a point above the target where the missile guidance section is energized. During this terminal phase, the guidance section sends commands to the control section to steer out launch errors and home on the target. Dive modified or bypassed missiles, initiate active control and guidance 3.0 sec after firing.

NOTE

For additional information regarding the AGM-45 missile and launch parameters, refer to TO 1F-4C-34-1-2-1.

AGM-45 DELIVERY MODES

The available AGM-45 delivery modes are selected on the delivery mode knob. The LOFT mode selects the ARBCS for missile firing. The DIRECT mode provides immediate firing in situations where the pilot must dive and fire directly at the target. The AGM-45 position selects the WRCS method, which is considered here as the primary (high altitude) delivery method. The pilot first selects the AGM-45 missile and then presses the appropriate station select button. These controls must be energized to activate the missile receiver and detect targets, regardless of the delivery mode selected. The master arm switch may remain SAFE until the pilot is ready to fire.

AGM-45 WRCS MODE

The primary purpose of the analog WRCS system is to generate a launch signal so that the missile arrives within sufficient distance from the aim point to enable the successful completion of the terminal guidance phase. The system:

- a. Determines when the aircraft is within missile range.
- b. Computes and displays ground range to target. A numerical range read-out is supplied on the BDHI and HSI indicators.
- c. Determines and displays the type of vertical maneuver the pilot must fly (as a function of range to target) in order to get the automatic fire signal.
- d. Provides a fire-ready, prelaunch signal to the missile.
- e. Provides the launch (fire) signal.

The system computer contains stored missile range information, or an in-range envelope peculiar to AGM-45 ballistics. Thus, the WRCS continually computes range-to-target and when the computed range is within the stored envelope, one of three command lights illuminate to indicate the maneuver which the aircrew must fly to fire the missile. These are the pullup, level and dive lights (angle of attack indexer lights, figure 1-64). For example, if the pullup indexer illuminates, the aircraft is at a range from target where a pullup maneuver is required for the missile to launch and subsequently reach the aim point. If the dive indexer illuminates, the computer is indicating that the target is too close to the target for a pullup or level launch and the pilot must dive the aircraft to get a computer solution and release signal. Each of the maneuvers will be discussed in later

paragraphs.

System Inputs

When the pilot selects AGM-45 on the delivery mode knob, the computer is ready to accept the following inputs.

From the inertial navigation set:

- a. Aircraft pitch angle.
- b. Aircraft climb or dive angle.
- c. Aircraft altitude above sea level.
- d. Aircraft total velocity.
- e. Aircraft ground speed.

From the computer control panel (hand-set by the WSO):

- a. Target altitude above sea level.
- b. Release advance time if more than one missile is to be launched.

The computer receives an input of elevation look angle, either from the missile DF seeker or from the inertial navigation gyro platform. Inputs from the missile DF seeker are grossly in error. Therefore, the DF REJ mode should be used.

With the reject switch in DF REJ, the inertial navigation set supplies the look angle input. The pilot dives the aircraft at the target and centers the needles on the ADI. When the nose is lowered, the horizontal range to the target is continuously read out on the DME window of the HSI and BDHI provided the INS position is selected.

When the indexer lights come ON, the pilot may press the pickle button and insert the dive angle into the system. This dive angle and the altitude AGL are used to compute the horizontal range to the target. This maneuver may be performed with no missile on the aircraft by diving the aircraft and placing the pipper (with 35 mils selected) on a point. By pressing and holding the pickle button, the distance to the point may be read on the DME.

Using the above inputs, the computer continually solves the following:

- a. Instantaneous ground range to target.
- b. Missile ground range to guidance activation altitude based on stored data describing missile range capability.
- c. The required maneuver command based on range to target, ground speed, lead range bias (aim point distance) and the release advance time. As mentioned previously, the commands are presented, one at a time, on the appropriate indexer light.

A ground based radar can operate in one of two modes: either a surveillance mode or a tracking (lockon) mode. Further, the lockon range of a specific radar is considerably less than its maximum detection range. In a surveillance (search) situation, the radar source sweeps the area so the aircraft is intermittently exposed to rf energy. The net result is the ADI horizontal and vertical pointers momentarily deflect and the tone sound pulses each time the radar energy sweeps through the missile receiver. In a lockon situation where the aircraft is

continually *spot lighted* by the rf source, the ADI pointers deflect steadily and the missile seeker tone is continuous. In either situation, the flying involved for the AGM-45 delivery is the same in a DF REJ mode. The surveillance situation requires more time, however, since it is more difficult to center the ADI pointers.

The Commands

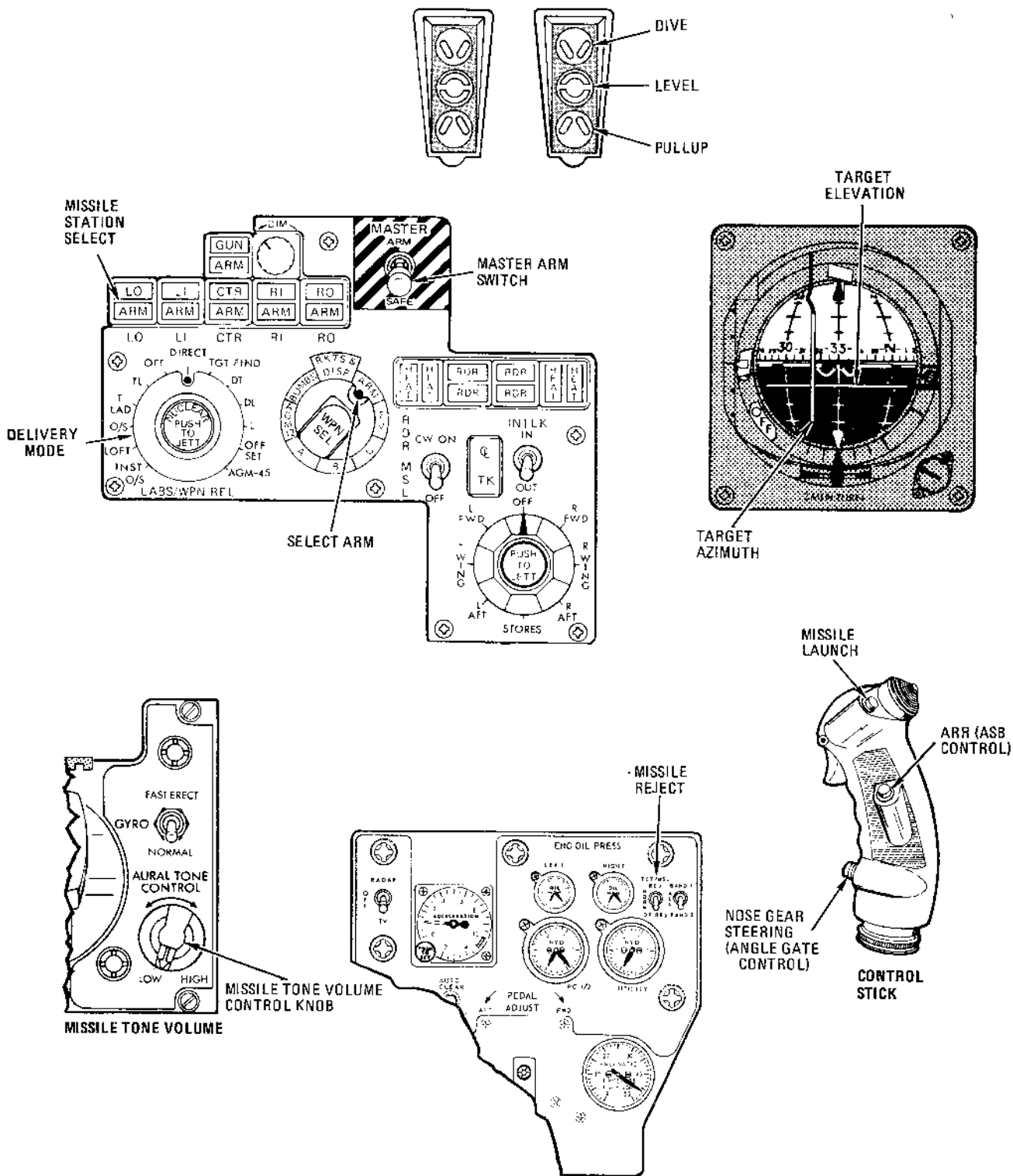
To develop an accurate firing solution through the WRCS computer, both ADI pointers must be centered at the instant the pickle signal is delivered. First, remove azimuth error by steering the aircraft until the vertical pointer no longer deflects. Now dive the aircraft to null the horizontal pointer, finding an attitude where the pointer no longer deflects. Using the variables listed previously including elevation angle from the INS platform, the computer solves for target range. The pilot holds the pointers centered until the computer can deliver an in-range indication by illuminating one of the indexer lights. (The indexer light that illuminates is a function of target range.) When the light illuminates, the pilot pickles to store the computed range into the computer. Range computations after pickle are based on stored range at the instant of pickle minus the distance flown since pickle. Therefore, the pilot is free to rotate (wings level) into a deliver maneuver.

The pullup command light indicates that the aircraft is at some range where the pullup maneuver must be flown to get a release signal. After pickle and with the indexer light indicating pullup, the pilot may begin a steady rotation into the pullup maneuver until the missile fires. The pilot may stop rotation at the level attitude (or approximate level attitude) and wait for the subsequent level fire signal. The level command light is actually a 5.0-second launch warning light. In a level flight attitude, the level command light indicates that about 5.0 seconds remain (at a constant ground speed) before the computer reaches the point where it would normally deliver the fire signal. During a pullup or steady climb maneuver (with the pullup command light ON), the level light illuminates during the maneuver indicating that the fire signal is imminent. The time-to-fire, however, may be something other than 5.0 seconds since ground speed is not constant during these maneuvers. In either a pullup or level environment, the level signal is simply an in-range indication denoting that the system is near a launch point.

The dive command has little application in a DF REJ mode. If the aircraft is located at ranges that require the pullup or level launch, the launch signal will occur well before the dive light illuminates. The dive command would occur only if the initial run begins in close (horizontally) to the target.

To illustrate the DF REJ mode further, suppose the pilot begins a dive to center the horizontal pointer. Based on the present dive angle, the computer can now solve a range solution and illuminate the maneuver light - even though the pilot has not yet centered the horizontal pointer. The pilot must not pickle, however, until the pointer is centered. Otherwise, the range information stored into the computer by the pickle signal will be in error and the launch solution will be in error. If the rf energy source passes through the aircraft intermittently, it could take several seconds to center the pointer and get an accurate

AGM-45 CONTROLS



46-34-1-1-155(C)

Figure 1-64

range solution. The pilot must, to a certain extent, "feel" for the attitude where the pointer no longer deflects. Again, it must be emphasized that *both* ADI pointers must be centered in order to expect optimum computer system accuracy. The vertical needle on the ADI must be kept centered throughout the maneuver to keep the missile pointing in the direction of the emitter. The vertical pointer will deflect in a direction opposite the target position when the wings are banked. While steering out azimuth error, the pilot may have to roll level periodically and check the vertical needle.

LOFT MODE

In the LOFT mode, the missile fire signal is provided by the ARBCS gyro as the aircraft passes through an angle preset by the pilot. The location of the radar sight must be known and the release point is situated so that the missile lofts to the aim point. An IP is selected and the time from IP to pullup is placed on the run-in timer. On the pedestal panel, the pilot selects either the NORM or the DF REJ position on the reject switch. In the DF REJ mode, both ADI pointers function in the normal manner by visually programming the LABS flight path in yaw-roll and acceleration. In the NORM mode, the horizontal pointer indicates the LABS acceleration program but the vertical pointer indicates left-right missile look angle. The NORM selection is the feasible one if the target can be detected. The vertical pointer comes into view when the pilot selects the AGM-45 position on the pedestal. The pilot presses the bomb button over (or adjacent to) the IP to begin the run-in countdown. The horizontal pointer comes into view to display acceleration error and the pullup light comes ON. At the end of the run-in interval, the pullup light and sight reticle go OFF. The timer runout signal also deenergizes the missile tone signal, which is available prior to pullup. The pullup maneuver is flown holding the horizontal G pointer and the vertical (missile look angle) pointer centered. The missile fires as the aircraft rotates to the preset angle. With the fire signal, the pullup and reticle lights illuminate and the tone ceases. As the pilot releases the bomb button, the horizontal pointer deflects from view and the pullup light goes OFF.

NOTE

The WRCS/LABS capability may be used in an AGM-45 LOFT delivery situation. The pullup warning tone, normally available in the WRCS/LABS modes, is not available with the AGM-45 missile selected.

DIRECT MODE

When the pilot selects DIRECT, the pickle signal fires the missile after a 1-second delay required for the batteries to come up to power. The delivery begins when the aircrew detects the audio from the target emitter. The aircraft is flown to center the needles on the ADI and the dive angle and altitude AGL are noted. Entering the dive delivery chart with dive angle and altitude AGL, the proper launch angle is determined. At least 10° of dive angle (with needles centered) is required to achieve a reasonable chance for a kill. The aircraft is smoothly pulled up to the proper launch angle and stopped at that point. The bomb button is pressed and held until the missile fires. This delivery may be used when the precise location is

unknown or when the WRCS solution cannot be obtained.

AGM-45 CONTROLS

As soon as the landing gear handle is placed in the up position, aircraft voltage is available for missile component heaters.

NOTE

When the AGM-45 system and the radar set is operated simultaneously, a distinct low frequency tone is heard and the ADI pointers move in a pattern corresponding to the antenna sweep pattern. Audible tone interference may be caused also by the tacan set in the T/R mode. When interference is encountered, place the radar set in STBY and the tacan set in REC until AGM-45 operations are complete.

Delivery Mode Knob

The missile delivery modes are DIRECT, LOFT and AGM-45 (WRCS).

Weapon Selector Knob

The AGM-45 missile is selected through the ARM (anti-radiation missiles) position of the WPN SEL control.

When the pilot selects the ARM position, the missile guidance system for all missiles aboard is activated. Power is available for the station select circuits and the audio tone circuits are placed under AGM-45 missile control instead of heat missile control. An aural tone control knob on the left console adjusts tone volume. The ARM position disables the trigger switch.

Station Select Switches

The station select buttons must be energized to fire the missile. With one or more buttons pressed, the audio tone and ADI pointer circuits are closed, and the fire-ready circuit in the pylon is closed. Now the system is ready to home on a radar target. At this point, only the green light is illuminated in the station select button; the amber light is not illuminated until the master arm switch is actuated to arm the bomb button circuit.

With four missiles aboard and with all stations selected, the firing order is from left to right, or

1. Left outboard
2. Left inboard
3. Right inboard
4. Right outboard

The audio tone and ADI steering functions are being received from the leftmost missile, even through the guidance circuits for the remaining missiles are energized. To get steering from the left INBD missile for example, the left outboard station select switch must be OFF. If the pilot intends to launch both left wing missiles in rapid order, the outboard missile must launch first before the inboard

missile will launch, etc., in the above order. To cite another example, both outboard missiles could be launched, but only if the two inboard stations remain deenergized. The time interval between each launch is about 0.5 to 1.0 second. Notice that if the first selected missile misfires, the corresponding station select button must be pressed OFF before the next missile can be launched.



The following condition can result in a hazardous situation and/or the loss of a missile. With AGM-45 selected on the delivery mode and weapon select knobs and the bomb button pressed, the illumination of the center indexer light means that a ready fire signal has been sent to the missile to activate the thermal batteries, even with the master arm switch in SAFE. The missile power supply will last a maximum of 3 minutes, after which the missile guidance and control units are inoperative. Aircrews must avoid the bomb button until an actual launch is intended.

Master Arm Switch

Selecting the ARM position on the master arm switch powers the bomb button and removes the final interlock in the missile firing circuit. The amber light(s) on the energized station select buttons come ON. If the delivery mode knob is on DIRECT, the missile fires approximately 1 second after the pilot presses and holds the bomb button. In a LOFT or AGM-45 mode, the release function is commanded by these respective systems. The following controls are positioned depending on the delivery mode selected.

NOTE

If WRCS/LOFT mode is to be used, the pullup warning tone, normally available in the tie-in modes, is not available with AGM-45 selected.

Reject Switch

In the AGM-45 mode, the reject switch controls the source of pitch input to the computer. As mentioned previously, the NORM position closes the elevation look angle/computer circuit; the DF REJ position opens this circuit and the elevation input must be supplied by the

INS as the pilot dives the aircraft. In the TGT REJ (momentary) position, the receiving functions of the missile is completely deenergized.

NOTE

Due to present missile DF inaccuracies, the pilot must continually operate with the reject switch in the DF REJ position (WRCS mode) so that the computer solution is based on INS attitude signals, rather than missile look angle.

With the LOFT mode selected, only the NORM and DF REJ positions have application. In the NORM position, missile azimuth look angle is supplied to the ADI vertical pointer; the horizontal pointer signals the LABS G program. In DF REJ, both pointers signal the LOFT flight path. If the aircrew elects to use the DIRECT mode, the reject switch has no function.

COMPUTER CONTROL PANEL

ALT Range

The pilot dials target altitude above sea level on the ALT RANGE counter in increments of 100 feet. The numeral 5, for example, represents an altitude of 500 feet MSL. With aircraft altitude MSL as an INS input, the computer can calculate instantaneous ground range as a function of actual height above target, aircraft pitch angle, and the ground range aim point bias.

Release Advance

The AGM-45 launch circuitry is arranged in such a manner that if more than one missile is aboard, all missiles will fire (salvo), provided the pilot has selected all of the loaded stations. The firing order is LO, LI, RI and RO with each missile firing within 0.5 to 1 second of the one previous. In order to compensate for this time lag, aircrews may wish to set about 250 milliseconds into the RELEASE ADVANCE counter when operating in the AGM-45 mode. Then the first missile would fire about 0.25 second early. Otherwise, there is no way to bracket the aim point other than to rely on normal dispersion that occurs in firing more than one missile.

NOTE

A description of the AGM-45 missile is provided in TO 1F-4C-34-1-2-1.

DELIVERY METHODS AIR-TO-AIR WEAPONS

AIR-TO-AIR GUNNERY

The following aircraft equipment comprise the air-to-air gunnery capability.

- a. M61A1 Nose Gun and/or SUU-16/A, SUU-23/A or GPU-5/A Gun Pod,
- b. AN/ASG-26 Lead Computing Optical Sight (LCOS) System.

The aircraft systems listed below supply information to the (LCOS).

- a. Inertial Navigation Set.
- b. Air Data Computer.
- c. Radar Set.

Definition Of Terms

- Gun Bore Line (GBL)** - a line extending through the gun's bore out to infinity.
- Gun Cross** - the imaginary point on the combining glass which represents the mil depression of the gun (35 mils in the F-4E). It is the gun aiming reference.
- Sight Line** - an imaginary line from the pilot's eye through the gun cross extending out to infinity. Ignoring parallax, the sight line represents the bullet line of departure under static conditions.
- Lead Prediction Angle** - the angle between the gun cross and the piper.
- Gravity Drop** - The vertical drop of the bullet over its time of flight due to the acceleration of earth's gravity.
- Plane of Motion (POM)** - the plane passing through the aircraft centerline pointed in the direction of aircraft movement.
- Plane of Symmetry (POS)** - the plane passing through the aircraft centerline perpendicular to the wings. The POS divides the combining glass down the middle and contains the gun cross.
- Parallax** - an error of displacement due to the M61A1 gun being mounted 64.4 inches below the sight line. To compensate, the gun is canted up slightly causing the bullet stream to intersect the sight line at 2250 feet (the gun harmonization range). At normal firing ranges the error between the sight line and the bullet stream is less than 3 feet. In comparison of other sight inputs, the magnitude of parallax error is small and is ignored in the F-4E.

In the lead computing mode, the optical sight provides a reference point for bullet impact in air-to-air gunnery. The final sight solution accomplishes this after accounting for the effects of velocity lead, acceleration lead and drag shift. These three inputs are discussed below.

VELOCITY LEAD

Velocity lead compensates for target motion (velocity) seen by the shooter at the instant the bullets are fired. The magnitude of velocity lead is target line of sight rate times the bullet time of flight. Velocity lead is greatest at longer ranges and at higher target airspeeds and aspect angles. The velocity lead component lies in the target's POM and accounts for approximately 85-90 percent of the total lead prediction angle.

ACCELERATION LEAD

Acceleration lead compensates for the target lift away from a ballistic flight path over the bullet time of flight. As the target pulls increased G greater than a zero G ballistic flight path, additional lead is required for bullet impact. In addition, acceleration lead also compensates for bullet gravity drop due to the earth's gravitational acceleration. The resultant summation of lead due to target acceleration and the earth's acceleration places acceleration lead in the target's plane of symmetry. Acceleration lead normally measures 5 to 6 mils per G per one second bullet time of flight.

DRAG SHIFT

Drag shift is caused by the bullet's deceleration due to air drag. The result is an apparent shift in the bullet's line of departure away from the gun cross (sight line) in a direction opposite the aircraft velocity vector. Drag shift is normally quite small and is often within the eight mil dispersion of the gun. Drag shift causes a reduction of the lead component in the plane of symmetry.

LEAD PREDICTION ANGLE

The total lead prediction angle is shown in figure 1-65. Starting at the gun cross, the velocity lead component is measured in the aircraft plane of motion. The acceleration lead component is then added in the plane of symmetry. Drag shift then reduces the total amount of lead necessary in the plane of symmetry. The result is the final piper location.

SIGHT MECHANIZATION

The principal component of the optical sight is a gyro mounted parallel to the gun bore line free to move in azimuth and elevation. As the shooter turns, the gyro attempts to maintain its inertial stabilization and thus displaces down in the plane of motion. A variable strength range magnet continually attempts to pull the gyro back toward the gun bore line during this turning. Using the predicted time of flight computed from target range, overtake, relative air density and true airspeed, the range magnet pulls the gyro to an equilibrium point corresponding to the required amount of velocity lead. A variable speed torque motor is installed on the gyro to input acceleration lead and drag shift. The torque motor is mounted in such a way as to displace the gyro in the plane of symmetry. This plane of symmetry depression is in addition to and independent of whatever gyro displacement has occurred due to turning (velocity lead). The magnitude of the torque motor displacement is a function of predicted time of flight, shooter G, angle of attack, true airspeed and relative air density. Azimuth and elevation pick-offs on the gyro, relay the final gyro position to the servoed mirror. The servoed mirror reflects the sight reticle onto the combining glass at the position called for by the gyro and corresponding to the correct lead prediction angle.

Sigma Factor and Settling Time

As stated previously, a gyro characteristic is to point to the same inertial reference point on the horizon even as the aircraft turns. Thus, if the pipper were tied directly to the gyro axis and the pilot made a stick input to bring the pipper to the target, he would find no instantaneous corresponding pipper movement. To provide the pilot some instantaneous feedback a sigma factor is introduced. The manner in which this is accomplished is analogous to a rubber band being connected between the gun cross and the gyro axis. At some distance along the rubber band the pipper is attached. Regardless of the length of the rubber band the pipper maintains its same relative proportional position along the rubber band. For example, if the pipper were located halfway along the rubber band and the gun cross (aircraft nose) is moved, only half of this movement is seen in pipper movement. The F-4E LCOS sigma factor is .25, meaning the pilot will see 25 percent of his stick input as corresponding pipper movement toward the target.

If a steady turn rate is maintained and gyro equilibrium has been established, the imaginary rubber band attaching the gun cross to the gyro axis will be at a constant stretch. The sight is then considered settled and provides an accurate aiming index. With sudden stick inputs, however, the gun cross moves causing an overstretch (or understretch) condition to occur in the "rubber band", resulting in an out of solution sight. Once the turn rate has been stabilized the rubber band will settle at its updated amount of stretch. Under typical firing conditions, sight setting occurs within 1 second or less. However, movement of the sight within the combining glass is not a measure of settling. The sight can be settled and still have some movement within the combining glass. This analysis requires a subjective judgment by the pilot.

Lcos Assumptions

The design of the optical sight assumes a low aspect situation with some overtake with the shooter reasonably matching the target line of sight rate with his own turn rate. Target and shooter airspeeds are assumed constant over the bullet time of flight. Also, target and shooter G are presumed nearly equal in magnitude and direction. The sight becomes less accurate as the actual parameters vary from the above assumptions. For example, the F-4E LCOS is typically accurate up to approximately 30 degrees of aspect angle, after which it underleads approximately 10 mils for each additional 10 degrees of aspect angle.

The following are the LCOS mechanization limits

- a. Slant range: 900-4000 feet
- b. Maximum overtake: 1000 feet per second (590 knots)
- c. Maximum altitude: 60,000 feet
- d. Maximum shooter velocity: 2.2 mach
- e. Elevation depression of the pipper: +35 to -209 mils from the gun cross
- f. Azimuth displacement of the pipper: ± 104 mils

Lcos Characteristics

In a typical lead pursuit firing pass, pipper position within the combining glass is unimportant until the aircraft nears firing range. The sensitivity of the pipper is greater at longer ranges given otherwise similar parameters. The sight provides lead for a target at 1000 feet when no radar lock-on exists or when a radar lock-on exists and the pilot holds the cage button depressed. Use of the cage button to fix the sight is discouraged. The pilot's attention is drawn away from the target at ranges where use of the pipper is not feasible. At these longer ranges, the pilot should concentrate on flying the proper pursuit course and temporarily ignore the pipper. Also, the pipper provides insufficient lead at a fixed 1000 foot slant range for most gun shots. Referencing a 1000 foot sight can result in an inaccurate gun pass with the bullets passing behind the target.

The sight displays range data from 900 to 6700 feet with a radar lock-on. However, the sight only computes lead up to a maximum range of 4000 feet. The INS gyro platform provides signals for the sight roll tabs. The pipper is always located on the uphill side of the combining glass. As aircraft G increases or bank angle decreases, the pipper aligns more closely with the plane of symmetry.

The most important factor to insuring a stable pipper position is smooth onset of G up to the necessary G required for tracking the target. As the pilot tracks and pulls the pipper from a point aft of the target up to the target, G build-up rate should be constant. A stabilized or nearly stabilized pipper indicates the point where the bullet stream would hit if fired one time of flight previously. Thus it is important to anticipate when the pipper will be on the target and initiate firing approximately one time of flight before the pipper reaches the target. The F-4E LCOS assumes relatively stable, low aspect situations. As aspect angle and G onset rates increase, the LCOS tends to underlead. This underlead must be taken into account in the more dynamic gunshot opportunities.

WINGSPAN VS. TARGET RANGE

Another device for quickly estimating target range involves the 25 and 50 mil reticle circles and the known wingspan of the target. The pilot may find this method useful when no radar lockon exists.

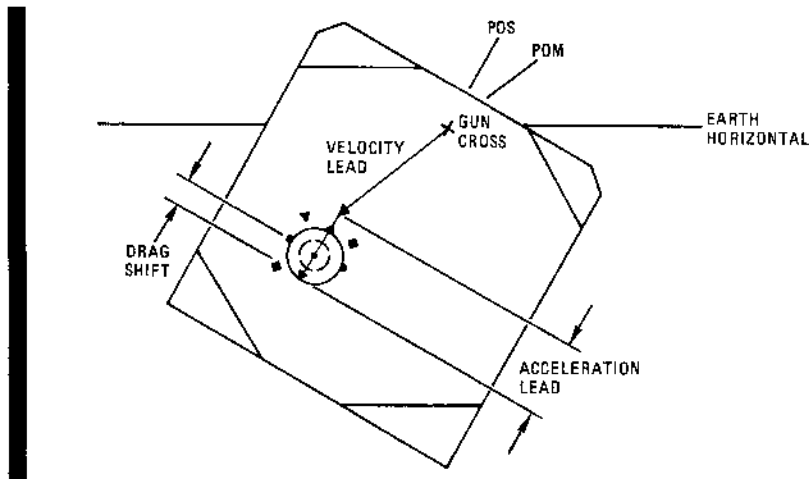
$$1000 \times \frac{\text{Wingspan (feet)}}{\text{Range (feet)}} = \text{mils in diameter (approximately)}$$

For example, an F-4 with a 38 foot wingspan at 1500 feet would fill the 25 mil reticle. The chart in figure 1-66 provides values of mil diameter as a function of wingspan and target range.

$$(1000) \frac{38 \text{ ft. WS}}{1500 \text{ ft. Rng.}} = 25 \text{ Mils Dia. (Approx)}$$

OPTICAL SIGHT SIGNAL FLOW

AIR-TO-AIR GUNNERY

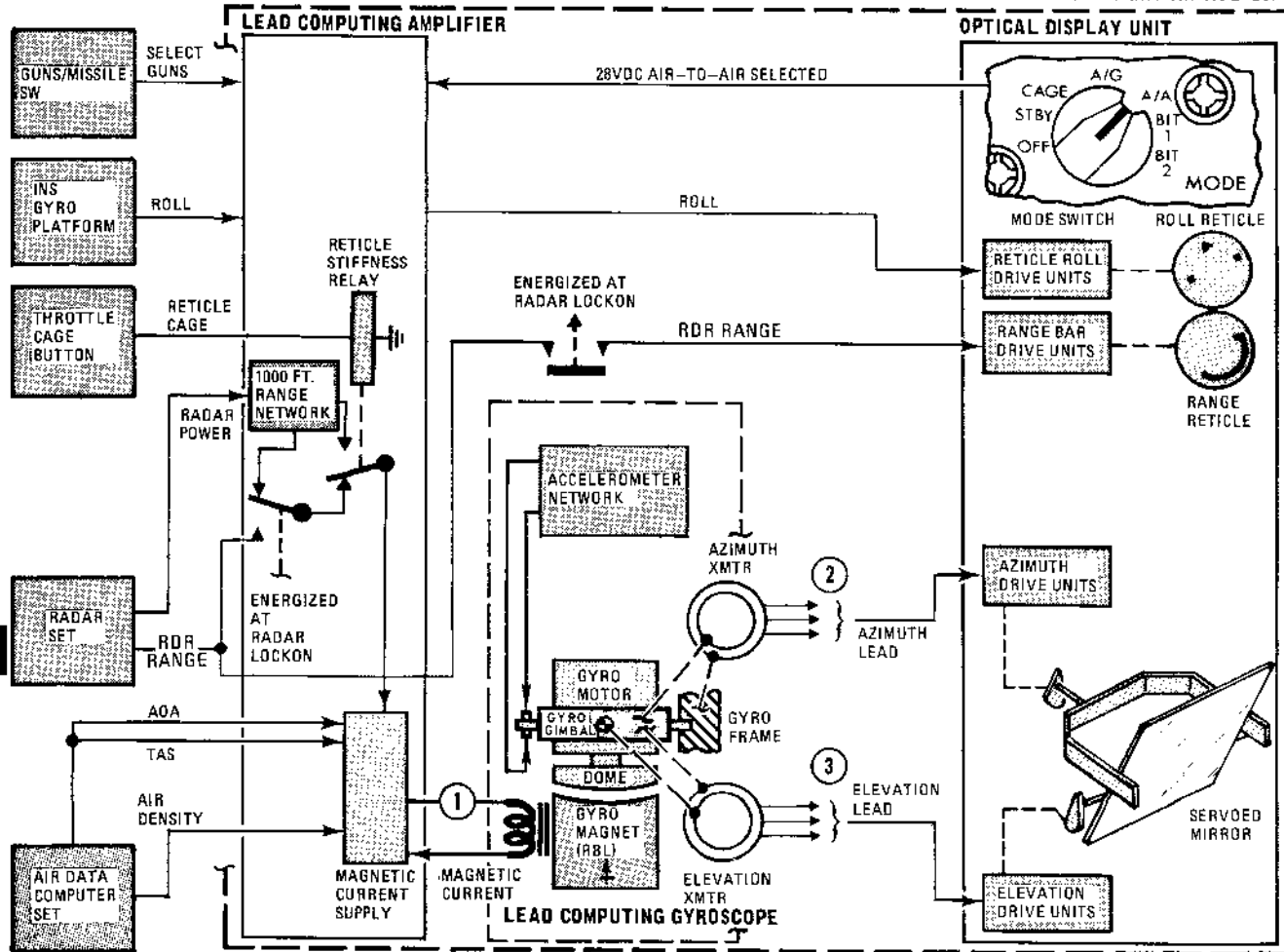


NOTES

- ① GYRO MAGNET CURRENT STRENGTH IS A FUNCTION OF SUMMED RADAR RANGE, AIR DENSITY, AOA & TAS SIGNAL INPUTS.
- ② AZIMUTH LEAD OUTPUT IS A FUNCTION OF AIRCRAFT YAW RATE. THE MAGNITUDE OF AZIMUTH OUTPUT IS CONTROLLED BY MAGNET CURRENT STRENGTH.
- ③ ELEVATION LEAD OUTPUT IS A FUNCTION OF AIRCRAFT PITCH RATE. THE MAGNITUDE OF ELEVATION OUTPUT IS CONTROLLED BY ACCELEROMETER OUTPUT & MAGNET CURRENT STRENGTH.

--- MECHANICAL CONNECTION
 —> ELECTRICAL CONNECTION

LEAD COMPUTING OPTICAL SIGHT AN/ASG-26A



4E-34-1-1-(56)B

Figure 1-65

AIR-TO-AIR MISSILES

AIM-7 missile preparation and launch requirements are stated in previous pages. Refer to Fire Control System, this section. With the AIM-9 missiles aboard, the use of the radar set is optional. The aircrew may use the radar as an aid in steering to an optimum firing point, or the radar may be OFF for an optical firing. Refer to TO 1F-4C-34-1-2-1 for a description of the AIM-7 and AIM-9 missiles.

AIM-7 MISSILE LAUNCH SEQUENCE

The pilot does not have control of the AIM-7 missile launch sequence. The sequence is programmed to automatically start with the first loaded station in the sequence.

Launch Sequence	Station
1	Left Forward
2	Right Forward
3	Left Rear
4	Right Rear

When a malfunctioning missile or an empty station is encountered in the sequence (no RDR light), that station is automatically stepped over; the next missile in the sequence is committed.

AIM-9 MISSILE LAUNCH SEQUENCE

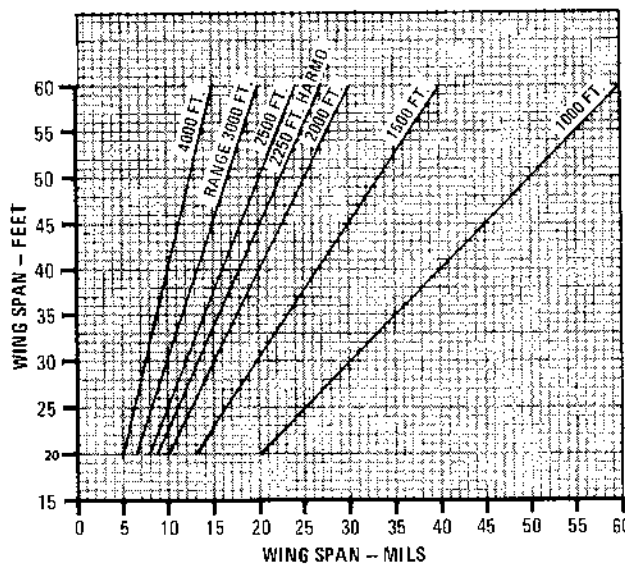
The automatic stepping sequence when launching missiles is:

Sequence	Station
1	Left outboard
2	Right outboard
3	Left inboard
4	Right inboard

The sequence can be started with any missile by actuating the guns/missile switch to the REJECT position. The stepping sequence can be monitored by the missile HEAT select light. Only one of the four missile HEAT select lights is ON to indicate which missile is selected. The applicable HEAT light will not illuminate when the step switch is on an empty station, nor will the firing pulse be automatically directed to the next station; the REJECT

position must be momentarily selected to obtain the HEAT light indication before attempting to launch a missile. If a missile malfunction occurs (no missile HEAT select light or heads up HEAT ready light), the missile must be manually stepped over by actuation to the REJECT position. If a missile hangfires, the HEAT select light will not extinguish until the next missile in sequence is selected. When the master arm switch is in ARM, the trigger also performs the stepping function when the trigger switch is released. The next station in sequence is automatically selected regardless of the status of the missile just committed or the load configuration of the next station. If a missile is not loaded aboard the next station in sequence, the loaded station must be manually selected by actuating the trigger switch or by actuating the guns/missile switch to the REJECT position. The HEAT select light illuminates regardless of the wing flaps position. The armament safety override must be IN, or emergency landing gear handle in NORM and landing gear handle UP or weight off the main gear for station step (see figure 1-67).

OPTICAL SIGHT VS WING SPAN



4E-34-1-1-(57)

Figure 1-66

)

)

)

.

.

)

)

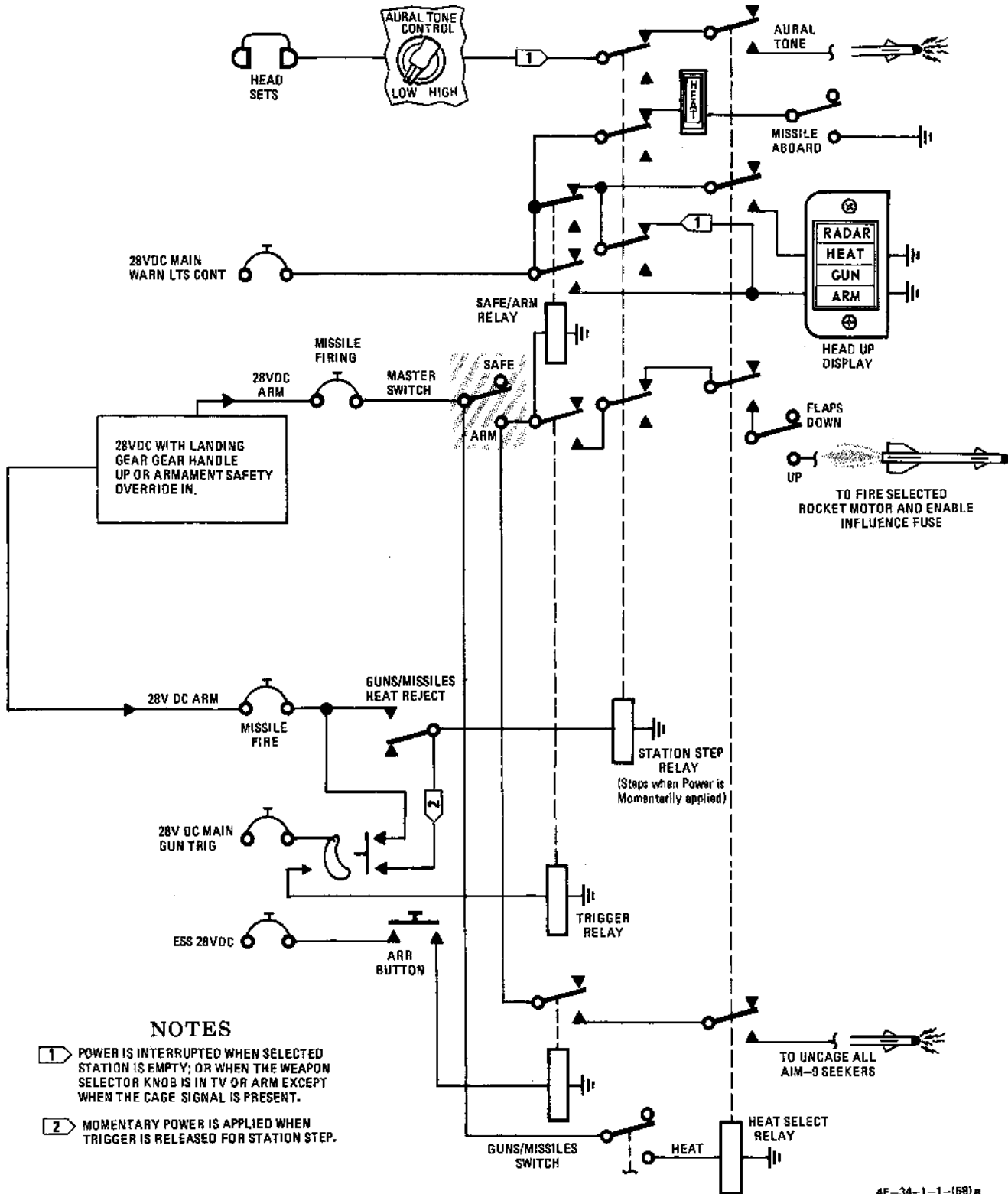
)

)

)

)

AIM-9 MISSILE LAUNCH DIAGRAM



NOTES

- 1 POWER IS INTERRUPTED WHEN SELECTED STATION IS EMPTY; OR WHEN THE WEAPON SELECTOR KNOB IS IN TV OR ARM EXCEPT WHEN THE CAGE SIGNAL IS PRESENT.
- 2 MOMENTARY POWER IS APPLIED WHEN TRIGGER IS RELEASED FOR STATION STEP.

Figure 1-67

4E-34-1-1-(58)B

WEAPON SUSPENSION EQUIPMENT

The suspension equipment used for carrying conventional weapons is shown in figure 1-69 sheets 1 thru 4. The aircraft weapons carriage capability may be summarized as follows:

- a. The centerline (CL) station AERO-27/A or BRU-5/A rack, which receives
 - (1) A single weapon; or
 - (2) A CL weapons adapter, which can receive either the gun pod or the MER (six station carrier) for multiple weapons carriage.
- b. The left and right inboard wing (LI, RI) armament pylons, which receive
 - (1) A single weapon; or
 - (2) The applicable launcher for AGM weapons; or
 - (3) The TER (three station carrier) for multiple weapons suspension.
- c. The left and right outboard wing (LO, RO) armament pylons, which receive
 - (1) A single weapon; or
 - (2) The applicable launcher for AGM weapons; or
 - (3) The MER (six station carrier) for multiple weapons suspension.

CENTERLINE STATION

AERO-27A RACK

The AERO-27A bomb rack (figure 1-69 sheet 3) is a self-contained ejector unit mounted within the aircraft at centerline station 5 (block 31 thru 40). The AERO-27/A rack has four suspension hooks; two 14 inches apart and two 30 inches apart. An ejector piston is located in the center of the rack. Operation of the rack hooks and the ejector piston is initiated through the jettison circuit or the DCU-94/A release circuit by igniting two ejector cartridges. Gases from the ejector cartridges cause the rack hooks to open and the ejector piston to push downward on the bomb or suspension equipment. With the bomb rack safety pin installed, an electrical safety switch is opened to prevent the cartridges

from firing; the pin is removed prior to flight. The MER cannot be suspended from the bomb rack without the centerline bomb rack adapter. The weight of the AERO-27/A bomb rack (51 pounds) is included in the basic weight of the aircraft.

The AERO-27/A can carry and release a single mounted GP bomb. Two arming solenoids are mounted on the aft bail retention assembly to the rear of the AERO-27/A (figure 1-69, sheet 3). The solenoids are powered through the nose/tail arm switch and master arm switch. The release system used for single carriage, however, is the DCU-94/A panel and associated controls. With MER carriage, the conventional weapons controls are used.

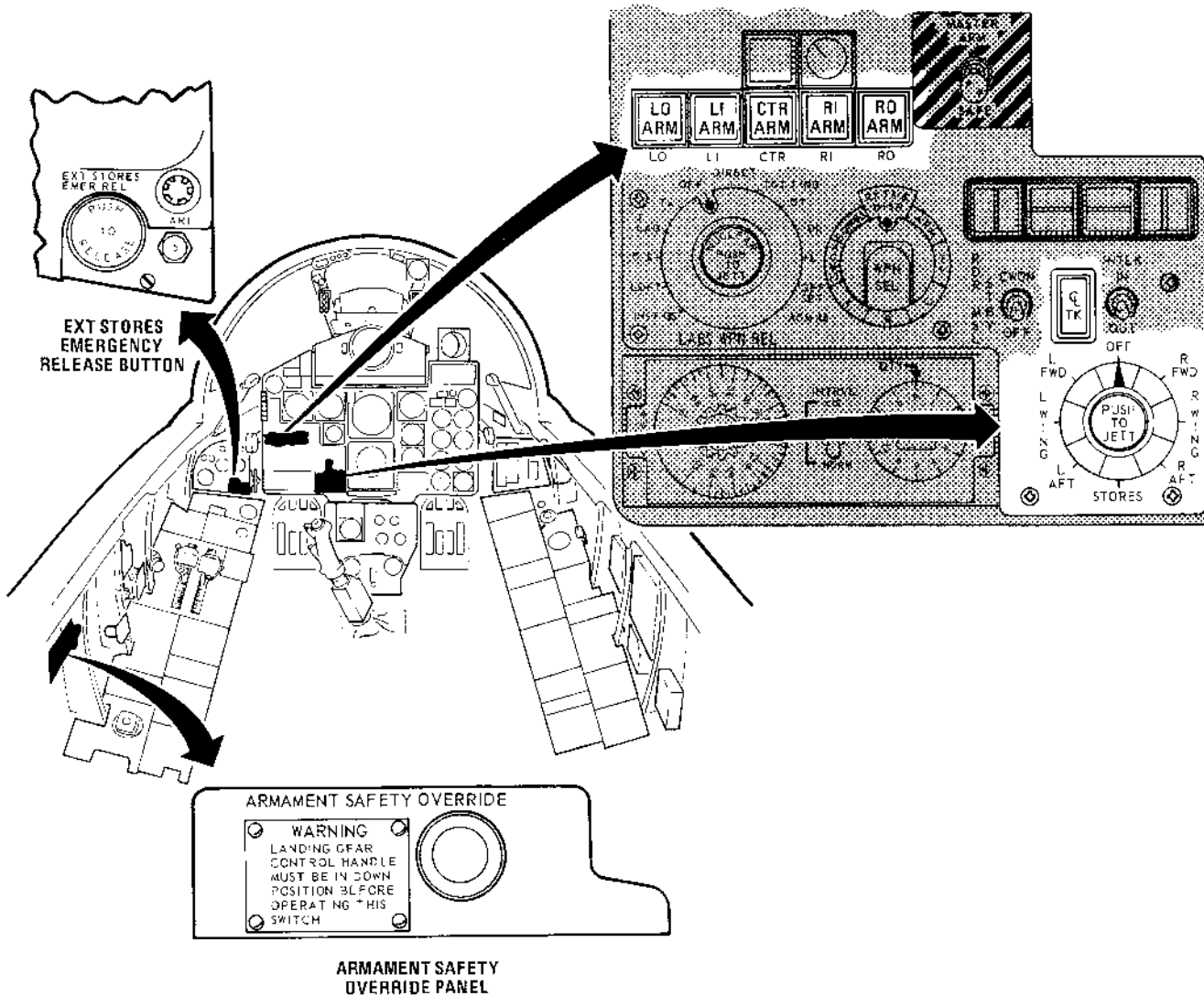
BRU-5/A BOMB RACK

The BRU-5/A is installed in aircraft block 41 and up. The rack is a modified AERO-27/A in which the two 14 inch suspension hooks are replaced by arming solenoids. Two solenoids are installed in the forward hook cavity and a single solenoid is installed in the rear hook cavity (figure 1-69, sheet 3). This rack, and the installation of a CL shorting plug, enables the release of both multiple or single suspended conventional weapons through the conventional weapons controls. With the shorting plug installed for single bomb carriage, the tank aboard (TK) light and station amber light illuminates continuously. In this case, the two forward fuselage missiles can be monitored, launched, and jettisoned. The BRU-5/A weighs 45 pounds.

CENTERLINE BOMB RACK ADAPTER

The centerline bomb rack adapter is attached to the centerline position to accept the MER assembly. The adapter is compatible only at the centerline, and attaches directly to the AERO-27/A or BRU-5/A bomb rack. The adapter weighs 55 pounds.

JETTISON CONTROLS



4E-34-1-1-160/A

Figure 1-68

ARMAMENT PYLONS

The inboard and outboard armament pylons (figure 1-69 sheets 1 and 2) are bolted to the wing at stations 1, 2, 8, and 9. Each armament pylon assembly includes the MAU-12B/A or C/A bomb rack, weapons relay panels, a power rectifier, and bomb release circuits. The bomb rack contains two cartridges breeches and ejector pistons, 14 and 30-inch suspension hooks, three arming wire solenoids, and a solenoid operated assembly that electrically locks (safeties) the cartridge fire circuit. When the cartridges detonate, gas pressure opens the rack hooks and forces the pistons downward, ejecting the bomb. The MAU-12 bomb racks are designed to carry and forcibly

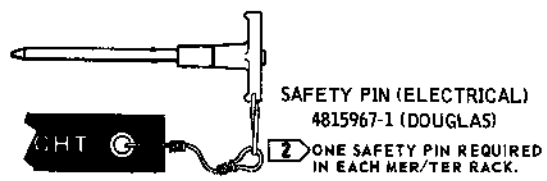
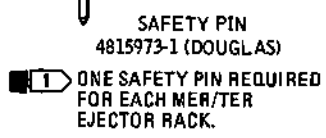
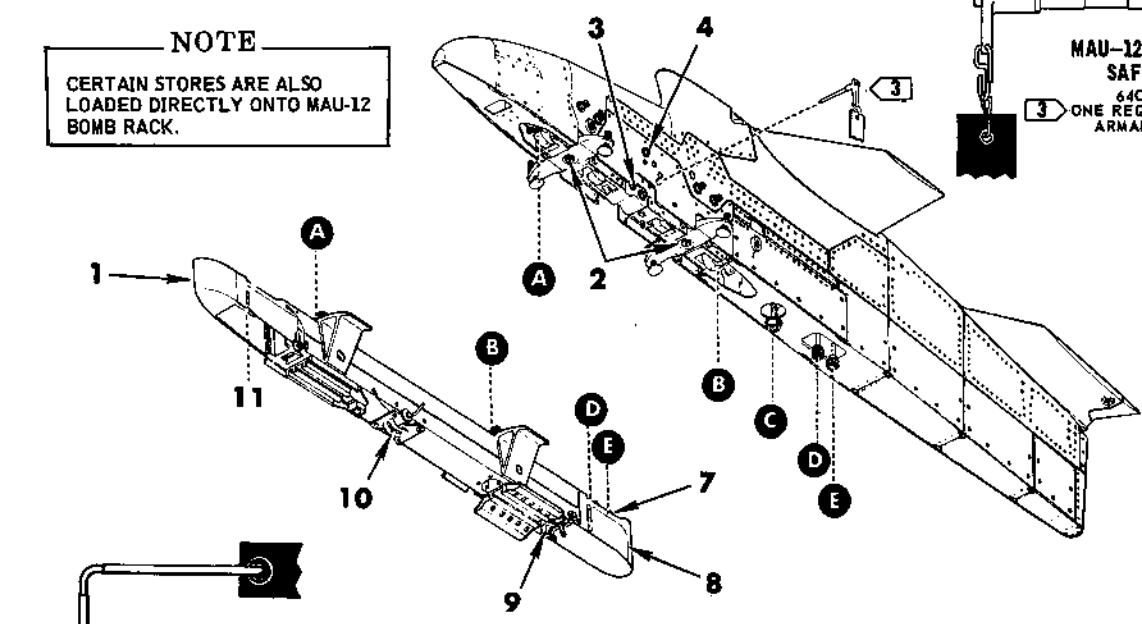
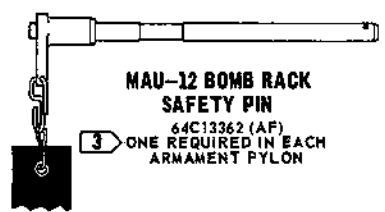
eject stores weighing up to 5000 pounds. To compensate for various bomb c.g. locations, orifices are installed into the rack to control bomb separation characteristics by varying the forces delivered to each piston. The ground safety pin provides only a mechanical lock in the hook linkage for ground safety purposes.

The inflight safety lockout solenoid electrically isolates the cartridges by mechanically controlling two switches that break the cartridge circuit. The lock must be removed with conventional weapons aboard by manually installing the inflight safety lockout pin (or bolt) in the pylon. The bolt is installed only for nonnuclear bomb carriage and must be removed for nuclear carriage. When the bolt is

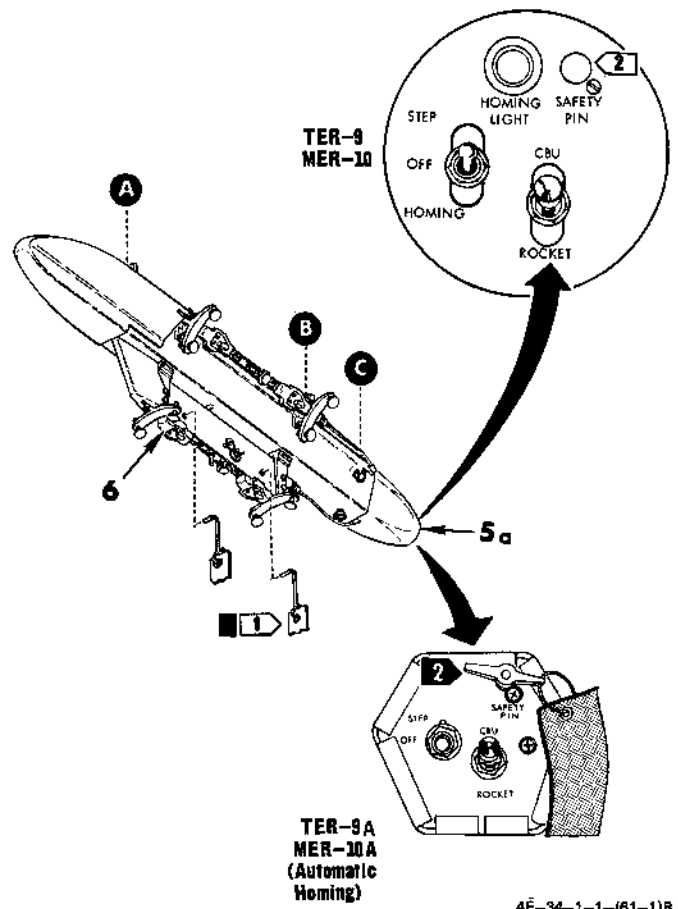
SUSPENSION EQUIPMENT

INBOARD ARMAMENT PYLON

NOTE
CERTAIN STORES ARE ALSO LOADED DIRECTLY ONTO MAU-12 BOMB RACK.



- 1. LAU-34/A MISSILE LAUNCHER (AGM-45 MISSILES)
- 2. EJECTOR RACK PISTON (2)
- 3. MAU-12 EJECTOR RACK
- 4. INFLIGHT SAFETY LOCKOUT PIN (BOLT)
- 5. (a) TRIPLE EJECTOR RACK ASSY (TER)
(b) MULTIPLE EJECTOR RACK ASSY (MER)
- 6. EJECTOR RACK, MER/TER
- 7. AGM-45 LAUNCHER BUNDLE (AFT)
- 8. JETTISON GUN ACCESS
- 9. AFT. MISSILE RETAINER
- 10. FWD MISSILE RETAINER
- 11. MISSILE/LAUNCHER CONNECTOR



4E-34-1-1-(61-1)B

Figure 1-69 (Sheet 1 of 5)

SUSPENSION EQUIPMENT (Continued)

OUTBOARD ARMAMENT PYLON

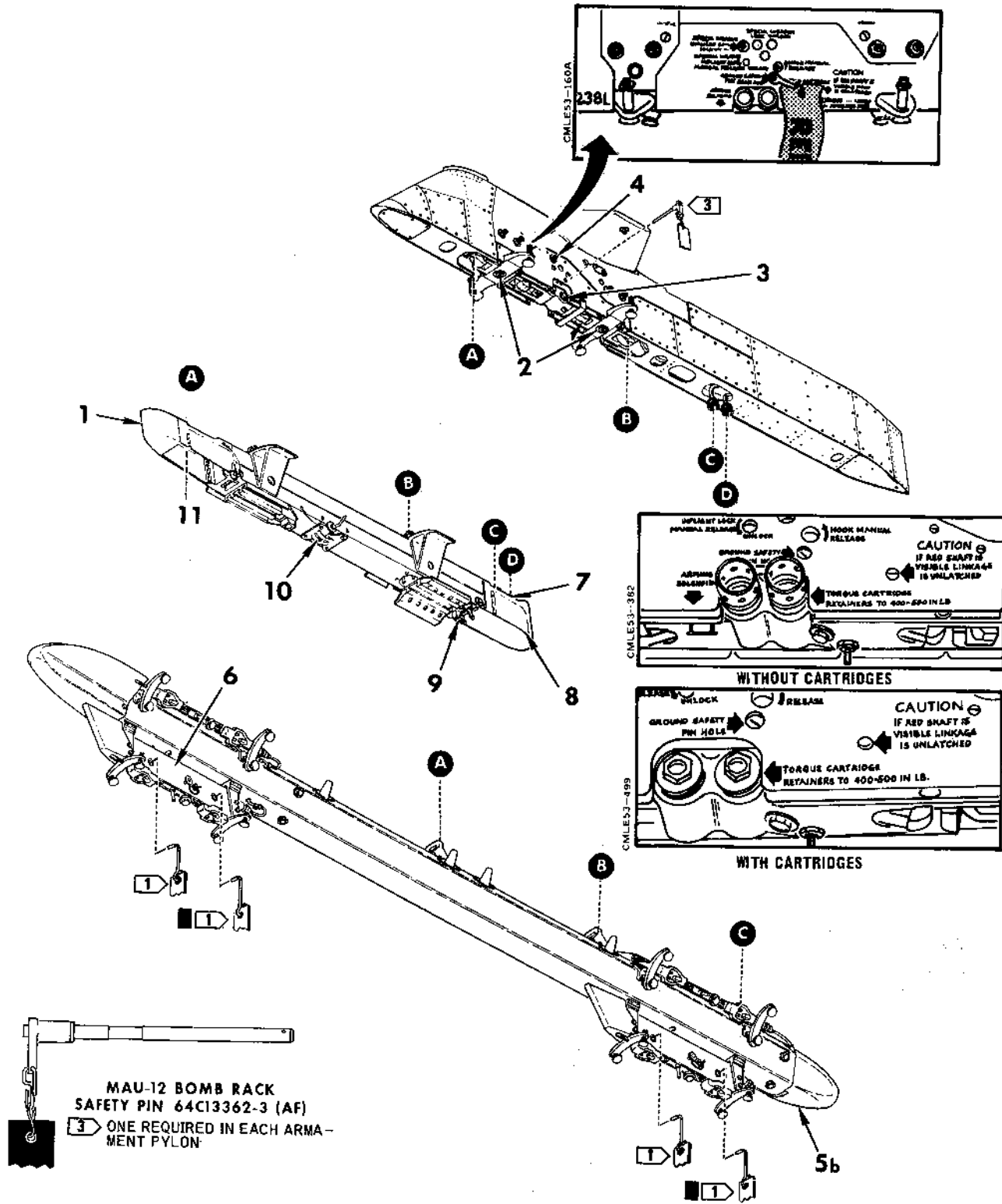
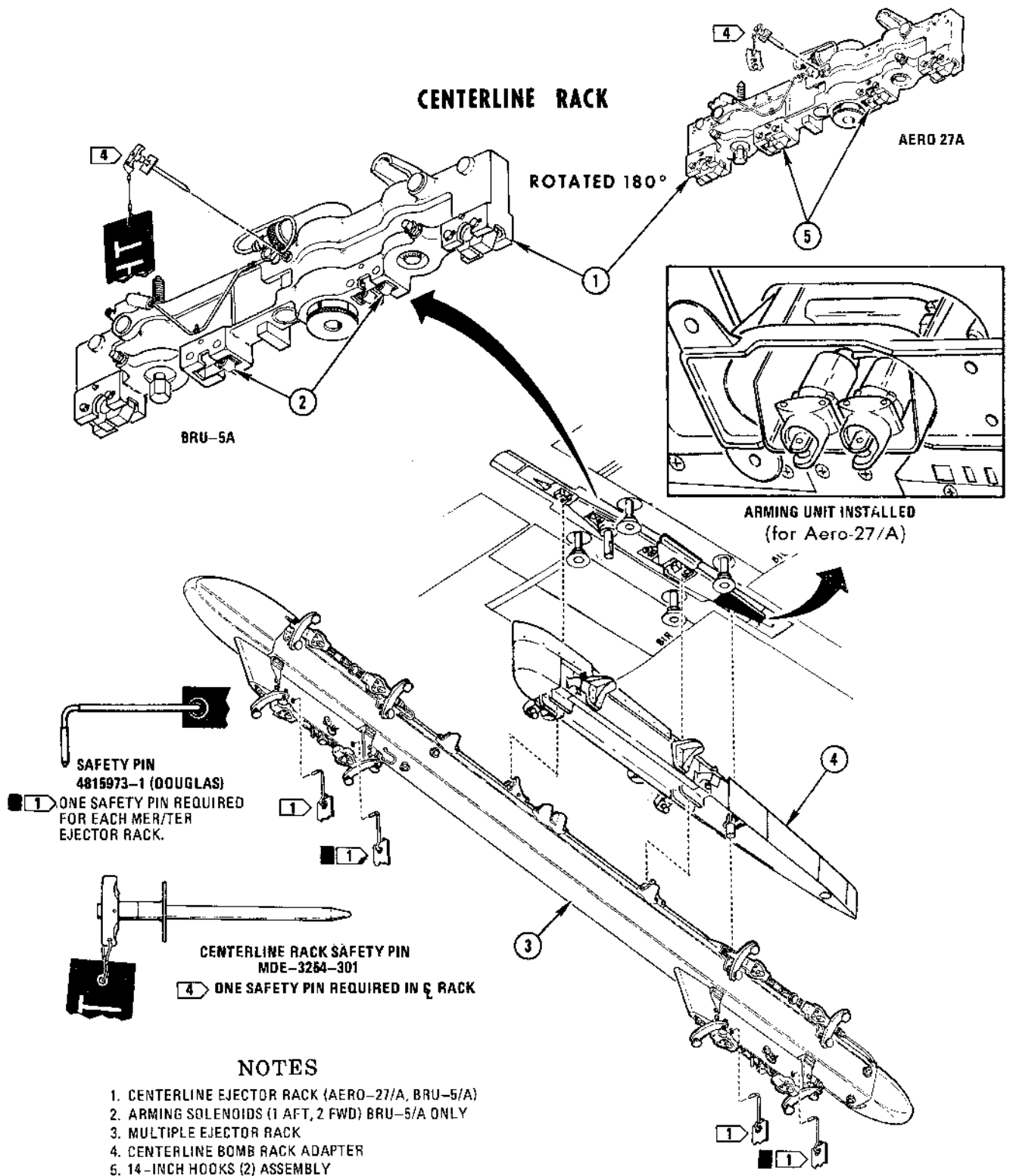


Figure 1-69 (Sheet 2 of 5)

SUSPENSION EQUIPMENT (Continued)



4E-34-1-1-(61-3)B

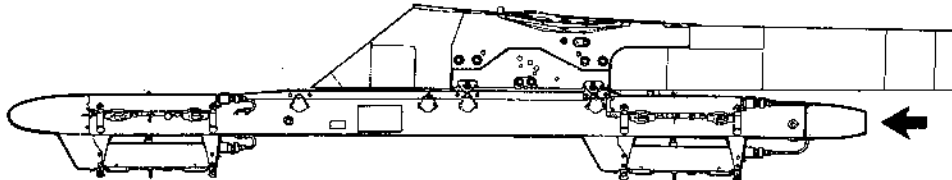
Figure 1-69 (Sheet 3 of 5)

SUSPENSION EQUIPMENT (Continued)

OUTBOARD

MER SHIFT

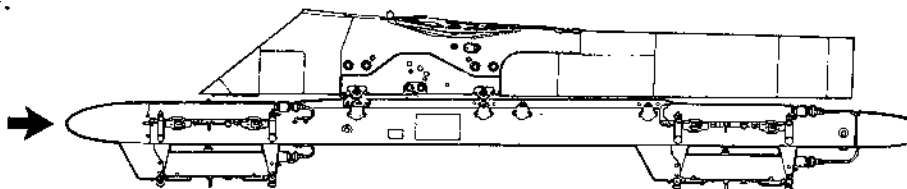
NORMAL FORWARD SUSPENSION



NOTE

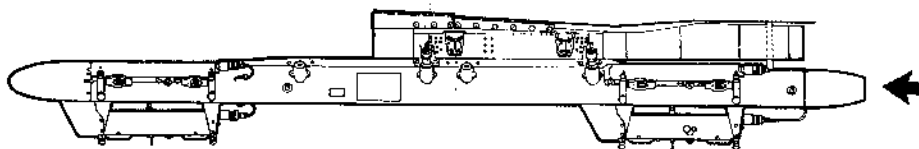
For some weapons, the MER must be shifted AFT to observe Aircraft C.G. requirement.

MER SHIFTED AFT

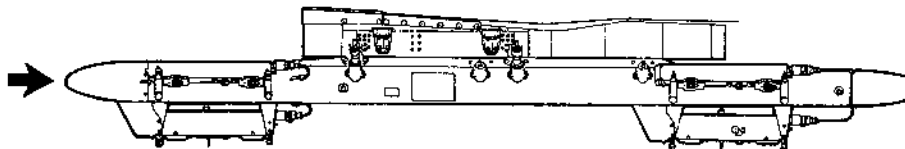


CENTERLINE

NORMAL FORWARD SUSPENSION



MER SHIFTED AFT



4E-34-1-1-661-4

Figure 1-69 (Sheet 4 of 5)

Each ejector rack (or point) is identified with a number corresponding to its release sequence. TER's are permanently rigged 1° nose down. The TER weighs 93 pounds.

a. Only the loaded MER-10A stations receive a release pulse regardless of the nose/tail arm switch position. checkout operation.

b. The step switch on the MER-10A is used for ground a homing light. The MER-10A does not have a homing light. The MER-10A is automatically homed to the first loaded station in sequence each time power is applied to the nose/tail arm switch position.

The MER contains six 14-inch bomb ejector units, arming solenoids, control units, and circuitry required to deploy bomb and dispenser munitions. The MER is carried on the outboard and centerline stations and are identical except for suspension lugs and sway brace pads. The suspension lugs are 30 inches apart with provisions to enable a forward and aft loading configuration (figure 1-69 sheet 2). The multiple ejector rack used at the outboard wing stations and the centerline station is either the MER-10 or MER-10A. The MER-10A function differs from the MER-10 as follows.

TRIPLE EJECTOR RACK (TER)

Each ejector rack or point is identified with a number corresponding to its release sequence. Outboard wing station MER are permanently rigged 1° nose down. The CL MER is rigged 1° nose down for SU-25, and 2.5° down for bombs and rockets. The centerline MER weight is 215 pounds, the outboard MER weighs 220 pounds.

a. Only the loaded MER-10A stations receive a release pulse regardless of the nose/tail arm switch position. checkout operation.

b. The MER-10A is automatically homed to the first loaded station in sequence each time power (28vdc Bus) is applied to the aircraft. The MER-10A does not have a homing light.

c. The step switch on the MER-10A is used for ground checkout operation.

The MER contains six 14-inch bomb ejector units, arming solenoids, control units and circuitry required to arm and deploy bomb and dispenser munitions. The MER is carried on the outboard and centerline stations and are identical except for suspension lugs and sway brace pads. The suspension lugs are 30 inches apart with provisions to enable a forward and aft loading configuration (figure 1-69 sheet 2). The multiple ejector rack used at the outboard wing stations and the centerline station is either the MER-10 or MER-10A. The MER-10A function differs from the MER-10 as follows.

MULTIPLE EJECTOR RACK (MER)

The MAU-120C/A is completely interchangeable with the MAU-12B/A bomb rack. Essentially, MAU-120C/A is a strengthened MAU-12B/A.

NOTE

installed, the DCU-94/A UNLOCK light for that station illuminates continuously (except RO station). The arming wire solenoids are controlled by the position of the nose/tail arm switch.

a. Weapons selector knob - RKTs & DISP; back to BOMBS.

If all the bombs carried do not release, the ejector racks should be rehommed and release attempted again. Rehome the MERS and TERS as follows:

- a. Faulty ejector rack cartridges.
- b. Broken or shorted wiring to the ejector rack cartridges.
- c. Faulty relays.

The following causes for failure of the bomb release circuit cannot be corrected in flight by rehomming the MERS and TERS.

- a. Improper homing of the MERS or TERS.
- b. Moisture in the bomb ejector rack breach that grounds-out the release signal. After the MERS and TERS are rehommed succeeding release pulses can (in some cases) generate sufficient heat to evaporate the moisture in the bomb ejector rack breach.

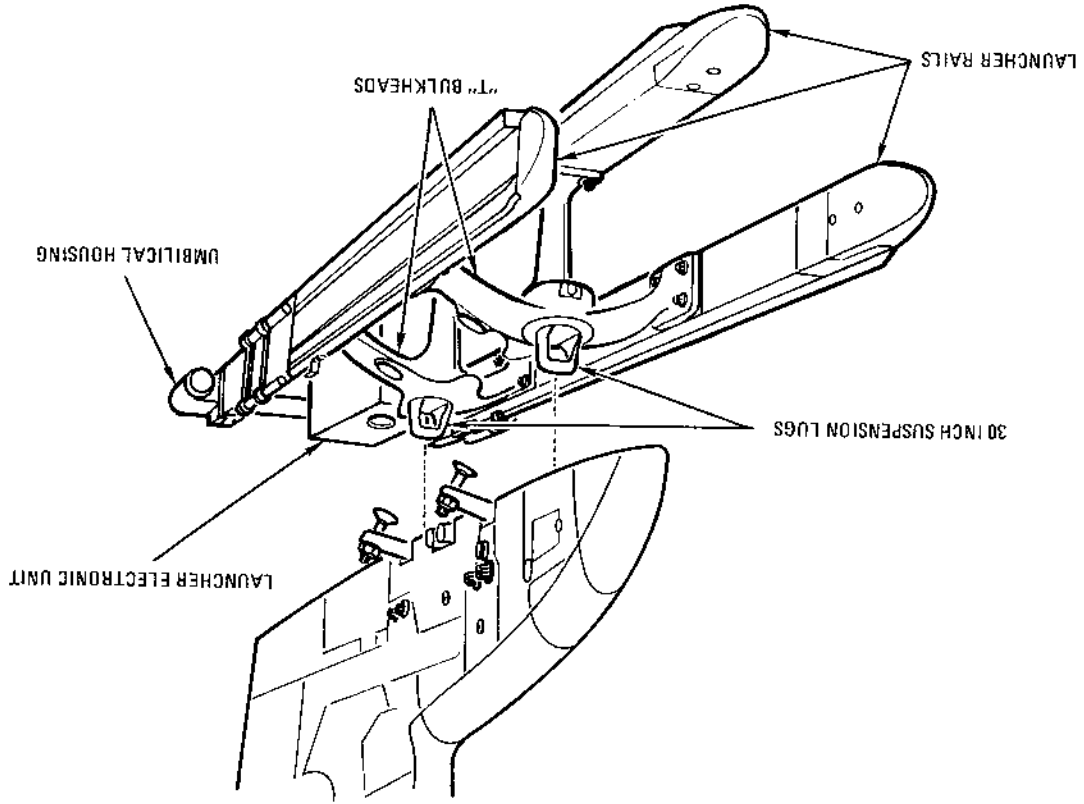
The following causes of bomb release failure can be corrected in flight by rehomming the MERS and TERS provided the MER/TER stepper switch has arrived at the OFF position.

- Do not confuse the rehomming procedure performed by the aircrew with the homing procedure performed by the load crew. The load crew will position the STEP-OFF-HOMING switch on the MER or TER to HOME and obtain a steady green light. After the load crew has homed the MERS and TERS, the RKTs & DISP position will not move the stepper switch.
- The TER-9A and MER-10A is automatically homed to the first loaded station in sequence each time power is applied to the aircraft. (The load crew does not home the MER-10A or TER-9A.)

NOTE

A hung bomb can be released, in some cases, after rehomming the MERS and TERS. Rehomming is accomplished in flight by cycling the weapon selector knob from BOMBS to RKTs & DISP and back to BOMBS. This causes the station stepper switch (in all MER/TERS aboard) to move from the OFF position to the first loaded (hung) station in sequence. The stepper switch will not move if the current station is loaded or the MER/TER is empty. (A defective store aboard sensing switch could cause the MER/TER to appear empty.) The stepper switch OFF position is obtained only in the BOMBS mode and after a release pulse has been sent to each of the loaded stations. Additional release pulses will not move the stepper switch from the OFF position. Selecting RKTs & DISP does move the switch because there is no stepper switch OFF position in the RKTs & DISP mode. With RKTs & DISP selected, stepper switch always steps to the next loaded station and continues to repeat the cycle.

REHOMING MERS AND TERS



LAU-88 LAUNCHER/AGM-65 MISSILE

SUSPENSION EQUIPMENT
(Continued)

After the remaining switches are set for bomb release, the bomb button is pressed and held for 4 seconds with single-ripple or continuous selected. With the MER-10/TER-9, if the weapon does not release when the nose/tail arm switch is in an armed position, rehome and then repeat the release procedure with the nose/tail arm switch in SAFE. The TAIL position does not apply this automatic stepping voltage; therefore, an extra pulse must be delivered to the MER/TER to step through each station. If the loaded station sensor switch has failed in the station empty position, releasing the weapons SAFE applies a release pulse to the loaded stations and the unloaded station.

NOTE

- The nose/tail arm switch position does not affect the operation of the TER-9A, MER-10A stepper switch; the release pulse is directed only to the loaded stations.
- If the bombs cannot be released after performing these procedures, it must be assumed that the ejector rack cartridges will not fire, or that the MER or TER is malfunctioning.

AIR-TO-GROUND MISSILE LAUNCHERS

LAU-34/A LAUNCHER, AGM-45

The LAU-34/A launcher contains the electrical circuits and relays which are responsible for the dispersal of missile preheat, arming, and missile launch voltage. The method of carriage is illustrated in figure 1-69, sheet 1 or 2. The launcher also contains a cartridge-fired jettison gun assembly. When the jettison system is activated, expanding gas from the detonated cartridges operates the assembly and slides the missile rearward, free of the launcher rails. Impulse cartridges are not installed in MAU-12 breeches of the stations configured with the LAU-34/A launcher. This weapon system will function with or without the installation of the MAU-12 inflight safety lockout pin.

LAU-88/A LAUNCHER, AGM-65

The jettisonable LAU-88/A launcher (figure 1-69, sheet 5) provides a mechanical and electrical means of carrying and launching three AGM-65 missiles from each inboard armament pylon. The launcher consists of three track-rail assemblies attached to a central structure which contains the launcher electronics unit. The electronics unit provides the electrical interface between the aircraft and the missiles, and controls the launch and jettison sequence. The missiles are attached to the rails by two suspension assemblies and are held in place by a shear pin. Missile launch occurs after the rocket motor thrust has reached the required level to shear the pin.

LAU-88A/A LAUNCHER, AGM-65

The LAU-88A/A is identical in outward appearance to the LAU-88/A (figure 1-69, sheet 5) and both are mechanically and electronically compatible with all AGM-65 and TGM-65 missiles. The LAU-88A/A however, contains added logic circuitry that augments the AGM-65D missiles. With LAU-88/A launchers, the selection sequence (outboard, bottom, inboard) may be performed only once without

deselecting and reselecting the station. With LAU-88A/A launchers, the sequencing cycle may be repeated continuously. LAU-88A/A launchers have a boresight memory module in the electronic unit that will provide boresight alignment to some other independent acquisition aid such as a gunsight piper. For the boresight memory to function, at least one missile on the launcher must be AGM-65D, and that missile must be activated. The missile is made to track an easily identifiable target and the aircraft is maneuvered to superimpose the sighting device of the independent acquisition aid on the target. Boresight memory is then commanded. Subsequent activation of any AGM-65 missiles on that launcher will result in the missile seeker being aligned to the remembered boresight position. The boresight memory module in the AGM-65D missile is inoperative when boresight memory is commanded and the launcher is LAU-88A/A.

To fire more than one AGM-65 missile on a single firing pass, the LAU-88A/A launcher provides the ability to automatically activate the second missile in firing priority sequence when the first priority missile is activated. If the first and second priority missiles are AGM-65D, the second (non-priority) missile seeker will be slaved to the line of sight of the priority missile. The third missile in priority sequence (if present) will activate after umbilical separation of the first priority missile. The second missile thus becomes the priority missile and the third missile becomes the non-priority missile. Approximately 1 second after umbilical separation the video from the second missile appears on the scope. This video will at first consist only of scope symbology as scene video is screened out by the dome cover. Approximately 1 second after launch of the priority missile, the dome cover squib of the non-priority missile is blown and scene video will appear. The second AGM-65D missile seeker will be ordered automatically to the field of view (NFOV or WFOV) that the fired missile was in at launch. This will facilitate locating the target on the video presentation, initiating lockon, and launch of another missile. The sequence may be repeated and the third missile launched, range and altitude permitting. If the MSL REJ switch is activated prior to launching a missile, the priority sequence advances to the next rail. If an AGM-65A or B missile is loaded on a LAU-88A/A launcher with an AGM-65D missile, the A or B seeker will align to the gimbal angles in the launcher boresight memory (there is no missile to missile slaving between an AGM-65D and an AGM-65A or B).

AIR-TO-AIR MISSILE LAUNCHERS

AERO 7A LAUNCHER, AIM-7

Four Aero 7A launchers are mounted in the fuselage structure so that the four AIM-7 missiles are semi-submerged. The launcher (figure 1-70) has two ejector pistons which are operated by gas generating cartridges to eject the missile downward approximately 8 inches before the missile motor is fired. Each of the forward fuselage stations has a cavity door that closes (after the missile is gone), to smooth the contour of the fuselage. Each launcher is electrically and mechanically protected from inadvertent firing of the ejector cartridges by a safety pin which is removed prior to flight.

AERO-7A LAUNCHER

AIM-7 MISSILE

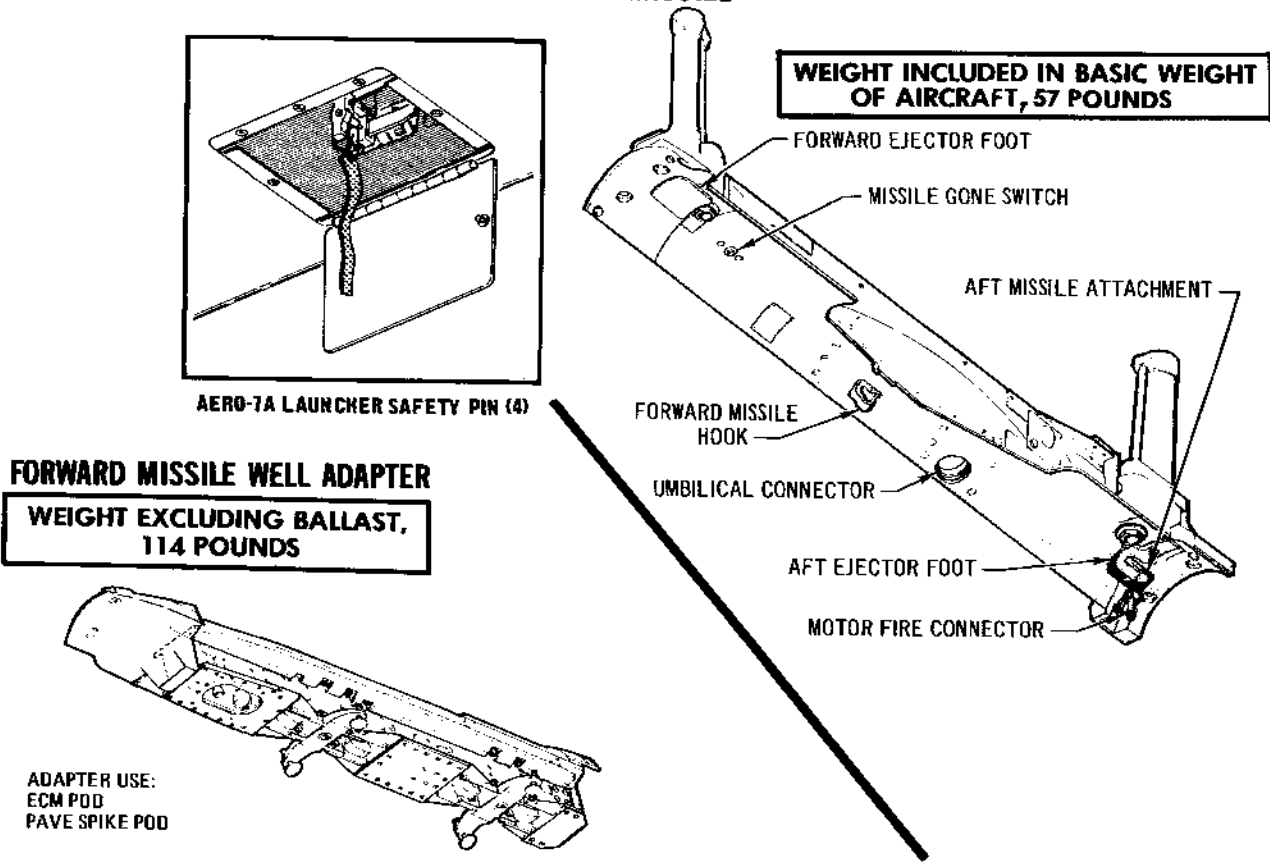


Figure 1-70

MISSILE WELL ADAPTER ASSEMBLY

The forward missile well ECM pod adapter assembly replaces the Aero 7A missile launcher when installed in fuselage stations 4 and 6. The adapter assembly is used to suspend and carry an ECM pod or Pave Spike pod. Swaybraces and hooks provide 14-inch and 30-inch pod suspension. The hooks are opened and closed manually. A lock pin is installed to mechanically lock the hooks closed. There is no provision for inflight operation of the hooks.

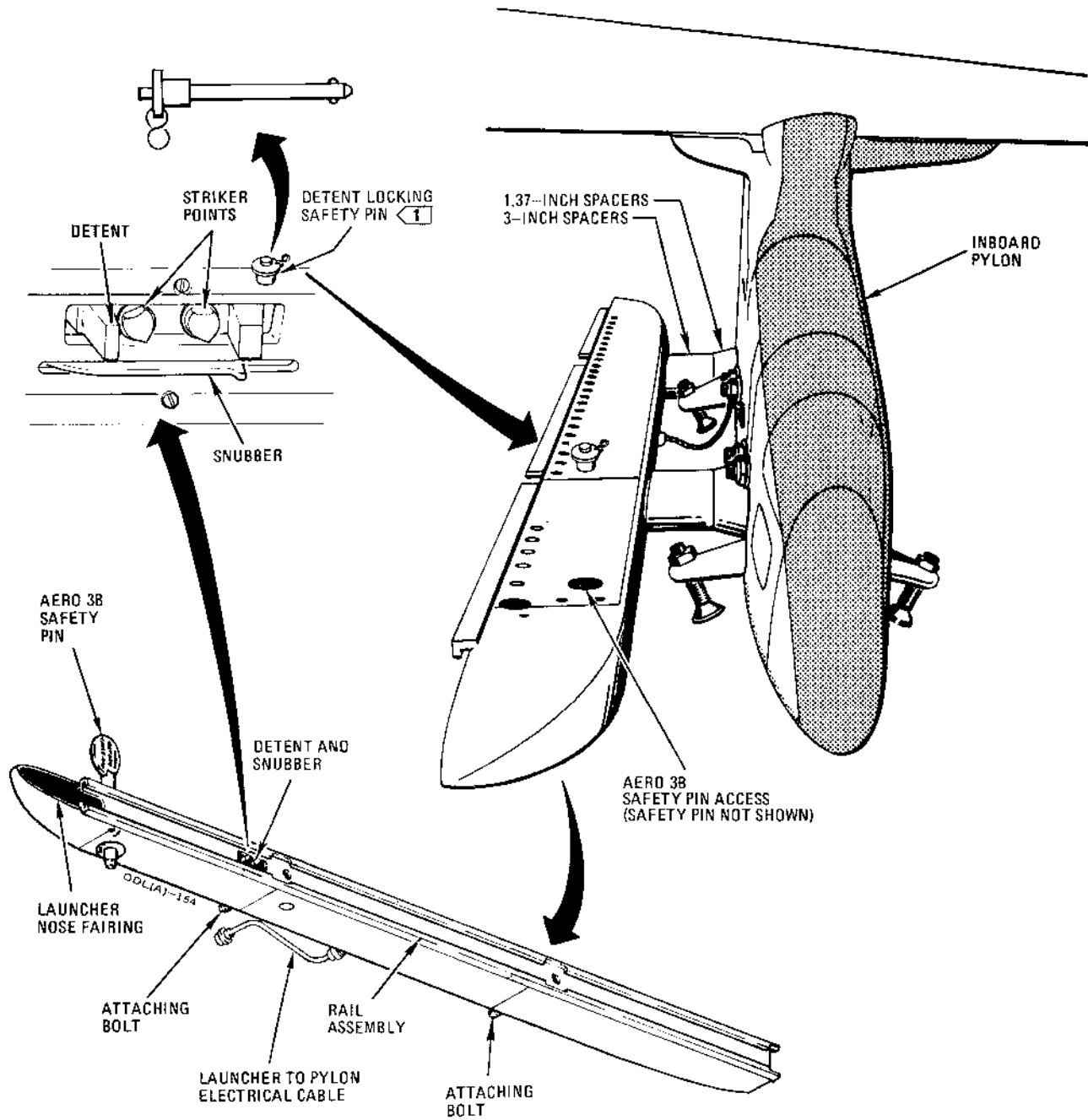
The adapter assembly (without ballast) weighs 114 pounds; however, only 57 pounds is added to the aircraft weight because the Aero 7A launcher which weighs 57 pounds is included in the basic weight of the aircraft. Ballast weight must be added to the adapter depending on the weight of the pod carried. For adapter assembly ballast requirements, refer to the external stores and attachment tables in TO 1F-4E-5.

AERO-3B LAUNCHER, AIM-9

The AIM-9 missile launcher (figure 1-71) is bolted to the side of the inboard armament pylon and provides AIM-9 missile suspension and launch capabilities. The launcher contains a detent and snubber mechanism that retains the missile on the rail. Trigger 7 voltage, through the launcher power supply, ignites the missile gas generator, which enables aircraft power to fire the missile rocket motor. The thrust overrides the restraining effect of the detent spring allowing missile launch. A detent locking safety pin is installed to ensure that the AIM-9 will not slide rearward during flight.

AERO-3B LAUNCHER

AIM-9 MISSILES



1 THE SAFETY PIN REMAINS INSTALLED DURING FLIGHT TO RESTRAIN REARWARD MOVEMENT OF THE MISSILE DURING FLIGHT.

WEIGHT	49 Pounds
LENGTH	87 Inches
WIDTH	3 Inches
HEIGHT	5 Inches

4E-34-1-1-(306)B

Figure 1-71

CAMERA SYSTEMS AND RECORDING EQUIPMENT

KB-18A STRIKE CAMERA SYSTEM

The aircraft can be equipped with the KB-18A strike camera system by installing the camera pod in the right forward fuselage missile well. The KB-18A pod consists of the camera and film magazine, camera control panel, defogging assembly, a thermostat controlled heater and a relay panel. The panoramic camera provides continuous film documentation of the strike area through an air-to-ground armament delivery. Camera operation is initiated through the trigger switch (front cockpit) or the bomb button (either cockpit). After the trigger switch or bomb button is released, extended camera operation is provided for a preset duration. This duration is manually set prior to flight on the control panel overrun dial. The camera may be operated without expending munitions by actuating the extra picture switch in the front cockpit (figure 1-72).

KB-18/A CAMERA AND FILM MAGAZINE

The camera has a 3-inch focal length (75mm), f/2.8 lens with automatic exposure control. Continuous panoramic coverage is accomplished by a double dove prism rotating in front of the lens while the film is advanced across a narrow slit at the focal plane of the camera. The film advance is synchronized with prism rotation, projecting the image on the film as the prism scans a 180° (front to rear) by 40° (lateral) area. The automatic exposure control senses variations in scene illumination and initiates compensatory aperture adjustments, thereby enhancing dawn-to-dusk photography. The film magazine is attached to the camera body and accommodates 250 feet of 70mm aerial roll film. The film is exposed at a pre-set rate of 1, 2, or 4 frames per second and produces photographs with a format size of 2.25 by 9.4 inches.

KB-18A CAMERA CONTROLS

The camera control panel contains all the switches, electronics units and the connectors necessary to operate the camera system. Located on the face panel are the manually adjustable controls that include the cycle rate switch, overrun dial and the AEI switch. All switches are set up prior to the flight according to the established mission requirements. A TEST switch is provided for ground test operations (figure 1-72).

Overrun Dial

The overrun dial controls the amount of time the release and overrun circuit is energized. The trigger and bomb button, when actuated, connect the cycle rate voltage to the scan drive to begin camera operation. After the trigger switch or bomb button is released, a holding relay maintains camera operation until the release circuit removes the input to the scan drive. The dial is calibrated in 2-second increments from 0 to 20 seconds and includes an additional 32 second dial setting. The extra picture switch, when actuated, does not energize the release and overrun circuit.

Cycle Rate Switch

The cycle rate switch connects the scan drive circuit to the proper signal and voltages to drive the system at the pre-selected cycle rate of 1, 2 or 4 frames per second.

AEI Switch

The automatic exposure index (AEI) switch is provided with a voltage proportional to the selected cycle rate. This voltage is modified, by the AEI switch, as a function of the exposure index (sensitivity) of the film. These index values are 40, 64, 80 and 100.

KB-18A Extra Picture Switch

During air-to-ground armament delivery the camera operates automatically and continues until overrun time terminates. However, the extra picture switch is provided to operate the camera without delivering armament. The extra picture switch bypasses the overrun switch to start camera operation at the cycle rate selected.

Defogging Assembly and Heater

The defog blower, located in the pod, prevents accumulation of dust and moisture condensation on the camera window. A thermostat-controlled heater operates to aid the defog blower when the ambient temperature drops below 85°F.

CAMERA OPERATING CONTROLS

KB-18A

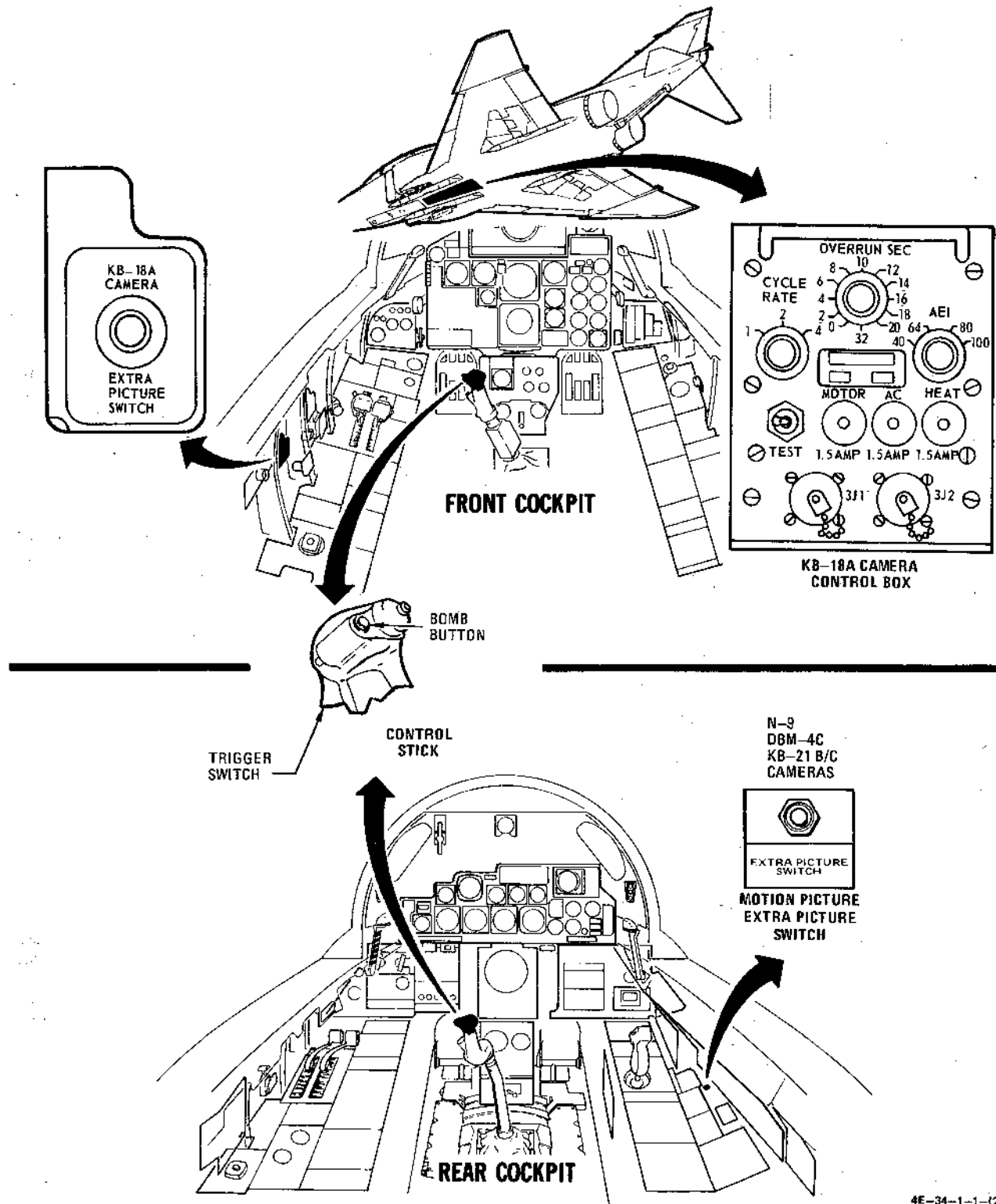


Figure 1-72

4E-34-1-1-(257)A

COMBAT DOCUMENTATION MOTION PICTURE SYSTEM

The combat documentation camera system consists of two 16mm motion picture cameras. One camera is mounted in a down forward looking position while the other is mounted in a down aft looking position. This configuration provides moving film documentation of the strike target before, during and after munitions delivery to provide a more accurate strike assessment. The aircraft are equipped with the aft looking camera mounted in a camera housing mounted under door 137L. The forward looking camera is mounted in a housing under door 137R. On a selected number of aircraft, a KB-21 (B/C) motion picture camera is installed in a down and aft looking position.

Normal system operation is controlled by actuation of the trigger switch (front cockpit) or bomb release button (either cockpit). Operation of the cameras without expending munitions is provided by an extra picture switch (rear cockpit). Various depression angles, ranging from 0°-18° for the forward camera and 10°-50° for the aft, can be set prior to takeoff (ground adjustable only) to give optimum strike coverage as dictated by the specific munition delivery. The camera overrun and start delay time is also preset prior to the flight.

A safety switch actuated by a quick release pin, which must be removed prior to flight, renders the system inoperative when the aircraft is on the ground.

N-9 CAMERA (FORWARD LOOKING)

The N-9 motion picture camera with film magazine is designed for use with standard 16mm black and white or color film. The camera is equipped with a 50mm variable focal length, f/2.5 or f/2.8 lens with filter provisions and is calibrated to operate at speeds of 16, 32 and 64 frames (or pictures) per second. Film capacity is 200 feet on daylight loading spools. An automatic recycling counter indicates the amount of film exposed. The top aft end of the magazine contains a window through which the quantity of unexposed film is indicated.

NOTE

The yellow filter should be used in extreme brightness conditions: over water, snow, desert sand, etc. The clear filter serves to protect the camera lens from damage when the yellow filter is not being used.

DBM-4C CAMERA (AFT LOOKING)

The DBM-4C camera, a high speed 16mm motion picture camera, uses standard 16mm black and white or color film. The camera has 17 - 68mm variable focal length, f/2.2 lens and can operate at speed of 64, 128, 200 or 400 frames per second. Film capacity is 200 feet on daylight loading spools. Camera mounted controls provide for manual setting of the lens opening (f/stop), and frame speed. An automatic recycling counter indicates the amount of exposed film. The film remaining indicator is located on the magazine.

KB-21B/C, CAMERA (AFT LOOKING)

Essentially, the KB-21B/C cameras are the same as the DBM-4C camera except for focal length and frame speed. The KB-21B/C variable focal length is 12.5mm and operates at 2 to 250 frames per second.

CAMERA CONTROLS

A relay panel under door 137R contains the camera timers and other controls used for ground operations. The camera power switch on the relay panel must be ON to allow operation of the cameras. The camera timers (one for each camera) are set to the desired overrun time; i.e., the time desired for the cameras to run after release of the trigger switch or bomb button. A delay timer is provided for the aft looking camera. When the mission involves guns or rockets, it is desirable to start the aft looking camera at a time later than firing time. The delay timer is set at this desired time interval. Momentary actuation of the bomb button or trigger switch activates the delay timer and the overrun timers. The forward looking camera begins running and continues until time-out of the overrun timer. At the completion of the delay time, the aft looking camera starts running and continues for the duration of the aft looking camera overrun timer setting. If the bomb button is held pressed for a period of time, the delay timer begins its countdown when the button is first pressed but the overrun timers begin counting down when the bomb button is released. A second actuation of the bomb button before the overrun timers have timed out (cameras still running) recycles the overrun timers so that the overrun begins when the bomb button is released the second time. The aft looking camera delay timer is activated on the first actuation of the bomb button and is not affected by a second actuation unless the overrun sequence is completed. Each timer has a setting range of approximately 1 to 30 seconds.

NOTE

Any actuation of the bomb button when the landing gear is up causes the cameras to operate regardless of other cockpit switch configurations. The trigger switch, however, will not operate the cameras unless the missile/gun arm switches are armed.

Extra Picture Button

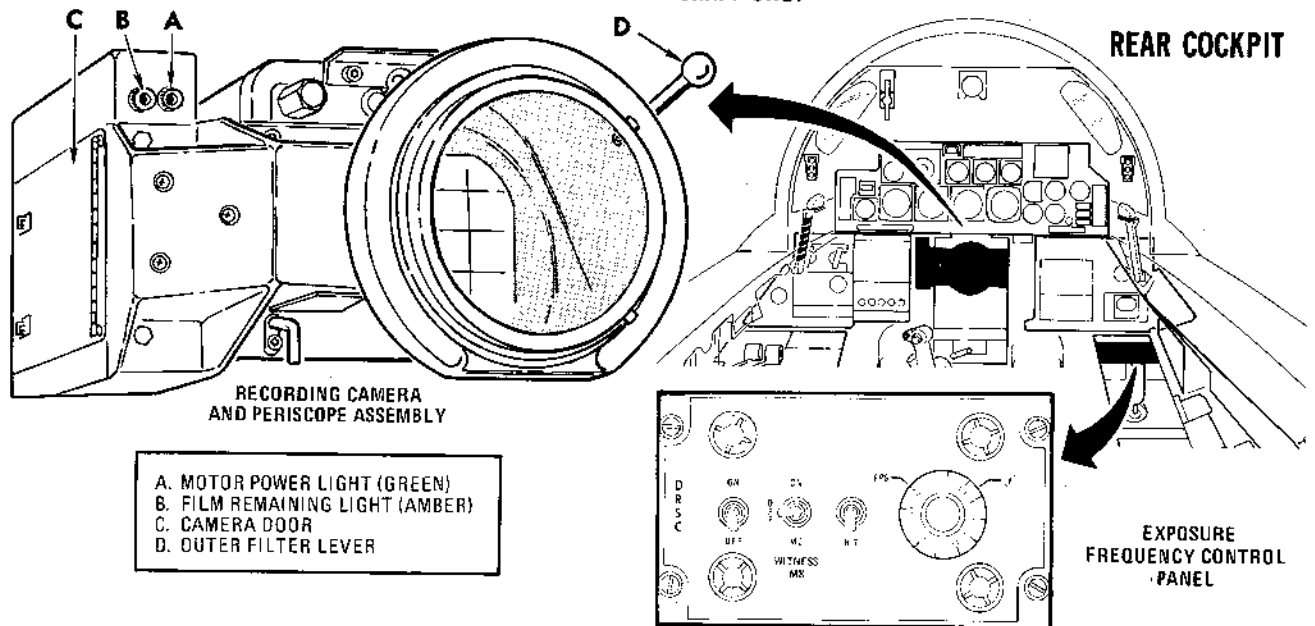
The rear cockpit extra picture button (figure 1-72) operates the cameras any time without the delivery of armament. Camera operation through the extra picture button is the same as operation through the bomb button and trigger switch. The overrun and delay timers function the same as explained previously.

RADAR SCOPE CAMERA SYSTEM

The DVST aircraft are equipped with a still picture radar recording system which consists of a exposure frequency control panel, recording camera, and periscope assembly. The recording camera and periscope assembly is mounted on the rear scope; the exposure frequency control panel is located on the right console. The system automatically

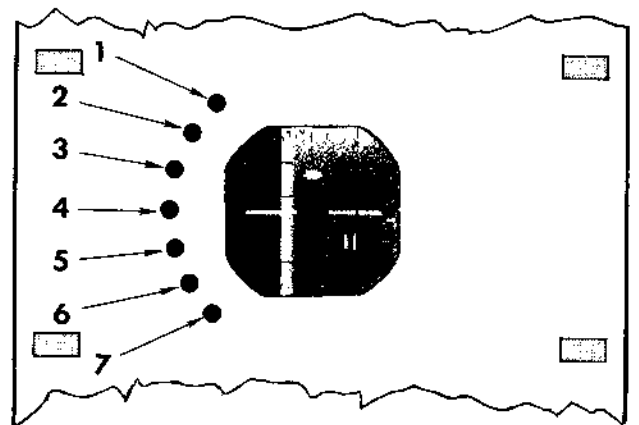
RADAR CAMERA & PERISCOPE

DVST AIRCRAFT ONLY



CORRELATOR LIGHTS

- Light 1 — With light on:
Indicates 200 mile range if light 4 is on and 100 mile range if light 4 is off.
- With light off:
Indicates AI 50 range if lights 3 and 4 are off.
- Light 2 — With light on:
Indicates FCS armed and trigger switch is pressed.
- With light off:
Indicates FCS not armed and trigger switch is not pressed.
- Light 3 — With light on:
Indicates AI 5 range if light 4 is on, and AI 25 range if light 4 is off.
- With light off:
Indicates AI 50 range if lights 1 and 4 are off.
- Light 4 — With light on:
Indicates AI 5 range if light 3 is on, 200 mile range if light 1 is on, and AI 10 range if lights 1 and 3 are off.
- With light off:
Indicates AI 50 range if lights 1 and 3 are off.
- Light 5 — With light on:
Indicates radar is in special mode (TRACK).
- With light off:
Indicates radar is not in special mode (TRACK).
- Light 6 — With light on:
Indicates radar set is in high PRF operation.
- With light off:
Indicates radar set is in low PRF operation.
- Light 7 — With light on:
Indicates AIM-7 missile is gone or that witness mark switch is in the ON or MC position.
- With light off:
Indicates AIM-7 missile is not gone or that witness mark switch is OFF.



4E-34-1-1-(258)C

Figure 1-73

photographs the radar scope display, keeping a continual record of radar presentations during the mission. The photo-optical arrangement and the design of the periscope assembly is generally shown in figure 1-73. The functions of these units are as follows:

- a. To reflect the radar display to the camera and transmit the display to the pilot.
- b. To attenuate any light from an outside source that may enter the periscope and degrade the quality of picture to be taken.

The optical theory is not discussed here, but in general, the polarized lenses enable the pilot to adjust the intensity of the video display to a desired level while the amount of light reaching the camera does not vary. The radar intensity control is set to a maximum for camera operations, and then the pilot rotates the outer filter on the periscope to obtain a desired video level.

The photo-optical system records the radar display, and also records various fire control system functions by momentarily illuminating small correlator lights in the camera. With the radar operating in the search mode, a picture is automatically taken at the end of each B-azimuth sweep or MAP PPI sweep. The pulse that momentarily opens the shutter to expose the film is synchronized with the antenna azimuth position. During lock-on, track, boresight, or BIT 2, 3, 5 or 6 operations, where there is no antenna scan, the pictures are taken at a rate determined by the position of the acquisition rate selector knob, placarded FPS (frames per second), on the camera control panel (from 2 to 6 frames per second).

Seven correlator lights, inside the camera, are connected to fire control system and armaments system circuits. When illuminated, the lights expose small dots along the edge of the film to mark an occurrence within the fire control or armament system. The position and indication of each light - when illuminated - is shown in figure 1-73.

RADAR CAMERA

The camera uses a standard 16mm Kodak film magazine with 50 foot capacity. The film magazine is loaded into a receiver on the inner face of the camera door. With the film properly inserted and the camera door closed, the camera gear train engages the magazine drive assembly. Also, the magazine pushes against a switch - opening the circuit to the film remaining (amber) light and closing the circuit to the camera clutch. A small micro switch assembly, that completes the circuit to the amber light during camera operation, is preset to illuminate the light when 0 to 15 feet of unexposed film remains in the magazine. If the camera door is opened before the film reaches the preset film-remaining value, the microswitch assembly will reset to the starting position. Hence, the door should not be opened after the film has been advanced unless the magazine is to be removed entirely.



Do not partially remove and reinsert the film magazine. Always remove the magazine completely; then reinsert. This prevents breakage

of correlator lights. On some cameras, the door will not close with the film magazine improperly installed. Any adjustment made to the magazine without completely removing the magazine from the door will cause correlator lights to break when the magazine is reinstalled. This is due to the light "slider" in the magazine not being fully reopened.

The green light, adjacent to the amber film-remaining light, illuminates to indicate power continuity in the camera circuits when the pilot places the camera power switch ON. The green camera power light receives power from the 28/14 volt ac bus and is controlled by the DIM/BRIGHT rheostat control knob. This light does not indicate the motor is actually running; however, by touching the camera case as power is applied, the WSO may be able to detect motor vibrations.

EXPOSURE FREQUENCY CONTROL PANEL

The exposure frequency control panel may be referred to as the DRSC (direct/data recording scope camera) panel. Basically, the panels contain circuits for control and operation of the camera system. Placing the camera power switch to ON energizes the following functions: the camera motor, links the correlator light functions to those of the radar and armament system; synchronize camera operation with antenna scan; and power the camera clutch. With the camera power switch ON the green light on the camera must illuminate indicating power exists between the control panel and the camera motor. The green light does not, however, indicate that the motor is running. The camera will not operate unless the radar is on and operating.

Witness Mark Switch

The witness mark switch may be used by the WSO to mark a specific area on the film; i.e., to reference a second target run, etc. The ON position of the switch illuminates correlator light No. 7 continually. The MC (momentary contact) position energizes a single flash illumination. Since the No. 7 light is on steady when AIM-7 missile is gone, it may be difficult to determine the difference between missile gone and the ON function of the switch when viewing the film. Hence, the MC position provides the most feasible function. In addition, the witness mark switch can be used to check the lamp status of correlator light No. 7. Actuation of the switch will not check function of the monitoring circuits of light No. 7 nor of the other six correlator lights, as a functional check of these circuits can only be accomplished by performing the events that the lights monitor.

Acquisition Rate Selector

The acquisition rate selector knob is a five position knob which is used to select the desired film speed from 2 to 6 frames per second (FPS) when operating in a lock-on, track, boresight or BIT 2, 3, 5 or 6. As the film speed is selected, the correct aperture setting (f/stop) may be read on the opposite side of the control. The f/stop value is for reference only since the aperture is preset during ground operations. The optimum FPS setting is 4 and the

optimum f/stop (as set on the ground) is 2.7.

BIT Switch

This switch is used for testing the camera operation and lamp status of the seven correlator lights. With the camera power switch ON, actuating the BIT switch illuminates all 7 correlator lights, and runs film through the camera to record illumination of the correlator lights. Actuation of the switch will not check the function of the monitoring circuits of the correlator lights, as a functional check of these circuits can only be accomplished by performing the events that the lights monitor. Operation of the camera motor can be checked by holding the switch actuated and feeling the side of the camera case for vibrations.

OPTICAL SIGHT CAMERA, KB-25/A

The KB-25/A 16mm gunsight camera is installed just above the optical display unit (ODU) and along the centerline of the sight combining glass (figure 1-74). The camera provides film documentation of the sight picture during weapon delivery. The camera may be operated with or without the expenditure of munitions by using controls available in either cockpit.

The KB-25/A system consists of the camera body, lens assembly, and a 100-ft capacity magazine or a dummy magazine. The lens covers a field of view of 8.25° in azimuth and 16.532° in elevation. The elevation limits are +3.532° to -13.532° with respect to zero boresight line.

CAUTION

When the magazine assembly is not installed on the camera, the dust cover must be inserted in its place. The dust cover provides the same weight/balance characteristics as a magazine assembly. Either a magazine or dust cover must be installed at all times to prevent reticle boresight changes. The dust cover is prominently labeled NO FILM.

CAMERA OPERATION AND CONTROLS

The camera receives motor power as soon as the aircraft bus system is operating. The only control that operates the camera on the ground is the camera run (test) button on the right side of the camera. With the button pressed, the pilot can watch the motor knob and check that the motor is running (figure 1-74). This may be accomplished without film installed.

The remaining controls on the camera body are the frames per second (FPS) switch, the overrun dial, and the aperture control. The FPS switch controls film speed; either 24 or 48 frames per second. The overrun dial is set on the required time period the camera is to run after the pilot releases the trigger or bomb button. The overrun function does not operate unless trigger 2 or the bomb button is used to operate the camera.

Bomb Button

For the bomb button (either cockpit) to operate the camera, the delivery mode selector must be on DIRECT, DIVE TOSS, or DIVE LAY. The bomb button signal energizes the camera motor, the overrun period, and the event marker. The event marker appears on the film to mark the application of the weapon launch/fire signal.

Trigger (Trigger 1 and 2)

The trigger 1 position of the trigger operates only the camera motor; the event marker and overrun period do not operate in trigger 1. The trigger 2 position runs the camera, and energizes the marker and overrun time, and applies the armament fire/launch signal.

WARNING

Continuous gunsight camera operation after takeoff and before initiation of any camera operational mode indicates a possible malfunction in the armament circuit that could cause premature firing of the gun or air-to-air missiles. All trigger-launched armament switches should remain OFF/SAFE.

If the ARM or TV weapon is selected, only the bomb button operates the camera.

Gun Camera Switches

The camera can be operated through the gun camera switch from either cockpit. With either switch ON, the camera runs continuously until the switch is placed OFF. The switch is automatically positioned OFF at the completion of the overrun time which is initiated by pressing the bomb button or trigger 2. The switches permit camera operation during target tracking, prior to pressing the bomb button or trigger 2.

OPTICAL SIGHT CAMERA, KB-25/A

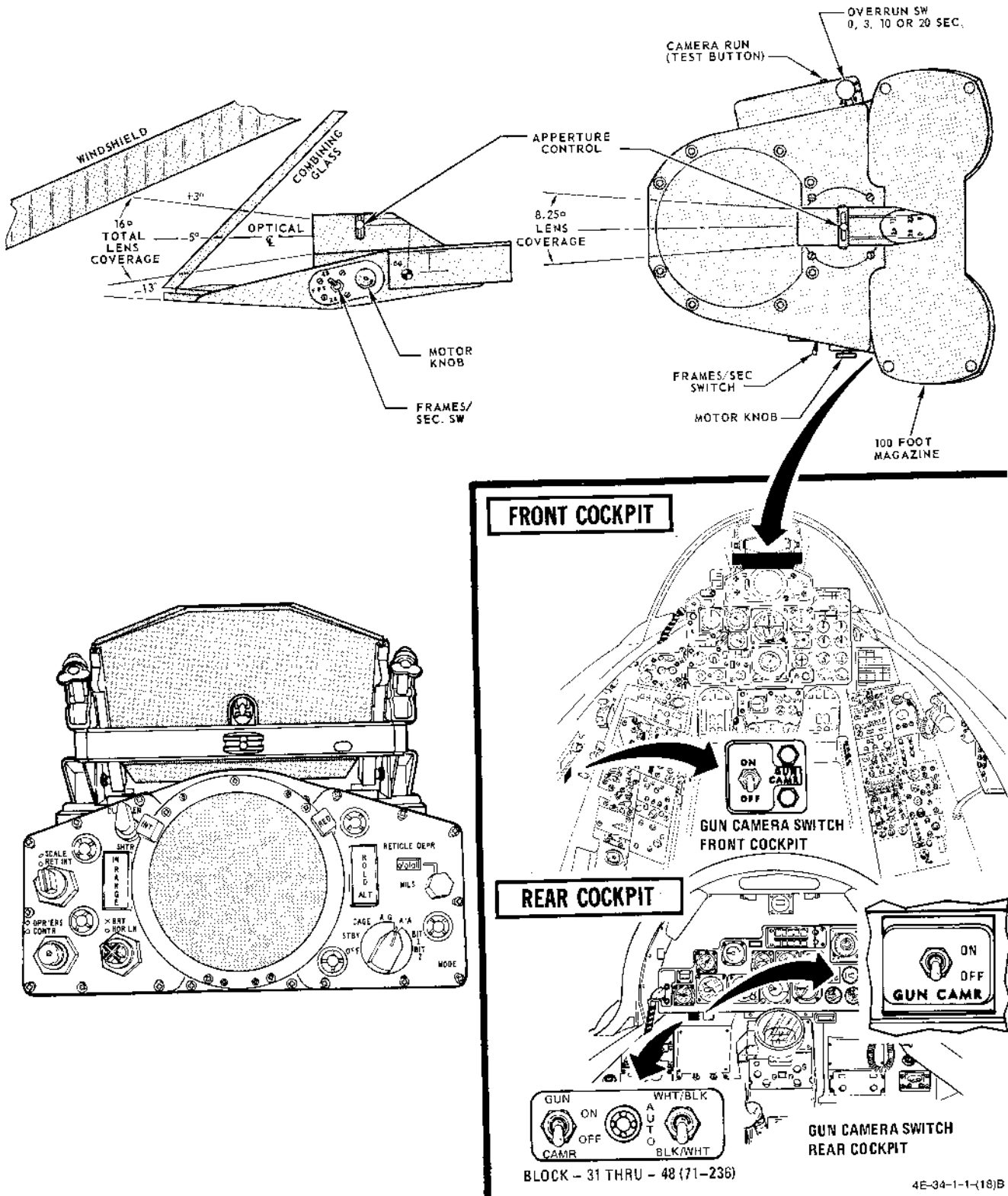


Figure 1-74

AIRBORNE VIDEO TAPE RECORDER

(Block 35 thru 45 After TO 1F-4E-639 and Aircraft 71-237 and Up)

The airborne video tape recorder (AVTR) is installed in the front cockpit and controlled by the AVTR switch in the rear cockpit (figure 1-74A). The AVTR records the video displayed on the rear DSCG scope and records the aft intercom audio. Each cockpit has an AVTR record light which is ON while the system is recording. After TO 1F-4-1245, the tape timer indicates the total time the AVTR has been in RECORD mode. Selecting OFF resets the timer to zero.

VIDEO TAPE CASSETTE

The cassette can be installed/removed by the pilot if the AVTR switch is in OFF.

NOTE

Ensure AVTR switch is OFF before engine shut-down. The AVTR loading door cannot be opened when STANDBY or RECORD is selected.

When installing the cassette, the window side of the cassette must be towards the window side of the recorder. The total total recording time available is determined by the size of the cassette installed (10, 20, or 30 minute U-Matic "S" standard). The recording is in black and white, 60 fields per second.

AVTR OPERATION

AVTR operation begins when the AVTR switch is placed to STANDBY. In STANDBY, the video tape leader is threaded into the recorder and the video tape is held in position until either RECORD or OFF is selected. If RECORD is selected before the leader is threaded into the recorder, the threading process continues and video recording begins at the end of the leader. The video tape and leader are automatically returned to the cassette when the end of tape (EOT) is reached and when OFF is selected. The EOT light comes ON and remains ON until the AVTR switch is placed to OFF.

When only short recording periods are desired, the STANDBY position should be used to stop recording. The OFF position causes an unthreading of the video tape in approximately 10 seconds. If RECORD is selected after the tape has been unthreaded, part of the previous recording may be erased. The AVTR tape timer lights are operated through the rear cockpit instrument panel lights control and may not be visible if the instrument panel lights are turned down.

EVENT MARK BUTTON

(Aircraft 71-237 and Up)

The event MARK button is located on the Control Lens Indicator in the rear cockpit. The MARK button is used to identify a point of interest by producing a 1000 Hz tone. The tone is recorded while the MARK button is pressed if the AVTR switch is in RECORD.

AIRBORNE VIDEO TAPE RECORDER (AVTR)

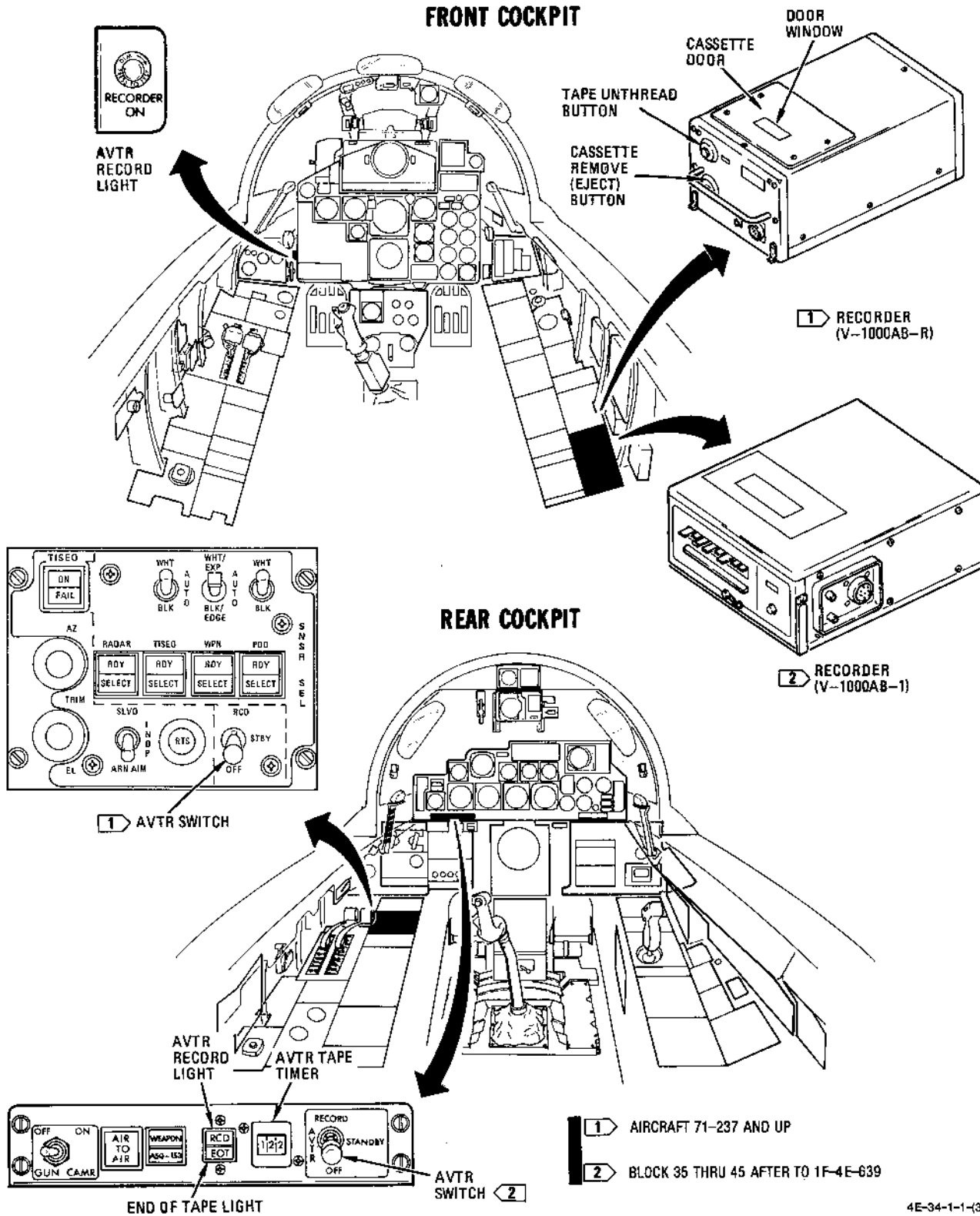


Figure 1-74A

4E-34-1-1-(307)C

TRANSPONDER EQUIPMENT

RADAR TRANSPONDER SST-181X

The aircraft is equipped with the SST-181X radar transponder system which increases the range tracking capabilities of mobile ground-based I-Band radar sets. The system increases navigation capabilities in adverse weather and in underdeveloped areas. The ground-based radar transmitters emit I-Band signals which interrogate the SST-181X radar beacon. The SST-181X receives and then transmits replies of much greater signal strength (same frequency). The radar site is actually receiving a considerably stronger signal than a radar signal. This improves acquisition/range at the receiving site.

The SST-181X transponder may be operated in a single-pulse reply or a double-pulse reply mode. In the single-pulse mode, the transponder transmits one reply pulse for each interrogation pulse received.

PULSE SELECTOR SWITCH

The pulse selector switch is on the rear cockpit right console. The switch has positions of OFF (center), SINGLE, and DOUBLE. If the WSO selects SINGLE, a single reply pulse is generated for each interrogation. In DOUBLE, the system generates two reply pulses at a predetermined spacing. The operating mode (SINGLE or DOUBLE) may be determined during mission briefing or by direct voice communication with the radar site.

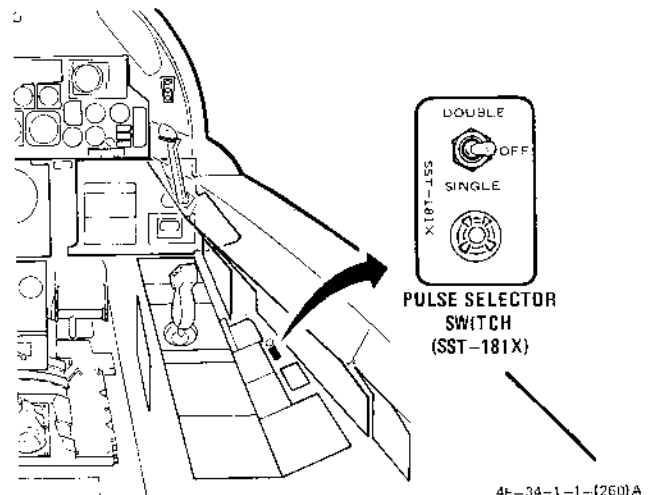


Figure 1-74B

RADAR TRANSPONDER OPERATION

There are no indicators that show system operation; the WSO energizes the system by selecting the SINGLE or DOUBLE operating mode. Vectoring information is obtained by voice communications between the aircrew and the site ground controller.

)

)

)

)

)

)

)

)

)

)

SECTION II

NORMAL AIRCREW PROCEDURES

TABLE OF CONTENTS

INTRODUCTION	2-2	RADAR WARNING RECEIVER (AN/ALR-46(V)-3) Refer to TO 1F-4E-34-1-1-1	
WEAPON EXTERIOR INSPECTION Refer to TO 1F-4C-34-1-2		TIRS DATA TRANSFER	2-71
ARMAMENT AREA - ARMING	2-2	AN/ALE-40 COUNTERMEASURE DISPENSER	2-72
BIT CHECKS (DVST)	2-19	AN/ALE-38 CHAFF DISPENSER	2-72
PreBIT Switch Setup	2-19	AIM-7 MISSILE	2-73
Radar Turnon.....	2-19	AIM-9 MISSILE	2-80
Radar Scope Camera.....	2-20	M61A1 NOSE GUN	2-82
AIR-TO-AIR BIT CHECKS (DVST)	2-21	SUU-16/A, -23/A GUN PODS, GPU-5A GUN POD ON CL STATION	2-82
Radar Checks	2-21	AGM-45 MISSILE	2-83
DVST BIT Fault Analysis (A/A)	2-26	AGM-65 MISSILE	2-83
AIR-TO-GROUND BIT CHECKS (DVST)	2-30	TGM (65) (TRAINING) MISSILE.....	2-86
Range Slope and Zero	2-30	LASER TARGET DESIGNATOR PAVE SPIKE	2-86B
Bomb Range Strobe Calibration	2-30	BOMBS & SUU-20 DISPENSER	2-94
WRCS BIT	2-31	SUU-20 BOMB DISPENSER (DCU-94/A).....	2-98
BIT Fault Analysis (A/G)	2-32	ROCKETS AND SUU-20 DISPENSER	2-99
POST BIT (DVST)	2-33	CBU AND FLARE DISPENSERS	2-99
SCRAMBLE BIT (DVST)	2-33	TMU-28/B SPRAY TANK	2-102
PreBIT Switch Setup	2-33	SUU-21/A BOMB DISPENSER (DCU-94/A) 2-102	
Turnon/Scramble BIT Check	2-33	SUU-21/A BOMB DISPENSER (MODIFIED) 2-103	
DVST BIT Fault Analysis (Scramble).....	2-34	BOMBING RANGE WEAPONS	2-103
CAGE MODE CHECK.....	2-34	A/A 37U-15 TOW TARGET SYSTEM (MODIFIED)	2-106
OPTICAL SIGHT CHECK	2-35	A/A 37U-33 AERIAL GUNNERY TARGET SYSTEM	2-107
Optical Sight BIT Fault Analysis	2-36	A/A 37U-36 Aerial Gunnery Target System	2-108
BIT CHECK (DSCG).....	2-52	AN/APX-80A Refer to TO 1F-4C-34-1-1-2	
PreBIT Switch Setup	2-52	LANDING	2-109
Radar Turnon.....	2-52		
AIR-TO-AIR BIT CHECKS (DSCG)	2-54		
Radar Checks	2-54		
DSCG BIT Fault Analysis (A/A).....	2-59		
AIR-TO-GROUND BIT CHECKS (DSCG).....	2-63		
Range Slope and Zero	2-63		
Bomb Range Strobe Calibration	2-63		
WRCS BIT	2-63		
BIT Fault Analysis (A/G)	2-65		
POST BIT (DSCG).....	2-66		
SCRAMBLE BIT (DSCG)	2-66		
PreBIT Switch Setup	2-66		
Turnon/Scramble BIT check	2-66		
DSCG BIT Fault Analysis (Scramble).....	2-67		
OPTICAL SIGHT CAMERA, KB-25/A	2-67		
RADAR WARNING RECEIVER (AN/APR-36/37) Refer to TO 1F-4E-34-1-1-1			

INTRODUCTION

The procedures contained in this section are reproduced in checklist form and presented in TO 1F-4E-34-1-1CL-1. When this section is changed or revised, the checklist will be changed concurrently. The following notations are used to distinguish between front and rear cockpit procedures.

- a. (P) Pilot system checks, front cockpit.
- b. (WSO) Weapon Systems Officer checks, rear cockpit.

NOTE

Procedures pertaining to the crew member having the minority task are coded by the (P) or (WSO) notation. For example, if a given procedure is performed almost entirely in the rear cockpit, (P) denotes those few steps performed in the front cockpit. Conversely, if nearly all steps apply to the front cockpit, (WSO) denotes the few steps performed in the rear cockpit.

EXTERIOR INSPECTION

Refer to TO 1F-4C-34-1-2 for exterior inspection procedures.

ARMAMENT AREA - ARMING

For those weapons which require specific arming preparations in a designated area, the following procedures should be used.

1. Armament switches - OFF/SAFE/NORMAL
2. Armament safety override button - PUSH IN (IF REQUIRED)

WARNING

When the armament safety override button is energized, the jettison circuit is placed in an inflight configuration, the pilot has a jettison capability during takeoff while weight is on the gear.

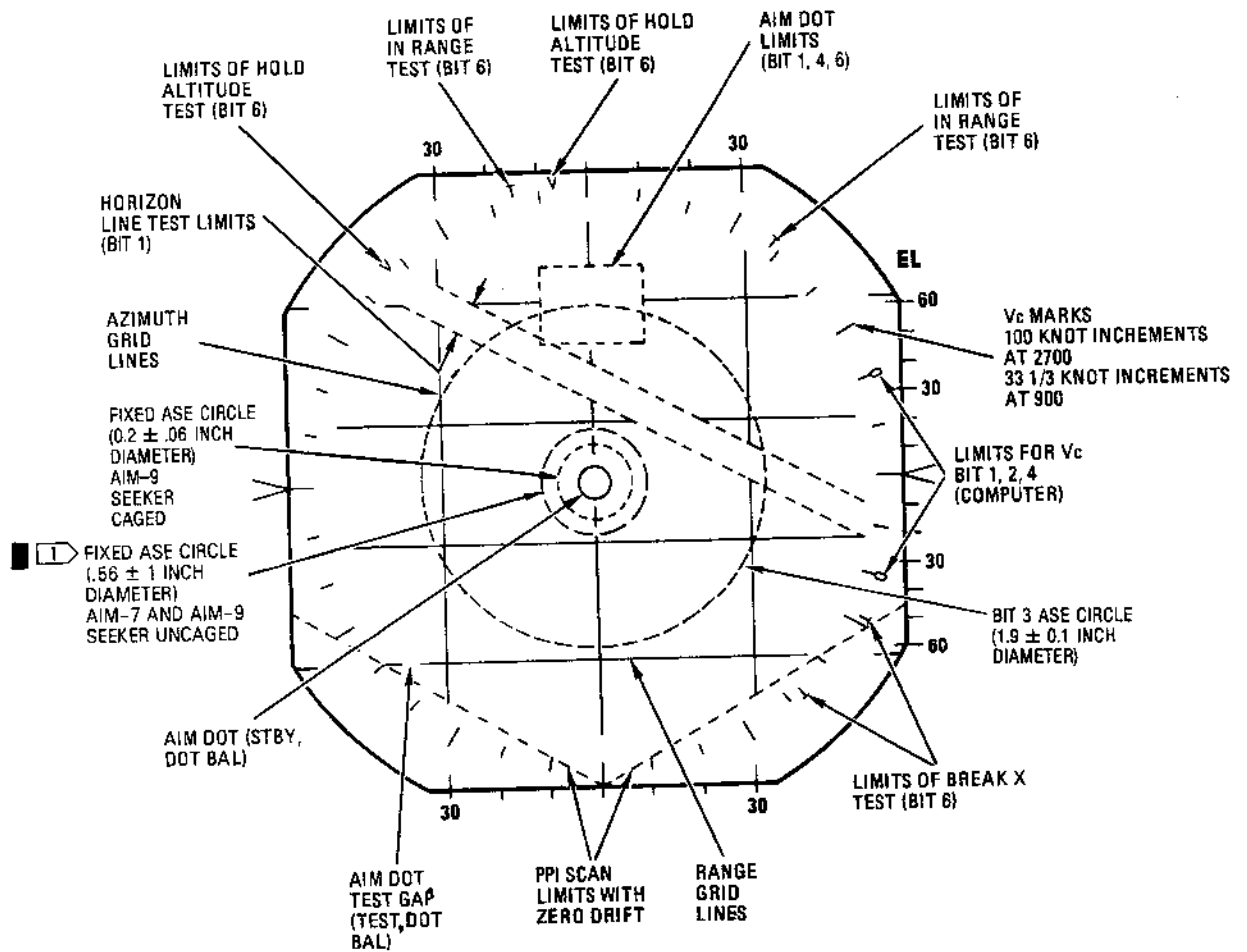
NOTE

Before takeoff, the armament safety override button can be extended (deenergized) by momentarily pulling the armt bus control CB No. 3 panel.

3. Aircrew - HANDS IN VIEW

The aircrew will place both hands in view as a signal to the load crew to approach the aircraft, remove all safety pins and install all access covers, and perform any final aircraft/weapon preparations.

DVST BIT DISPLAY GRID



NOTE

DOTTED LINES ARE NOT ETCHED ON INDICATOR FACE.

BEFORE OFF P005.

4E-34-1-1-(315)B

Figure 2-1.

BIT CHECKS (DVST)

PREBIT SWITCH SETUP

DVST BIT display grid is shown in figure 2-1.

WEAPON CONTROLS

1. Radar missile power switch - OFF
2. Guns/missile switch - RADAR
3. Master arm switch - SAFE
4. Interlock switch - IN
5. Weapon select knob - C
6. Delivery mode knob - OFF
7. HSI mode knob - NAV COMP

RADAR SET CONTROL PANEL

1. Radar power switch - OFF
2. Polar switch - LIN
3. Radar range knob - AI 25
4. Maneuver switch - HI G
5. Scan switch - 1 BAR
6. Aspect knob - NOSE
7. Receiver gain knob - FULL CLOCKWISE
8. Track switch - AUTO
9. Display switch - B-WIDE
10. Manual Vc knob - 0
11. Pulse switch - AUTO
12. Radar mode knob - MAP

NOTE

To increase the serviceable life on the radar feed horn assembly components, the MAP mode should be used, except when mission requirements dictate use of the RADAR mode.

13. Air-to-air light - OFF

CONTROL MONITOR PANEL

1. Meter selector knob - \emptyset A
2. Test knob - 0
3. Meter switch - VOLT
4. Vc switch - 2700
5. Stab switch - NOR

WEAPON DELIVERY PANEL

1. Activate switch - NORM
2. Target find switch - NORM
3. Range switch - X100

WRCS CONTROL PANEL

1. Target distance N/S knob - N274
2. Target distance E/W knob - E114
3. Target altitude/range knob - 000
4. Drag coefficient knob - 2.00
5. Release advance knob - 900
6. Release range knob - 050

RADAR TURNON

WARNING

- (P) To prevent possible injury to personnel from rf radiation through the radar antenna, do not press the cage button during ground operation unless the radar power knob is in TEST.
- (WSO) During ground operations, check that the pilot has the missile power switch in OFF or STBY prior to moving the radar power knob beyond the TEST position.

CAUTION

- Do not energize the Target Find/Offset Bomb modes unless the aircraft altitude is greater than the altitude set in the target altitude/range counter. Damage to the pitch servo may occur.
- The radar power knob should remain OFF until the aircraft is operating on internal power and the engines are up to IDLE power.
- To prevent damage to the pulse transmitter, do not rapidly cycle the radar mode knob, the pulse switch or the power knob.
- The missile power switch must be OFF during ground operations except when needed for BIT or missile tuning.
- During hot weather conditions, delay radar turnon as long as practical. Damage to the radar or klystron transmitter may occur prior to illumination of the TEMP light. If the radar overtemp light illuminates during extended ground operation, turn the radar OFF. If radar operation is required and a ground air conditioning unit is not available, momentarily advance either engine to 85 percent rpm to assure that the equipment air conditioning shutoff valve is energized open and then maintain that engine rpm as follows:

AMBIENT TEMP (MAX) °F	% ENGINE RPM (MIN)
0	65
59	75
90	80
103	85

CAUTION

- If engine power on either engine cannot be adjusted as in the table of Ambient Temp. versus Engine RPM, the radar should not be operated for more than 5 minutes with the ambient temperature above 90°F or for more than 10 minutes with ambient temperature below 90°F.

NOTE

A continuous break X display indicates ACM computer malfunction.

1. (P) Sight mode knob - STBY

NOTE

The optical sight is placed in STBY at this time to provide warmup time prior to performing BIT 2 of the Optical Sight Check. Approximately 5 minutes is required to completely erect the lead computing gyroscope.

2. (WSO) Radar power knob - TEST
3. After 30 seconds, 0A thru -250 VDC read in 1 area; +35 VDC reads 2.0 or greater.
4. (P-WSO) Radar scopes - TURN ON
 - a. Operate/erase button - PRESS
5. Radar overtemp light - OUT

DVST (AFTER OFF P005)

6. Display knob - V1
7. Vc switch - 900
8. Vc switch - 2700
9. Display knob - B-WIDE

RADAR SCOPE CAMERA**CAUTION**

To prevent damage to the camera correlator lights, do not partially remove/install the film magazine. Always remove the magazine completely, then reinstall. On some cameras, the door will not close with the magazine improperly installed.

NOTE

Prior to performing this check, ensure the camera connector is connected to the receptacle on the base of the radar scope rack.

1. Aft console light knob - FULL CLOCKWISE
2. Camera power switch - ON
 - a. Green continuity light - ON
 - b. Amber film remaining light - ON
3. Camera power switch - OFF
4. Film magazine - INSTALL
 - a. Insert magazine into clamps so that magazine is aligned with sprocket gear on top left side.
 - b. Close camera door.
5. Camera power switch - ON
 - a. Amber film remaining light - OFF
6. BIT switch - ACTIVATE
 - a. Correlator lights - ALL 7 LIGHTS ON
7. Witness mark switch - MC
 - a. Number 7 correlator light - ON

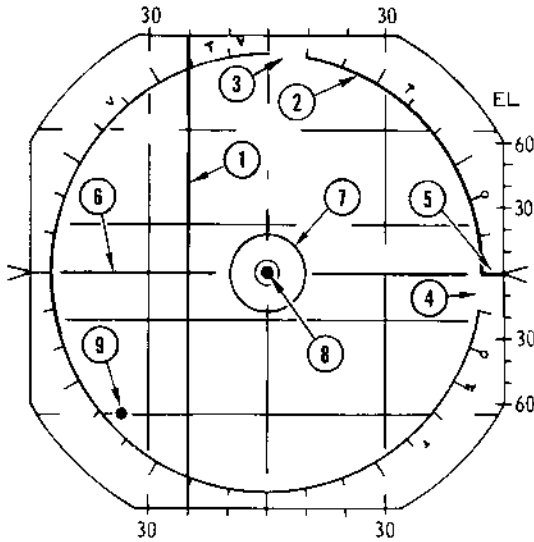
NOTE

Illumination of all seven lights can be viewed by WSO. Perform steps 6 and 7 to record lamp status of all seven correlator lights. Correlator light function cannot be determined except by performing the event that the light monitors. In step 7, the No. 7 correlator light is on momentarily (for one frame) for each switch actuation to the MC position.

8. Acquisition rate select - SET AS REQUIRED
9. Outer filter lever - ADJUST
10. Film title - INSERT
11. After 15 seconds, film title - REMOVE
12. Camera power switch - OFF (if not required for BIT filming).

AIR-TO-AIR BIT CHECKS (DVST)

BIT 0 DVST



1. B-SWEEP (SCANNING)
2. RANGE RATE CIRCLE
3. Vc GAP (STBY SELECTED)
4. Vc GAP (TEST SELECTED)
5. ELEVATION STROBE
6. HORIZON LINE
7. ASE CIRCLE
8. AIM DOT (STBY SELECTED)
9. AIM DOT (TEST SELECTED)

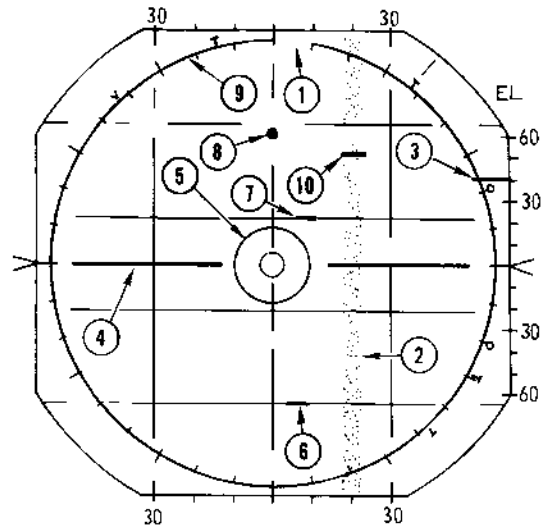
4E-34-1-1-(317)A

Figure 2-11

4. Test knob - DOT BAL & HOLD
 - a. Vc gap at 3:00 (figure 2-11).
 - b. Aim dot in calibration area.
5. (P) Adjust horizon line for zero pitch. (CALL)
6. Position EL strobe 30° down.

The 30° down position prevents the radar antenna from hitting the mechanical stops during BIT 1.
7. Stab switch - OUT
 - a. Horizon line is removed.
8. Stab switch -NOR
9. Radar power knob -STBY

BIT 6 DVST



1. Vc GAP AT 12:00 O'CLOCK (AIM-7E MISSILES/PLUGS INSTALLED OR STATION EMPTY. 3:00 O'CLOCK INDICATES AIM-7F MISSILES/PLUGS INSTALLED, CW ON OR STBY)
2. B-SWEEP (DITHERED, NO TARGETS) (20° RIGHT)
3. ELEVATION STROBE (40° UP)
4. HORIZON LINE
5. ASE CIRCLE FIXED (.56" DIA) NO VARIANCE
6. Rmin STROBE 5 ± 1.25 MILES
7. Rmax STROBE 15 ± 1.5 MILES
8. AIM DOT (STATIONARY IN UPPER CALIBRATION AREA)
9. RANGE RATE CIRCLE
10. RANGE STROBE

1 BEFORE OFF P005.

4E-34-1-1-(318)B

Figure 2-12

RADAR CHECKS

AIM DOT AND Vc GAP CALIBRATION

1. Radar power knob - STBY
2. Test knob - DOT BAL & HOLD
 - a. Vc gap at 12:00 (figure 2-11).
 - b. Aim dot centered.
3. Radar power knob - TEST

AIM-7 ATTACK DISPLAY AND INTERLOCKS

1. Test knob - 6 (figure 2-12)
2. Radar power knob - TEST
3. Missile power switch - STBY
4. Position range strobe beyond 15 miles.
 - a. Rmax at 15 miles, Rmin at 5 miles.
 - b. After OFP P005, the OFP version number will be displayed for the first 10 seconds by the Vc gap for example, OFP version P005 will be approximately 500 knots.
5. Move range strobe down (manually or with full action).
 - a. Vc gap programs as shown.
 - b. HOLD ALTITUDE light ON then OFF. (CALL) When hold altitude light goes OUT, Vc gap at 12 o'clock indicates AIM-7E missiles/plugs installed or stations empty. At 3 o'clock indicates AIM-7F missiles/plugs installed.
 - c. Aim dot stationary in upper calibration area.
 - d. IN RANGE and SHOOT lights ON when range strobe is between Rmax and Rmin.
 - e. ASE circle fixed at 0.56 inch diameter.
 - f. IN RANGE and shoot lights OFF and break X occurs when range strobe is aligned with Rmin. (CALL)
6. Radar power knob - STBY

RADAR SIGNALS CHECK

1. Radar mode - RDR
2. Meter switch - SIGNALS
3. Meter selector - ROTATE
 - a. CIR - No Deflection
 - b. LIN - Needle in 1 area
 - c. LOV - Sweeps within the limits of 1.5 to 2.8
 - d. TP-2, TP-1 - 1 area
 - e. EX2 thru RX1 - XTAJ area
4. Select MAG on meter selector
5. Radar mode - MAP

MINIMUM DISCERNIBLE SIGNAL, LOCKON SENSITIVITY, RANGE TRACK MEMORY

1. Test knob - 1 (figure 2-13)
2. Radar power knob - TEST
 - a. Monitor meter (RDR MAG) indicates 1.4 to 1.8
 - b. Horizon line as shown
3. Adjust scopes for maximum persistency and gain.
 - a. Minimum of 11 targets visible in search
 - b. Position range knob to 5, 10, 50, 100, 200, and 25 while checking uniform video presentation on all ranges.
4. Place acquisition symbol beyond last target.
5. Move range strobe down while holding full action.
 - a. Range strobe locks on before passing seven targets.
 - b. Maintain lockon for 5 seconds.
6. Test knob - 0
 - a. System unlocks in 4 to 6 seconds.
7. Test knob - 1
8. Pulse switch - SHORT
 - a. Monitor meter (RDR MAG) indicates 0.9 to 1.15.
 - b. Minimum of eight targets visible in search
9. Place acquisition symbol beyond last target.
10. Move range strobe down while holding full action.
 - a. Range strobe locks on before passing eight targets.
 - b. Maintain lockon for 5 seconds

11. Test knob - 0 for 3 seconds then select TEST 1
 - a. System goes into memory for 3 seconds then reacquires lockon (SKIN TRK light OFF then ON).

NOTE

Check is invalid and should be reaccomplished if targets do not reappear before break lock occurs.

Ranging, coding, 28 volts delayed -

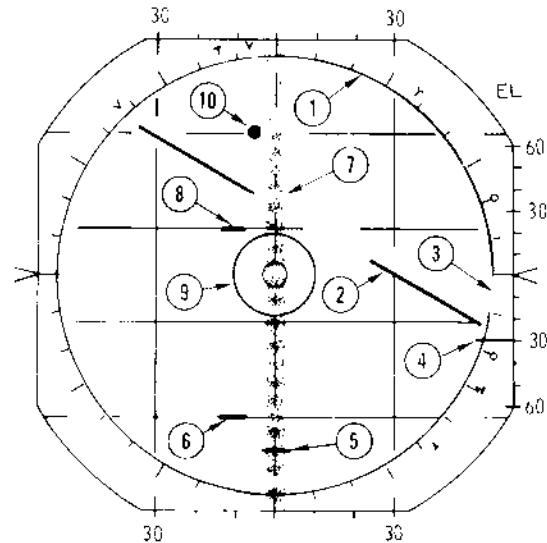
WARNING

The cw transmitter will create a radiation hazard to the ground crew if operated on the ground unless the radar power knob is in TEST.

CAUTION

Do not cycle the radar power knob between TEST and STBY when cw power is ON. Damage to the cw transmitter could result if waveguide switch has not cycled.

BIT 1 DVST



1. RANGE RATE CIRCLE
2. HORIZON LINE (30° ROLL AND DIVE)
3. Vc GAP POSITION FOR CORRECT RANGING-CODING 28V DELAYED
4. ELEVATION STROBE (30°)
5. RANGE STROBE
6. Rmin STROBE 5 ± 1.25 MILES
7. B SWEEP (WITH WCAK TEST TARGETS)
8. Rmax STROBE 15 ± 1.5 MILES
9. ASE CIRCLE FIXED (.56" DIA)
10. AIM DOT

1 BEFORE OFP P005

4F 34 1 1319-B

Figure 2-13

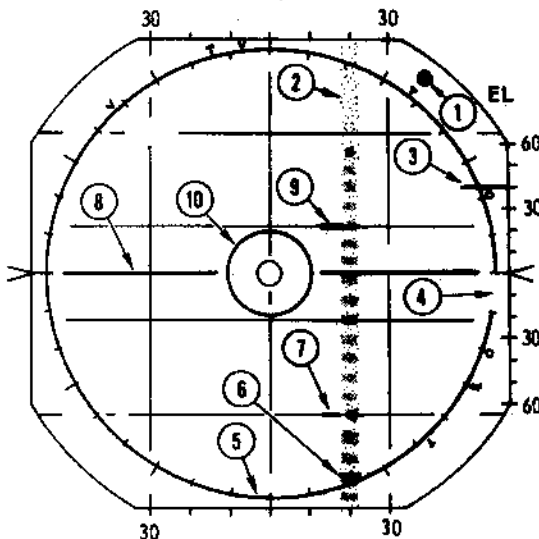
12. (P) Radar missile power switch - STBY FOR 1 MINUTE
13. (P) Radar missile power switch - CW ON
Check missile tuning (if applicable).
 - a. RDR light - ON STEADY 1 MINUTE

CAUTION

To prevent possible heat damage to the AIM-7 missile, the maximum ground time for radar missile power switch in STBY or CW ON should be limited to 10 minutes when the ambient temperature is 90°F or greater or 15 minutes when the ambient temperature is below 90°F.

14. Meter selector - KLY
 - a. Monitor meter reads 0.25 to 1.25
15. Lock on third target.
 - a. Aim dot steady in upper calibration area
 - b. Vc gap between 0 scribes
 - c. Break lock

BIT 2 DVST



1. AIM DOT
2. B-SWEEP (DITHERED, AT 20° RIGHT WITH STRONG TARGETS)
3. ELEVATION STROBE (40° UP)
4. Vc GAP FOR CORRECT ANTENNA POSITION
5. RANGE RATE CIRCLE
6. RANGE STROBE (ON 2nd TARGET)
7. Rmin STROBE 5 ± 1.25 MILES
8. HORIZON LINE
9. Rmax STROBE 15 ± 1.5 MILES
10. ASE CIRCLE FIXED (.56" DIA)

1 BEFORE OFF P005.

4E-34-1-1-(320)B

Figure 2-14

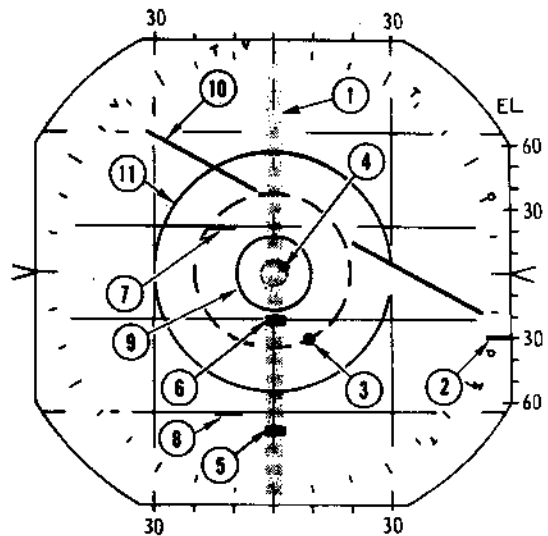
RANGE TRACK ACCELERATION, ANTENNA POSITION

1. Test knob - 2 (figure 2-14)
2. Lock on 10th target.
 - a. System breaks lock in less than 30 seconds.
3. Lock on second target.
 - a. System maintains lock for at least 30 seconds.
 - b. Vc gap between 0 scribes.
4. Break lock.
5. Pulse switch - AUTO

Beacon check

6. Radar mode knob - BEACON
 - a. BIT targets disappear and at least one beacon target reappears
7. Radar mode knob - MAP

BIT 3 DVST



1. B-SWEEP (DITHERED, 0°).
2. ELEVATION STROBE (-30°) AFTER LOCKON.
3. AIM DOT ROTATES BETWEEN ASE & RANGE RATE CIRCLES (LOCKED ON 4TH TARGET).
4. AIM DOT ROTATES INSIDE ASE CIRCLE (LOCKED ON 10TH TARGET).
5. RANGE STROBE ON 4TH TARGET.
6. RANGE STROBE ON 10TH TARGET.
7. Rmax (ON 3RD SCRIBE) AT 15 MILES.
8. Rmin (ON 1ST SCRIBE) AT 5 MILES.
9. ASE CIRCLE.
10. HORIZON LINE.
11. RANGE RATE CIRCLE.

4E-34-1-1-(321)A

Figure 2-15

ANGLE TRACK

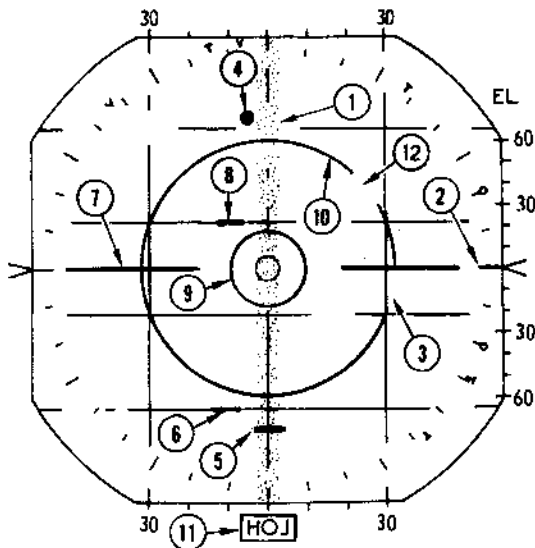
1. Test knob - 3 (figure 2-15)
 - a. B-sweep and EL strobe approximately 0° (before lockon).
2. Lock on fourth target.
 - a. Aim dot rotates between ASE and range rate circles (exceeding neither by more than 1/4 inch).

NOTE

On some aircraft, the aim dot rotation may cut through the circles. This should not be considered abnormal unless the tolerance is exceeded.

- b. Rmax and Rmin at 15 and 5 miles.
- c. Bottom of ASE circle in first blank segment of zero azimuth scribe.
- d. EL strobe goes 30° down (after lockon).
- 3. Break lock and lock on 10th target.
 - a. Aim dot rotates inside ASE circle.
- 4. Maintain lockon for BIT 4.

BIT 4 DVST



- 1. B-SWEEP (DITHERED, AT 0°, NO VISIBLE TARGETS)
- 2. ELEVATION STROBE (0°)
- 3. Vc GAP POSITION FOR CORRECT PSEUDO AND SIMULATED DOPPLER
- 4. AIM DOT IN UPPER CALIBRATION AREA (NOT MANUALLY POSITIONABLE)
- 5. RANGE STROBE (AT 4 MILES)
- 6. Rmin STROBE 5 ± 1.25 MILES
- 7. HORIZON LINE
- 8. Rmax STROBE 15 ± 1.5 MILES
- 9. ASE CIRCLE FIXED (.56" DIA)
- 10. RANGE RATE CIRCLE (1.9 ± 0.1 INCHES IN DIA)
- 11. HOJ LIGHT ON
- 12. Ve GAP POSITION FOR SIMULATED DOPPLER AFTER TO 1F-4-1424.

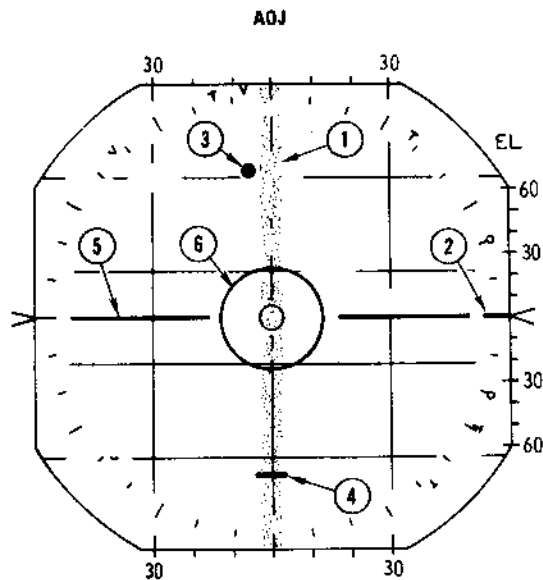
4E-34-1-1-3221A

Figure 2-16

HOJ, ANGLE TRACK MEMORY, AOJ, PSEUDO & SIMULATED DOPPLER, CORRIDOR SCAN

- 1. Test knob - 4 (figure 2-16)
 - a. Vc gap between 0 scribes with cw power on. (After TO 1F-4-1424, Vc gap between 1 o'clock and 2 o'clock.)
- 2. (P) Radar missile power switch - OFF (or when AIM-7 missiles are tuned)

BIT 4 DVST



- 1. B-SWEEP (DITHERED, AT 0°, NO VISIBLE TARGETS)
- 2. ELEVATION STROBE
- 3. AIM DOT IN UPPER CALIBRATION AREA (NOT MANUALLY POSITIONABLE)
- 4. RANGE STROBE (AT 4 MILE POSITION)
- 5. HORIZON LINE
- 6. ASE CIRCLE (1" DIA)

4E-34-1-1-(323)A

Figure 2-17

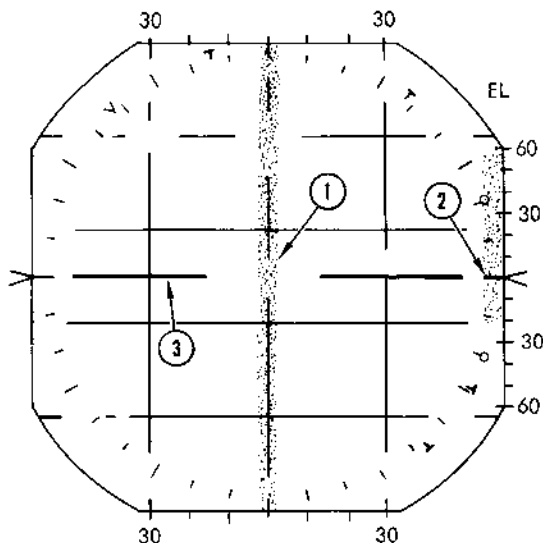
CAUTION

To prevent possible heat damage to the AIM-7 missile, the maximum ground time for radar missile power switch in STBY or CW ON should be limited to 10 minutes when the ambient temperature is 90°F or greater or 15 minutes when the ambient temperature is below 90°F.

- 3. Position B-sweep and EL strobe at 0° for reference.
- 4. Radar power knob - STBY
 - a. B-sweep and EL strobe drift less than ±5° before unlock (approximately 4 to 6 seconds)
- 5. Radar power knob - TEST
- 6. Action switch - FA
 - a. AOJ display, figure 2-17
- 7. Track switch - AOJ OUT
 - a. System return to search.
- 8. Track switch - AUTO
- 9. Display - VI
 - a. B-sweep shifts ±2° from zero position (figure 2-18).
 - b. EL-strobe scans from -21° to +57°.
- 10. Display - B-wide

BIT 4 DVST

COMPUTER CONTROLLED SCAN MODE



1. B-SWEEP (SHIFTING BETWEEN $+2^{\circ}$ AND -2° IN AZIMUTH)
2. ELEVATION STROBE ($+57^{\circ}$ TO -21° SWEEPING)
3. HORIZON LINE

4E-34-1-1(324)A

Figure 2-18

RANGE RATE NOISE, PLMS, CAA

NOTE

During the PLMS check it may be necessary to adjust receiver gain to achieve a stable lockon.

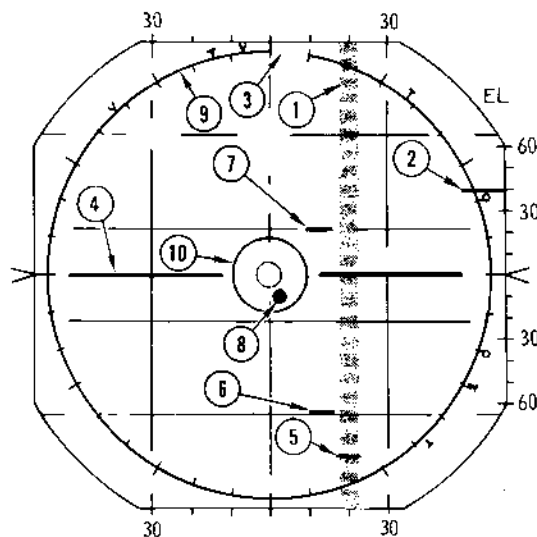
1. Test knob - 5 (figure 2-19)
2. Lock on third target
 - a. Vc gap at 12:00
 - b. Aim dot within ASE circle.
 - c. ASE circle as shown.
3. Break lock
4. Pulse switch - SHORT
5. (P) Sight mode knob - A/A
6. Radar mode knob - BST
7. Radar range knob - AI 5
8. (P) Auto acq button - PRESS and RELEASE
 - a. Radar locks on first target.

WARNING

Check personnel are clear of nose wheel before actuating the auto acq button.

BIT 5 DVST

RDR MODE



1. B-SWEEP (DITHERED, AT 20° RIGHT WITH STRONG TEST TARGETS)
2. ELEVATION STROBE (40° UP)
3. Vc GAP AT 12:00
4. HORIZON LINE
5. RANGE STROBE ON 3rd TARGET
6. Rmin STROBE 5 ± 1.25 MILES
7. Rmax STROBE 15 ± 1.5 MILES
8. AIM DOT (WANDERING WITHIN ASE CIRCLE)
9. RANGE RATE CIRCLE
10. ASE CIRCLE FIXED (.56" DIA)

4E-34-1-1 (325)A

Figure 2-19

NOTE

The optical sight check (figure 2-21) may be incorporated at this point.

9. (P) Auto acq button - PRESS and RELEASE
 - a. Radar breaks lock, range gate sweeps to next target and locks on.
 - b. Repeat this step through all targets.
10. Air-to-Air button - PRESS
 - a. Air-to-Air light - OFF
 - b. Radar control transfers to RCP.
11. Break lockon
12. Radar mode knob - MAP
13. Radar range knob - AI 25
14. Pulse switch - LONG
15. Lock on fifth target.
 - a. RDR MAG indicates 1.4 to 1.8
16. Pulse switch - AUTO
 - a. RDR MAG indicates 0.9 to 1.15 (PLMS).

DVST BIT FAULT ANALYSIS (A/A)

Step	Problem	Additional Tests	Status
NOTE			
A continuous break X indicates ACM computer malfunction. No AIM-7 capability exists except a BST shot.			
RADAR TURNON			
3	Voltage(s) out of limits	Check meter - VOLTS. Repeat check.	Possible degraded system. Perform remaining BIT checks to determine status.
5	TEMP light ON	Check -6, +12, and -25 volts on monitor meter.	If any of these voltages are fluctuating or out of tolerance, continue BIT checks to determine status. If voltages are in tolerance, turn radar OFF. If radar operation is required, the engine power setting must be advanced to 85% rpm.
BIT 0			
2a	Vc gap not at 12:00		Vc gap not properly calibrated. Note new Vc zero reference.
2b	Aim dot not centered		Aim dot not properly calibrated. Note new zero reference point for both BIT and operate.
4a	Vc gap not at 3:00	Check Vc - 2700	Vc gap not properly calibrated. Note new Vc gap reference for both BIT and operate.
4b	Aim dot not in calibration area		Aim dot not properly calibrated. Launch with aim dot as close to center as possible. BIT 5 may be affected. Possible ACM computer problem, perform remaining BITs.
BIT 6			
4A	Rmax not at 15 miles, Rmin not at 5 miles.	Check pinky switch - RADAR Check range - AI25, Check SHOOT/IN RANGE lights ON at 15 miles, check break X at 5 miles. Check BIT 3 step 2c.	Rmax/Rmin incorrect. Use SHOOT/IN RANGE lights for missile launch.
5a	Vc gap incorrect or inoperative.	Check CW PWR STBY or ON and proper sim plugs or missiles installed.	No AIM-7 capability.
5b	HOLD ALT light incorrect or inoperative.	Warning light - TEST	Hold altitude capability inoperative, estimate snop-up range.
5c	Aim dot erratic.	Check pinky switch - RADAR	Aim dot may be unreliable. Use SHOOT/IN RANGE lights for missile launch.
5e	ASE circle erratic.	Check pinky switch - RADAR	Use SHOOT/IN RANGE lights for missile launch.

CONTINUED

DVST BIT FAULT ANALYSIS (A/A) (CONT)

Step	Problem	Additional Tests	Status
RADAR SIGNALS CHECK			
3a	Needle deflects in CIR.	Check polar - LIN	Polarization plate stuck in CIR 1 position. No problem for missiles.
3b	No deflection in LIN.	Check needle in CIR. Check polar - LIN	If needle deflects in CIR, polarization plate stuck in CIR 1 position. If needle does not deflect in LIN or CIR, polarization plate may be stuck in CIR 2 position; minimal AIM-7 capability.
3c	Needle does not sweep in LOB.	Check radar mode - RDR	No feedhorn nutation which precludes angle track capability. Alternate modes: MAN track, BORESIGHT and ASPECT.
3d	No deflection in TP-1 and/or TP-2.	Repeat step after MAG time in (4 minutes)	If TP-2 is good and TP-1 is bad, temperature interlock is open. If TP-1 and TP-2 are bad, pressure interlock is open. Select EMER only under emergency conditions.
3e	XTAL out of limits.	Repeat check after MAG time in. Check targets in BIT 1.	Possible degraded receiver. May have weak or intermittent video.
BIT 1			
2a	RDR MAG out of tolerance.	Check pulse - AUTO	Degraded radar transmitter. Use SHORT pulse if capable. Alternate mode: BST
2b	Horizon line not in gap.	Check stabilization in STBY mode. Check BIT 0 step 5 performed correctly.	Use STBY stabilization if capable. Roll and/or pitch stabilization may be erratic. Use STAB OUT.
3a	Less than 11 targets in search.	Check receiver gain full clockwise. Check MAG and XTAL current. Check targets in SHORT pulse.	Possible degraded transmitter and/or receiver. Use SHORT pulse if capable. Alternate mode: BST and ASPECT.
3b	Video presentation not uniform.	Recheck receiver gain, persistency and intensity. Check SHORT pulse.	Possible write rate problem. Scope(s) may be used. Use appropriate range with best presentation.
5a	System fails to lock on before passing seven targets.		Degraded lockon capability. Use SHORT pulse if capable. Alternate modes: MAN track, BST and ASPECT.
6a	System does not break lock in 5 seconds.	Check track - AUTO	Degraded memory circuit. Closely monitor skin track light inflight for memory indication.
8a	RDR MAG out of tolerance.	Check pulse - SHORT	Degraded transmitter. Use LONG pulse if capable. Alternate mode: BST.
8b	Less than eight targets in search.	Check receiver gain full clockwise. Check MAG/XTAL current. Check targets in LONG pulse.	Possible degraded transmitter/receiver. Use LONG pulse if capable. Alternate mode: BST and ASPECT.
10a	System fails to lock on before passing eight targets.		Degraded lockon capability. Use LONG pulse if capable. Alternate modes: MAN track, BST and ASPECT.

CONTINUED

DVST BIT FAULT ANALYSIS (A/A) (CONT)

Step	Problem	Additional Tests	Status
11a	System does not reacquire lock on in range memory check.	If targets do not reappear before break lock occurs, check is invalid and should be performed again.	Degraded range memory circuit. Closely monitor skin track light for memory indications. If system goes into memory, reacquire lock with hand control.
14a	KLY drops to zero.	If missile previously tuned, place RDR MSL power sw to CW OFF for 1 minute to prevent possible damage to missile circuits. Then momentarily advance either engine RPM to 85% and place RDR MSL power sw to CW ON.	If KLY voltage returns and/or missiles tune, full AIM-7 capability is available.
	KLY out of limits HIGH	None	If missiles tune, full AIM-7 capability is probable.
	KLY out of limits LOW	None	Marginal AIM-7 capability. If missiles tune, maximum missile range will be degraded.
15b	Vc gap out of limits. (Ranging/coding/28V delayed)	Cycle radar missile power switch to STBY, then CW ON and observe Vc gap.	If the Vc gap moves and the missiles tune, ranging and/or coding is at fault and the mission may be flown with marginal AIM-7 capability.
BIT 2			
2a	(1) Range strobe does not drive off target; system does not break lock. (2) Range strobe drives off but system does not break lock.		(1) Degraded range track acceleration capability in SHORT pulse. Alternate mode: LONG pulse, MAN track, BST and ASPECT. (2) Degraded target detection circuit and/or memory circuit. System may transfer lock to clutter/altitude line. Monitor closely.
3a	System breaks lock on second target.		Degraded range track acceleration circuit. System may break lock on high velocity/accelerating targets. Alternate modes: MAN track, BST and ASPECT.
3b	Vc gap out of limits (antenna position).		No AIM-7 capability. Select alternate weapon system.
6a	No Beacon targets.	Check beacon in operate.	If beacon works in OPR but not in TEST, MAG is not driving to correct beacon BIT frequency. No beacon capability if it does not work in OPR. Occasionally MAG motor drive will bind. Slowly cycle mode switch between BCN and RDR until targets appear.
BIT 3			
1a	B-sweep and/or EL strobe out of tolerance.		B-sweep and/or EL strobe calibration out of limits. Compensate for off center scope presentation.
2a	(1) Aim dot does not rotate.	Check track - AUTO Check angle track in operate.	(1) Azimuth and/or elevation angle tracking is inoperative. Alternate mode: MAN track, BST and ASPECT.

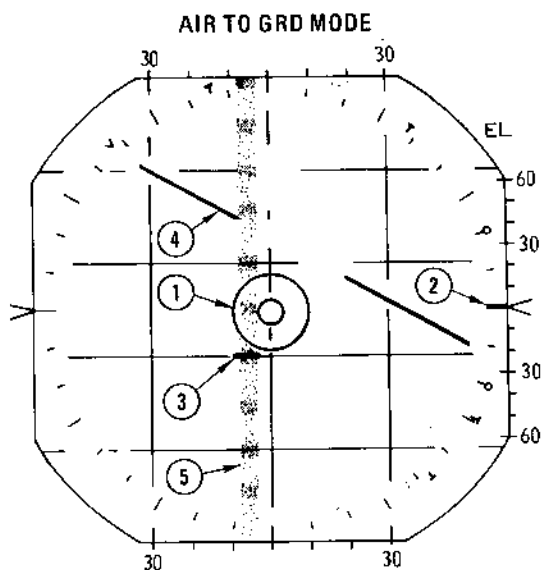
CONTINUED

DVST BIT FAULT ANALYSIS (A/A) (CONT)

Step	Problem	Additional Tests	Status
2b	(2) Aim dot rotates out of limits. Rmax and/or Rmin out of tolerance.	Check range - AI 25	(2) Automatic gain control is at fault; system may transfer lock to clutter/altitude line. Rmax and/or Rmin scope display out of alignment. Affects BIT 6. IN RANGE light and ASE circle not affected.
2c	ASE circle size out of tolerance.		ASE circle scope display out of tolerance. Use interlocks OUT. Attempt to center aim dot prior to launch.
2d	EL strobe does not go 30° down.		EL strobe position will be unreliable during tracking.
BIT 4			
1a	Vc gap out of limits (pseudo/simulated doppler). (After TO 1F-4-1424, simulated doppler.)	Before TO 1F-4-1424, check missile tuning in ARM and SAFE. After TO 1F-4-1424, no additional test.	If missiles tune in ARM, no missile degradation. If missiles do not tune in ARM, no AIM-7 capability. (After TO 1F-4-1424, if missiles do not tune in SAFE, no AIM-7 capability.)
1b	No HOJ indication.	Warning light - TEST.	If light tests good, degraded HOJ capability.
4a	B-sweep/EL strobe drift more than 10° during angle track memory check.		Degraded angle track memory circuit. Closely monitor skin track light for memory indication. If system goes into memory, reacquire lockon with hand control.
6a	No AOJ display.	Check track - AUTO	Degraded AOJ capability.
7a	System does not return to search with AOJ OUT.		Aircrew cannot preclude AOJ function.
9a, b	No CAA scan		No CAA capability.
BIT 5			
2c	ASE circle out of tolerance.	Check locked on third target.	ASE incorrect. Attempt to center aim dot. Use interlocks OUT.
8a, 9a	Range strobe does not sweep out and/or lockon in auto acq	Check BST/5 mi range selected. Check auto acq in operate. Check auto acq from rear cockpit.	No auto acq capability. Cage mode affected.
16a	PLMS does not occur	Check pulse - AUTO	System may PLMS late or not at all. Manually select SHORT pulse when target return is strong enough to maintain lockon.

AIR-TO-GROUND BIT CHECKS (DVST)

BIT 5 DVST



- | |
|---|
| <ol style="list-style-type: none"> 1. ASE CIRCLE FIXED (.56" DIA) 2. ELEVATION STROBE 0° 3. RANGE STROBE ON 4th TARGET 4. HORIZON LINE 5. B-SWEEP (DITHERED, AT 5° LEFT WITH STRONG TEST TARGETS IN HA; TARGETS FADE WHEN LOCKED ON) |
|---|

4E-34-1-1-(326)A

Figure 2-20

RANGE SLOPE AND ZERO

1. (P) Sight mode knob - A/G
2. Radar power knob - TEST
3. Radar range knob - AI 5
4. Radar mode knob - A/G
5. Test knob - 5 (figure 2-20)
 - a. Monitor (RDR MAG) - 0.9 to 1.15
 - b. B-sweep 5° ± 3° left of center.
 - c. Acquisition symbol centered on B-sweep (before lockon).
 - d. Horizon line indicates 30° left bank and 30° dive (same as BIT 1 and 3).
6. Lock on first target.
 - a. ASE circle appears and B-sweep fades (AGC). AGC action reduces the B-sweep intensity and the weaker test targets fade. However, it is not abnormal for the stronger test targets to be visible in the B-sweep.
 - b. (P) range bar at 5:00 within ± 5° (6000 feet).
7. Lock on second target.
 - a. (P) range bar at 3:00 within ± 5° (12,000 feet).
8. Lock on third target.
 - a. (P) range bar at 1:00 within ± 5° (18,000 feet).

BOMB RANGE STROBE CALIBRATION

1. Test knob - 1
2. Display knob - PPI WIDE
3. Radar mode knob - MAP
4. Radar range knob - AI 10
 - a. PPI sweep scans 120° sector.
 - b. PPI sweep drift offset 5.6°.
 - c. Far edge of bombing strobe just touches appropriate BIT target.

WRCS BIT

1. INS - ALIGN or NAV
2. Target alt/range knob - 170
3. ARBCS bombing timers - SET
 - a. Pullup - 5.0
 - b. Release - 10.0
4. (P) BRG/DIST switch - NAV COMP
5. (WSO) Nav mode switch - NAV COMP

NOTE

- If aircraft power is interrupted or fluctuates during a BIT check, a NO GO indication may occur and the BIT check should be repeated.
- If a momentary NO GO is indicated as the BIT button is released, disregard indication if a GO is obtained with button pressed.

LAYDOWN MISSION

1. WRCS BIT selector - LAYDOWN
2. BIT button - PUSH and HOLD
3. After 5 seconds, FRZ button - PUSH ON
 - a. Range indicator - ON
 - b. After 15 seconds - GO/NO GO

DIVE LAYDOWN MISSION

1. WRCS BIT selector - DIVE LAYDOWN
2. BIT button - PUSH and HOLD
3. After 5 seconds, FRZ button - PUSH ON
 - a. Alt indicator - ON
 - b. After 15 seconds - GO/NO GO

DIVE TOSS MISSION

1. WRCS BIT selector - DIVE TOSS
2. BIT button - PUSH and HOLD
3. After 5 seconds, FRZ button - PUSH ON
 - a. Alt indicator - ON
 - b. After 15 seconds - GO/NO GO

AGM-45 MISSION

1. WRCS BIT selector - AGM-45
2. BIT button - PUSH and HOLD
 - a. BDHI and HSI miles - 7.6 ± 1.0 NM
 - b. Alt indicator - ON
3. After 5 seconds, FRZ button - PUSH ON
 - a. BDHI and HSI miles DECREASE
 - b. AOA lower indexer - PULL UP COMMAND
 - c. After 10 seconds, AOA center indexer - LEVEL COMMAND
 - d. After 5 seconds - GO/NO GO
 - e. After 5 seconds, AOA upper indexer - DIVE COMMAND

TARGET FIND/OFFSET BOMB MISSION

1. WRCS BIT selector - TGT FIND/OFFSET BOMB
2. BIT button - PUSH and HOLD
 - a. Alt indicator - ON
3. After 5 seconds, along track cursor control - MOVE
4. Cross track control - MOVE
5. Cursor intensity - ADJUST

6. Reset button - PUSH
 - a. Cursors return to zero range and azimuth.
7. Target insert button - PUSH ON
 - a. Along track cursor - 6.5 NM on 0° grid line (± 2000 feet)
 - b. Cross track cursor - $30^{\circ} \pm 1.5^{\circ}$ RIGHT.
 - c. (P) HSI bearing pointer - $23^{\circ} \pm 2.5^{\circ}$ (right of lubber); HSI TGT light - ON
 - d. TGT INS light - ON
 - e. BDHI #1 needle - $23^{\circ} \pm 2.5^{\circ}$ (right of top index)
 - f. (P-WSO) HSI and BDHI miles - 4.8 ± 1.0 NM
 - g. (P) Sight roll tabs - ROTATED CLOCKWISE
 - h. (P) ADI vertical pointer - DEFLECTS FULL RIGHT
8. After 5 seconds, FRZ button - PUSH ON
 - a. (P-WSO) HSI and BDHI miles - DECREASE TO ZERO, THEN INCREASE
 - b. (P) Sight roll tabs - ROTATES (as miles pass through zero)
 - c. After 15 seconds - GO/NO GO

BOMB RANGE CALIBRATION/INTEGRATION CHECK

1. INS mode - NAV
2. WRCS control panel - SET
 - a. Target distance N/S - N120
 - b. Target distance E/W - 000
 - c. Target altitude - SET PRESENT AIRCRAFT HSL (29.92)
 - d. Release advance - 000
 - e. Release range - 000
3. Weapons delivery panel - SET
 - a. Activate switch - NORM
 - b. Target find switch - HOLD
 - c. Range switch - X100
4. Front cockpit switches - SET
 - a. Delivery mode - T LAD
 - b. Weapon select - BOMBS
 - c. Station select buttons - OFF
 - d. Armament override - PUSH IN

NOTE

Tone and ADI steering indications are not available if ARM is selected.

5. Timers - SET (values for delivery)
 - a. Pullup timer
 - b. Release timer
6. Target insert button - PUSH ON
 - a. Along track cursor - Jumps to second BIT target
7. WRCS distance counters N/S - Increase or decrease until near edges of along track cursor and second BIT target coincide.
 - a. Note difference between counter and N120.
 - b. For larger counter value, correction is +; for smaller counter value the correction is -.
8. Target distance N/S - RESET
 - a. Set preflight release range adjusted for calibration error in step 7.
 - b. Release range switch - NORM or X100 (as required)
 - c. Activate switch - ON
9. Release range counter - INCREASE (slowly until 1/3 second tone)
 - a. Check timer accuracy.
 - b. (P) Check LABS indications.

- c. Note difference between derived RR counter reading and preflight release/activation range and apply as correction to all ranges.
 (1) For larger counter value, correction is +; for smaller counter value, the correction is -.

FCS range cursor or will have isolated any system malfunction which may have existed.

NOTE

This is a correction factor only and does not indicate a system malfunction or deficiency. Previous air-to-ground BIT checks will have verified the operational status of the INS, and

WRCS TURN OFF

1. WRCS BIT selector - RELEASE and OFF
2. Target alt/range counter - 000
3. Weapons delivery panel
 - a. Activate switch - NORM
 - b. Target find switch - NORM
 - c. Range switch - NORM
4. WRCS control panel - RESET

BIT FAULT ANALYSIS (A/G)

Step	Problem	Additional Tests	Status
RANGE SLOPE AND ZERO			
5a	MAG does not indicate 0.9 to 1.15.	Manually select SHORT pulse and check MAG indication.	Use SHORT pulse if capable and continue mission.
5b	B-sweep drift stabilization is erratic or incorrect.	Check B-sweep scope calibration in boresight. Compare drift with BDHI indications while airborne.	If B-sweep scope calibration is shifted, use new reference and recheck drift. If drift is erratic or incorrect, use A/G with a CAGED sight and DRIFT OUT.
5c	Acquisition symbol not centered on B-sweep.	Recheck in BST.	Possible indication of deflection or display problem. Most likely Rmax and Rmin strobes will be affected. If lockon can be achieved, mission can be accomplished.
5d	Horizon line does not indicate 30° left bank and 30° dive.	Recheck horizon line in BIT 1, 3.	Roll & pitch stabilization may be erratic. Use STAB OUT.
6	System does not lock on in A/G.		Degraded A/G lockon capability. Manually track ground return with hand control in HA. Reduce receiver gain prior to manual track.
6a	B-sweep does not fade.		Automatic Gain Control (AGC) is degraded. Manually track ground return with hand control in HA. Reduce receiver gain prior to manual track.
6b 7a 8a	Range bar out of tolerance.	Check sight mode - A/G. Compare VI meter with range bar while locked on 1st target in A/A radar mode.	A/G range slope is out of alignment. Use alternate bombing mode. In this check the tolerances for the VI and/or range bar must be considered.
BOMB RANGE STROBE CALIBRATION			
4c	Bomb strobe miscalibrated.		If slight inaccuracy can be accepted, adjust strobe with screwdriver adjustment on antenna hand control.
WRCS BITS			
Any or all	NO GO	Recheck switches and WRCS inputs; repeat check.	If NO GO repeats, select an alternate delivery mode.

CONTINUED

BIT FAULT ANALYSIS (A/G) (CONT)

Step	Problem	Additional Tests	Status
BOMB RANGE CALIBRATION/INTEGRATION CHECK			
9	System does not integrate.	Recheck switches and WRCS inputs and repeat check.	Use alternate delivery mode.
9a	ARBCS timers out of tolerance.	Check timer settings; check timers in T LAD only.	Use stopwatch method of LADD delivery.

POST BIT (DVST)

- | | |
|-------------------------------------|-----------------------------|
| 1. Radar missile power switch - OFF | 4. Weapon select knob - C |
| 2. Guns/missile switch - RADAR | 5. Delivery mode knob - OFF |
| 3. Master arm switch - SAFE | 6. Sight mode knob - STBY |

SCRAMBLE BIT (DVST)

PREBIT SWITCH SETUP

1. Radar missile power switch - OFF
2. Guns/missile switch - RADAR
3. Master arm switch - SAFE
4. Interlock switch - IN or OUT
5. Weapon select knob - C
6. Delivery mode knob - OFF
7. HSI mode knob - NAV COMP

RADAR SET CONTROL PANEL

1. Radar power knob - OFF
2. Radar range knob - AI 25
3. Polar switch - LIN
4. Maneuver switch - HI G
5. Scan switch - 1 BAR
6. Aspect knob - OPTIONAL
7. Receiver gain knob - FULL CLOCKWISE
8. Track switch - AUTO
9. Display knob - B WIDE
10. Manual Vc knob - 0
11. Pulse switch - AUTO
12. Radar mode knob - MAP
13. Air-to-air light - OFF

CONTROL MONITOR PANEL

1. Meter selector knob - -250VDC
2. Test knob - BIT 1
3. Meter switch - SIGNALS
4. Vc knob - 2700
5. Stab switch - NOR

TURNON/SCRAMBLE BIT CHECK

1. Radar power knob - TEST
2. (P) Operate erase button - PRESS
3. (P) Missile power switch - STBY
4. (P) (MAG current present) Missile power switch - CW ON
5. Lock on third target.
If system breaks lock during test, relock on third target
6. Aim dot is stationary in upper calibration area.
 - a. Vc gap between 0 scribes (ranging/coding).
 - b. Rmax and Rmin at 15 ± 1.5 miles and 5 ± 1.25 miles respectively.
7. Maintain lockon and select BIT 2.
 - a. Vc gap between 0 scribes (antenna position).
8. Select BIT 3 and lock on 4th target.
 - a. Aim dot rotates.
9. Maintain lockon and select BIT 4.
 - a. Vc gap between 0 scribes (pseudo/simulated doppler). (After TO 1F-4-1424, Vc gap between 1 o'clock and 2 o'clock, simulated doppler).
10. Maintain lockon and select BIT 5.
 - a. Vc gap at 12 o'clock.
 - b. Aim dot inside ASE circle.
11. Select BIT 6, move range strobe between Rmax and Rmin.
 - a. Aim dot in upper calibration area.
 - b. IN RANGE/SHOOT lights ON.
12. (P) Check AIM-7 missiles tuned.
13. (P) Radar missile power switch - STBY

DVST BIT FAULT ANALYSIS (SCRAMBLE)

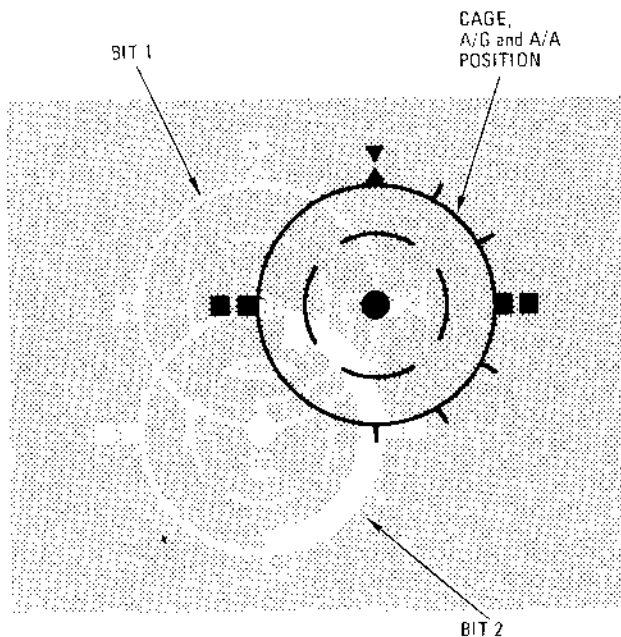
Step	Problem	Additional Tests	Status
SCRAMBLE BIT			
5a	Vc gap out of tolerance in BIT 1 (ranging/coding/28 volts delayed)		If missiles do not tune in ARM, no AIM-7 capability. If missiles tune in ARM, marginal AIM-7 capability due to ranging/coding faults.
6a	Vc gap out of tolerance in BIT 2 (antenna position).		No AIM-7 capability; select alternate weapon system.
7a	Aim dot does not rotate.		Angle track inoperative. Alternate modes: MAN track, BST and ASPECT.
8a	Vc gap out of tolerance in BIT 4 (simulated/pseudo doppler). (After TO 1F-4-1424, simulated doppler.)		If missiles tune in ARM, no mission degradation. If missiles do not tune in ARM, no AIM-7 capability. (After TO 1F-4-1424, if missiles do not tune in SAFE, no AIM-7 capability.)
9b	Aim dot out of tolerance in BIT 5.		Degradation of range rate accuracy and missile envelope.

CAGE MODE CHECK (AIRBORNE)

1. Guns/missile switch - RADAR
2. Sight mode knob - A/G
3. (WSO) Radar power knob - STBY
4. (WSO) Radar range knob - AI 25
5. (WSO) Track switch - AUTO
6. (WSO) Pulse switch - AUTO
7. (WSO) Radar mode knob - MAP
8. (P) CAGE button - PRESS and RELEASE
 - a. (P) Pipper moves to RBL
 - b. (WSO) Air-to-air light ON
 - c. (WSO) B-sweep and EL strobe - 0°
 - d. (P-WSO) Scope display - AI 5
 - e. (WSO) Monitor (RDR MAG) - 0.9 to 1.15

9. (P) Weapon select knob - B then C
 - a. (WSO) Air-to-air light - OFF
10. (P) Cage button - PRESS and RELEASE
11. (P) Lock on target with CAA.
12. (P) Cage button - PRESS
 - a. Lock-on broken
13. (P) Guns/missile switch - GUNS
14. (P-WSO) Lock on target
15. (P) Cage button - PRESS and RELEASE
 - a. Lock-on maintained
16. (WSO) Air-to-air button - PUSH OFF
 - a. Air-to-air light - OFF
 - b. Monitor (RDR MAG) - 0
17. (WSO) Radar power knob - OPR

OPTICAL SIGHT CHECK



Notes

- a. 10 mils must be set into manual depression window for proper rear-out of BIT functions.
- b. Rear cockpit; radar power switch must be out of "Off" position for at least 30 seconds.

4E 34-1 1 12001

Figure 2-21

1. Pinky switch - RADAR
2. Sight shutter lever - OPEN
3. Sight mode knob - CAGE
4. Reticle depression knob - 35 MILS
5. Reticle intensity knob - AS REQUIRED
6. Armament switches - OFF/SAFE
 - a. Station green/amber lights - OFF
7. Delivery mode knob - DIRECT
8. Armament safety override button - PUSH IN
9. Sight mode knob - CAGE to A/G to A/A
 - a. Pipper (at RBL) moves no more than ± 2 mils.
10. Reticle depression knob - 10 MILS
11. Sight mode knob - BIT 1 (figure 2-21)
 - a. Reticle jumps 25 ± 4 mils left.
 - b. Roll tabs rotate 90° clockwise.
 - c. Range bar indicates 4000 feet (3 o'clock within $+15^\circ$.)
12. Sight mode knob - BIT 2 (figure 2-21)
 - a. Reticle drops down 25 ± 4 mils.
 - b. Roll tabs indicate level flight.
 - c. Range bar indicates 6700 feet (12:30 o'clock within $\pm 15^\circ$).

NOTE

The tab on the leading edge of the range bar may not be visible during BIT 2.

13. Sight mode knob - A/A
 - a. Pipper returns to RBL.
14. (WSO) Radar power knob - TEST
15. (WSO) Test knob - 5
16. (WSO) Range knob - AI 5
17. (WSO) Radar mode knob - BST
18. (WSO) Lock on first BIT target.
19. Pinky switch - RADAR to HEAT
 - a. Pipper remains at RBL.
20. Pinky switch - GUNS
 - a. Head-up GUN light - ON
 - b. Range bar indicates 6000 feet (1 o'clock within $\pm 15^\circ$).
 - c. Reticle slowly depresses (pipper angle ± 4 mils) according to the corresponding AOA:

AOA Units	Mils
0	(36)
5	(31)
10	(27)
15	(22)
20	(17)
25	(13)
30	(8)

21. Cage button - PRESS AND HOLD
 - a. Pipper moves to 1000 feet cage range (approx 2 mils below RBL).
 - b. Range bar remains at 6000 feet (1 o'clock within $\pm 15^\circ$).
22. (WSO) Break radar lock.
 - a. Range bar - OFF
 - b. Pipper moves to RBL.
23. Cage button - RELEASE
 - a. Pipper moves to 1000 feet cage range (approx 2 mils below RBL).
24. Sight mode knob - STBY or CAGE
25. Delivery mode knob - OFF
26. Armament safety override button - RESET

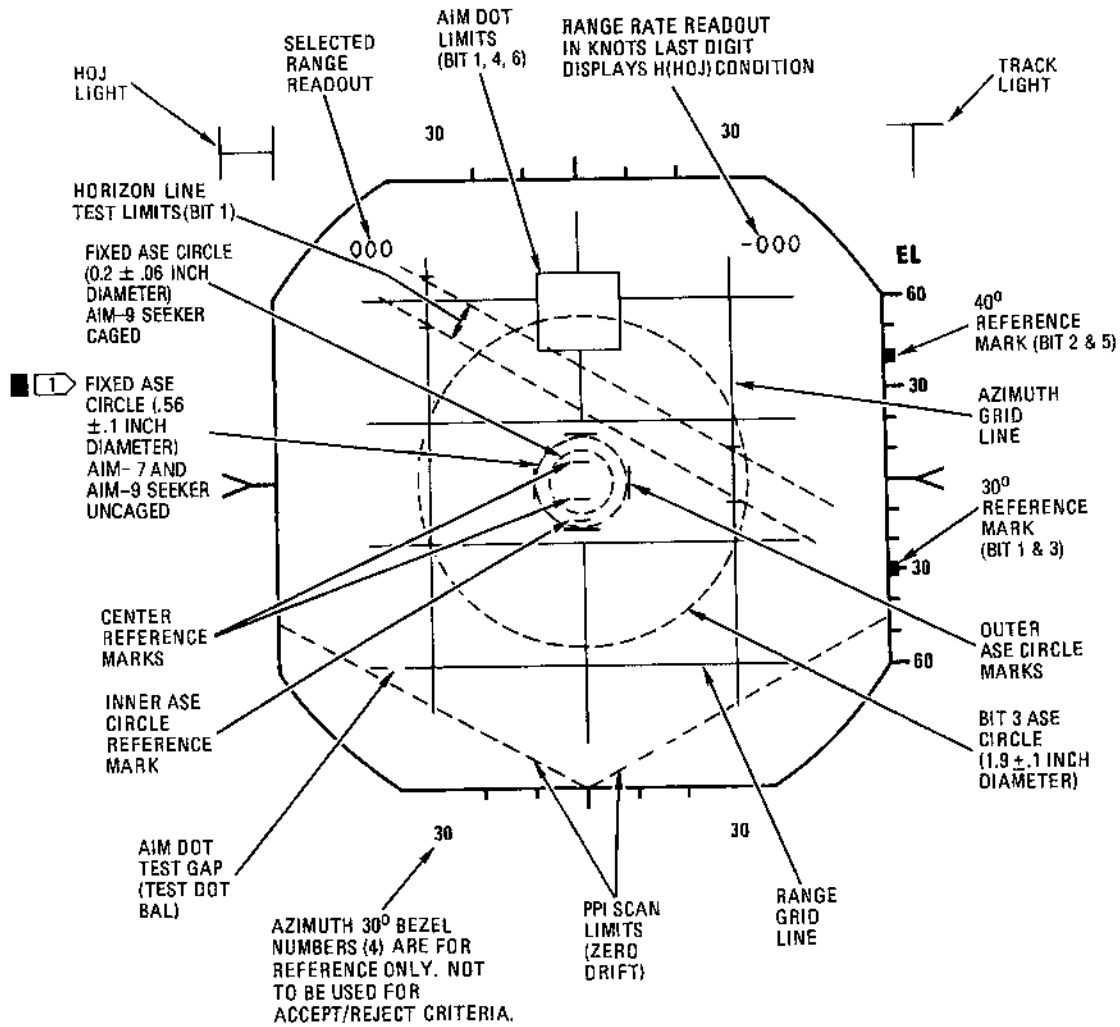
OPTICAL SIGHT BIT FAULT ANALYSIS

MODE	PROBLEM	STATUS
BIT I (Elevation)	Reticle goes to +10 mils with -10 set in the reticle depression control.	Manual depression CDX is functioning, but cannot be manually adjusted. Sight is useless for WRCS laydown, dive bombing, rockets air-to-ground, and guns air-to-ground. Dive toss, dive laydown, missile and guns air-to-air and offset bombing modes are operational.
BIT II (Elevation)	Reticle remains at RBL.	There is either no malfunction, or all modes except WRCS Laydown, missiles and guns air-to-air, and offset bomb are inoperative.
BIT I (Elevation)	Reticle drives to bottom of combining glass.	All modes inoperative.
BIT I (Elevation)	Reticle drives 35 mils to top of combining glass.	WRCS Laydown may be affected.
BIT II (Elevation)	Reticle drives down but not to 25 mils.	Correct lead angles are not being generated and lead computing operation is in error.
BIT I and BIT II	Reticle remains at RBL in elevation and azimuth.	Reticle may remain fixed at RBL in all modes.
BIT I	Reticle remains at RBL.	Reticle may remain at RBL in all modes. Reticle may not respond to drift signal applied in Dive Laydown, WRCS Laydown, or Dive Toss. Lead compute operation is unaffected.
BIT I and BIT II (Azimuth)	Reticle travels to extreme left of combining glass.	Lead computations are incorrect.
BIT II (Azimuth)	Reticle remains at RBL in azimuth after being 25 mils to left in BIT I.	BIT malfunction - should not affect lead compute mode.
BIT I and BIT II	Jittery reticle.	Problem present in all modes.
BIT I and BIT II	Analog bar is in stow position.	Analog bar remains stowed in all modes and lead compute operation is not possible.
BIT I	Analog bar is at 1,500-foot position.	BIT malfunction - analog bar should function properly in all modes. Ranging and lead compute may be correct.
BIT II	Analog bar is at 1,000-foot or 4,000-foot position.	BIT malfunction - analog bar should function properly in all modes. Ranging and lead compute may be correct.
BIT I and BIT II	Analog bar keeps driving.	Problem present in all modes.
BIT I and BIT II	Analog bar is jittery.	Problem present in all modes.
BIT I and BIT II	Analog bar sticks.	Problem present in all modes.
BIT I	Tab remain at wings-level.	BIT malfunction - roll tabs may or may not function.

OPTICAL SIGHT BIT FAULT ANALYSIS (CONT)

MODE	PROBLEM	STATUS
BIT I and BIT II	Roll tabs rotate continuously.	Roll not functional in any mode.
BIT I and BIT II	Jittery roll tabs.	Problem present in all modes.

DSCG BIT DISPLAY GRID



NOTE

DOTTED LINES ARE NOT DISPLAYED ON INDICATOR
 ■ 1 BEFORE OFF P005.

4E-34-1-1-(327)C

Figure 2-22.

All data on pages 2-37 thru 2-51 including figures 2-23 thru 2-31 deleted.

BIT CHECKS (DSCG)

PREBIT SWITCH SETUP

DSCG BIT display grid is shown in figure 2-22.

WEAPON CONTROLS

1. Radar missile power switch - OFF
2. Guns/missile switch - RADAR
3. Master arm switch - SAFE
4. Interlock switch - IN
5. Weapon selector knob - C
6. Delivery mode knob - OFF
7. HSI mode knob - NAV COMP

FRONT SCOPE CONTROLS

1. Brightness control knob - MID POSITION
2. Contrast control knob - MID POSITION
3. Scale control knob - MAX CCW

REAR SCOPE CONTROLS

1. Mode control knob - OFF
2. Brightness control knob - MID (5) POSITION
3. Contrast control knob - MID (5) POSITION
4. Scale control knob - MAX CCW
5. Grid control knob - MAX CCW
6. Range control cursor knob - MAX CCW
7. Offset control cursor knob - MAX CCW

RADAR SET CONTROL PANEL

1. Radar power knob - OFF
2. Polar switch - LIN
3. Radar range knob - AI 25
4. Maneuver switch - HI G
5. Scan switch - 1 BAR
6. Aspect knob - NOSE
7. Receiver gain knob - FULL CLOCKWISE
8. Track switch - AUTO
9. Display knob - B-WIDE
10. Manual Vc knob - 0
11. Pulse switch - AUTO
12. Radar mode knob - MAP

NOTE

To increase the serviceable life on the radar feed horn assembly components, the MAP mode should be used, except when mission requirements dictate use of the RADAR mode.

13. Air-to-air light - OFF

CONTROL MONITOR PANEL

1. Meter selector knob - \emptyset A
2. Test knob - 0
3. Meter switch - VOLT
4. Vc switch - 2700

NOTE

With the DSCG, the 900 position of the Vc switch is not used.

5. Stab switch - NOR

WEAPON DELIVERY PANEL

1. Activate switch - NORM
2. Target find switch - NORM
3. Range switch - X100

WRCS CONTROL PANEL

1. Target distance N/S knob - N274
2. Target distance E/W knob - E114
3. Target altitude/range knob - 000
4. Drag coefficient knob - 2.00
5. Release advance knob - 900
6. Release range knob - 050

RADAR TURNON

WARNING

- (P) To prevent possible injury to personnel from rf radiation through the radar antenna, do not press the cage button during ground operation unless the radar power switch is in TEST.
- (WSO) During ground operation, ensure that the pilot has the radar missile power switch in OFF or STBY prior to moving the radar power switch beyond the TEST position.

CAUTION

- Do not energize the TARGET FIND/OFFSET BOMB modes unless the aircraft altitude is greater than the altitude set in the target altitude range counter. Damage to the pitch servo may occur.
- The radar power knob should remain OFF until the aircraft is operating on internal power and the engines are up to IDLE power.
- To prevent damage to the pulse transmitter, do not rapidly cycle the radar mode knob, the pulse switch, or the power knob.
- The missile power switch must be OFF during ground operations except when needed for BIT or missile tuning.

CAUTION

During hot weather conditions, delay radar turnon as long as practical. Damage to the radar or klystron transmitter may occur prior to illumination of the TEMP light. If the radar overtemp light illuminates during extended ground operation, turn the radar OFF. If radar operation is required and a ground air conditioning unit is not available, momentarily advance either engine to 85 percent rpm to assure that the equipment air conditioning shut-off valve is energized open and then maintain that engine rpm as follows:

AMBIENT TEMP (MAX)	% ENGINE RPM (MIN)
0	65
59	75
90	80
103	85

- If engine power on either engine can not be adjusted as in the table of Ambient Temp versus Engine RPM, the radar should not be operated for more than 5 minutes with the ambient temperature above 90°F or for more than 10 minutes with ambient temperature below 90°F.

1. (P) Sight mode knob - STBY

NOTE

The optical sight is placed in STBY at this time to provide warmup time prior to performing BIT 2 of the Optical Sight Check. Approximately 5 minutes is required to completely erect the lead computing gyroscope.

2. Radar power knob - TEST
3. After 30 seconds, ϕ A thru -250 VDC read in 1 area; +35 VDC reads 2.0 or greater.
4. Radar scopes - TURN ON
 - a. (WSO) DSCG mode knob - RDR
 - b. (WSO) (DMAS) SNSR SEL panel, radar SELECT button - PRESS
 - c. (P) Block 36 thru 48 (71-236); Scope display select switch - RADAR (Aircraft 71-237 and up) RDR SEL button -PRESS
5. Radar overtemp light - OUT
6. Scale and grid control knobs - ADJUST
 - a. Scale light and radar grid brightness vary in response.
7. Scope radar grids - CHECK
 - a. Center azimuth line aligned with upper and lower 0° bezel scribes (figure 2-22)

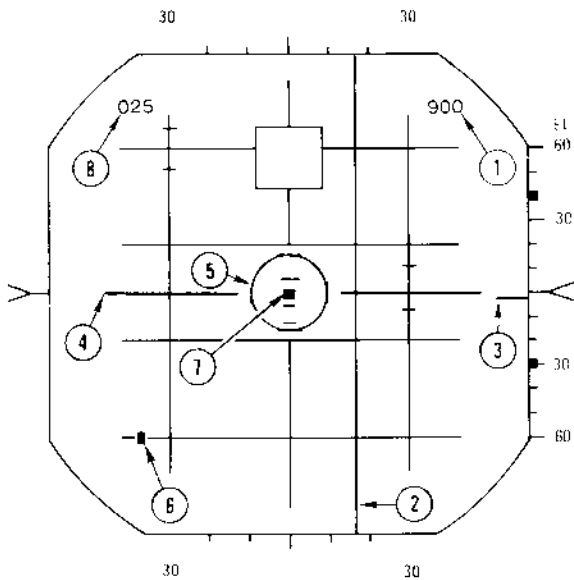
NOTE

The scope 30° azimuth bezel digits are for reference only and are not to be used as an accept or reject criteria in the preceding step.

8. Radar range knob - AI 25

AIR-TO-AIR BIT CHECKS (DSCG)

BIT 0 DSCG



- 1. RANGE RATE READOUT
- 2. B-SWEEP (SCANNING)
- 3. ELEVATION STROBE
- 4. HORIZON LINE
- 5. ASE CIRCLE (FIXED (.56" DIA))
- 6. AIM DOT (TEST SELECTED)
- 7. AIM DOT (STBY SELECTED)
- 8. SELECTED RANGE

BEFORE OFF P005.

4E 34 1 1 (338)B

Figure 2-32

RADAR CHECKS

AIM DOT AND RANGE RATE CALIBRATION

1. Radar power knob - STBY
2. DSCG mode knob - RDR BIT
 - a. Test grid present and center azimuth line is aligned with upper and lower 0° bezel line $\pm 1/16$ inches.
3. Test knob - DOT BAL and HOLD (figure 2-32)
 - a. Aim dot and ASE circle centered.
 - b. Range rate readout 0 ± 20 knots.
4. Radar power knob - TEST
5. Test knob - DOT BAL and HOLD (figure 2-32)
 - a. Aim dot in calibration area (within the gap of first range line).
 - b. Range rate readout 900 ± 50 knots.
6. (P) Adjust horizon line for zero pitch (CALL).
7. Radar range knob - AI 10
8. DSCG mode knob - DSCG TEST
 - a. Search display with eight shades of gray is present (background shading counts as one).
 - b. (P-WSO) Adjust BRT and CONTR knobs for optimum.

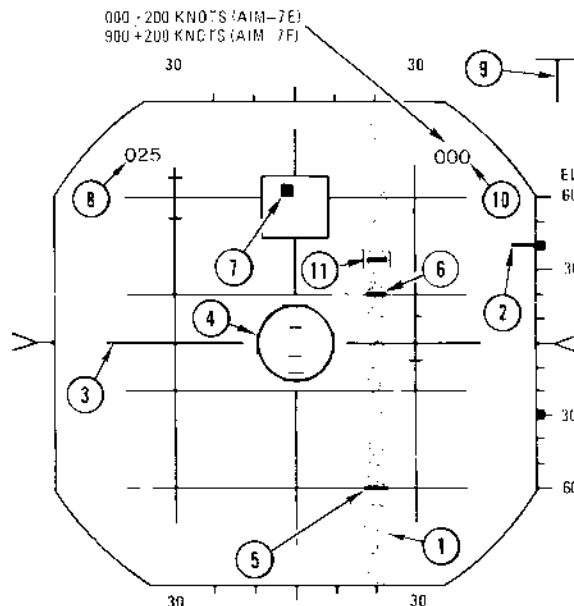
NOTE

With DSCG TEST selected, the acquisition symbol is limited to azimuth movement only.

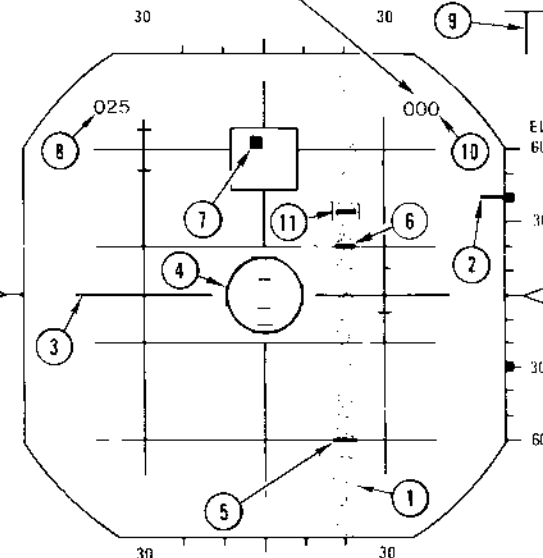
9. DSCG mode knob - RDR BIT
10. Radar range knob - AI 25
11. Position the EL strobe 30° down.

The 30° down position prevents the radar antenna from hitting the mechanical stops during BIT 1.
12. Stab switch - OUT
 - a. Horizon line is removed.
13. Stab switch - NOR
14. Radar power knob - STBY

BIT 6 DSCG



000 - 200 KNOTS (AIM-7E)
900 - 200 KNOTS (AIM-7F)



- 1. B-SWEEP (DITHERED, NO TARGETS, 20° RIGHT)
- 2. ELEVATION STROBE (40° UP)
- 3. HORIZON LINE
- 4. ASE CIRCLE FIXED (.56" DIA)
- 5. Rmin STROBE AT 5 MILES
- 6. Rmax STROBE 15 \pm 1.5 MILES
- 7. AIM DOT (STATIONARY IN AIM DOT TEST LIMIT BOX)
- 8. SELECTED RANGE
- 9. TRK LIGHT ON
- 10. RANGE RATE READOUT (NO MANUAL CONTROL)
 - 000 KNOTS - INDICATES AIM-7E MISSILES/PLUGS INSTALLED OR EMPTY STATIONS.
 - 900 KNOTS - INDICATES AIM-7F MISSILES/PLUGS INSTALLED, CW ON OR STBY.
- 11. RANGE STROBE (MANUAL CONTROL) AND ACO SYMBOL

BEFORE OFF P005.

4E 34 1 1 (337)B

Figure 2-33

AIM-7 ATTACK DISPLAY AND INTERLOCKS

1. Test knob - 6 (figure 2-33)
The T (track) light illuminates but SKIN TRK light remains OFF during this test. This is a normal indication with the DSCG.
2. Radar power knob - TEST
3. Missile power switch - STBY
4. Position range strobe beyond 15 miles.
 - a. Rmax at 15 ± 1.5 miles, Rmin at 5 ± 1.25 miles.
 - b. Range rate 000 knots indicates AIM-7E missiles/plugs installed or stations empty. 900 knots indicates AIM-7F missiles/plugs installed. After OFF P005, the OFF version number will be displayed for the first 10 seconds in place of range rate readout for example, OFFP version P005 will be approximately 500 knots.
5. Move range strobe down (with half action or full action)
 - a. Aim dot stationary inside box.
 - b. HOLD ALT light ON beyond 15 miles, OFF at 15 miles.
 - c. IN RANGE and SHOOT lights ON when range strobe is between Rmax and Rmin.
 - d. ASE circle remains fixed in size.
 - e. Break X occurs, IN RANGE/SHOOT lights OFF at 5 miles or less.
6. Radar power knob - STBY

RADAR SIGNALS CHECK

1. Radar mode - RDR
2. Meter switch - SIGNALS
3. Meter selector - ROTATE
 - a. CIR - No deflection
 - b. LIN - Needle in 1 area
 - c. LOB - Sweeps within the limits of 1.5 to 2.8
 - d. TP-2, TP-1 - 1 area
 - e. EX2 thru RX1 - XTAL area
4. Meter selector - MAG
5. Radar mode knob - MAP

MINIMUM DISCERNIBLE SIGNAL, LOCKON SENSITIVITY, RANGE TRACK MEMORY

1. Test knob - 1 (figure 2-34)
2. Radar power knob - TEST
 - a. Monitor meter (RDR MAG) indicates 1.4 to 1.8.
 - b. Horizon line within limit markers as shown.
3. Adjust indicators for optimum contrast (CONTR) and brightness (BRT).
 - a. Minimum 11 targets visible in search.
 - b. Position range knob to 5, 10, 50, 100, 200, and 25 while checking uniform video presentation on all ranges.
4. Place acquisition symbol beyond last target.
5. Move range strobe down while holding full action.
 - a. Range strobe locks on before passing seven targets.
 - b. Maintain lockon for 5 seconds.
6. Test knob - 0
 - a. System unlocks in 4 to 6 seconds.

7. Test knob - 1
8. Pulse switch - SHORT
 - a. Monitor meter (RDR MAG) indicates 0.9 to 1.15.
 - b. Minimum of eight targets visible in search.
9. Place acquisition symbol beyond last target.

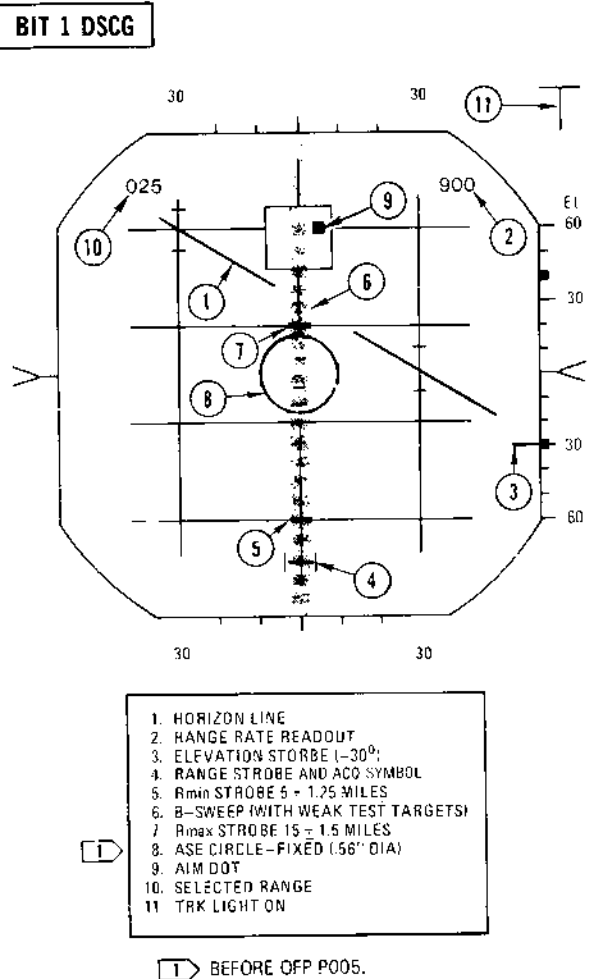


Figure 2-34

4E-34-1 1 (338)R

10. Move range strobe down while holding full action.
 - a. Range strobe locks on before passing eight targets.
 - b. Maintain lockon for 5 seconds.
11. Test knob - 0 for 3 seconds then select TEST 1
 - a. System goes into memory for 3 seconds, then re-acquires lockon (SKIN TRK and T lights OFF, then ON).
 - b. Range rate readout flashes at 4 HZ for 3 seconds.

NOTE

Check is invalid and should be reaccomplished if targets do not reappear before break lock occurs.

Ranging, coding, 28 volts delayed

WARNING

The cw transmitter will create a radiation hazard to the ground crew if operated on the ground unless the radar power knob is in TEST.

CAUTION

Do not cycle the radar power knob between TEST and STBY when cw power is on. Damage to the cw transmitter could result.

12. (P) Radar missile power switch - STBY FOR 1 MINUTE
13. (P) Radar missile power switch - CW ON
 - a. RDR light - ON STEADY 1 MINUTE

CAUTION

To prevent possible heat damage to the AIM-7 missile, the maximum ground time for radar missile power switch in STBY or CW ON should be limited to 10 minutes when the ambient temperature is 90°F or greater or 15 minutes when the ambient temperature is below 90°F.

14. Meter selector - KLY
 - a. Meter reads 0.25 to 1.25
15. Lock on third target.
 - a. Aim dot in box.
 - b. Range rate 900 ± 200 knots.
 - c. Break lock.

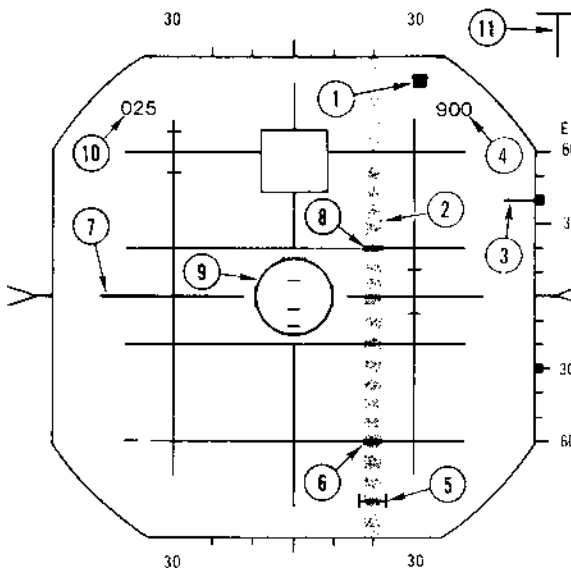
RANGE TRACK ACCELERATION, ANTENNA POSITION

1. Test knob - 2 (figure 2-35)
2. Lock on 10th target.
 - a. System breaks lock in less than 30 seconds.
3. Lock on second target.
 - a. System maintains lock for at least 30 seconds.
 - b. Range rate readout 900 ± 200 knots
4. Break lock.
5. Pulse switch - AUTO

Beacon check

6. Radar mode knob - BEACON
 - a. BIT targets disappears and at least one beacon target reappears.
7. Radar mode knob - MAP

BIT 2 DSCG



1. AIM DOT
2. B-SWEEP (DITHERED, AT 20° RIGHT WITH STRONG TARGETS)
3. ELEVATION STROBE (40° UP)
4. RANGE RATE READOUT 900 ± 200 KNOTS
5. RANGE STROBE (ON 2nd TARGET) AND ACO SYMBOL
6. Rmin STROBE 5 ± 1.25 MILES
7. HORIZON LINE
8. Rmax STROBE 15 ± 1.5 MILES
9. ASE CIRCLE - FIXED (1.56" DIA)
10. SELECTED RANGE
11. TRK LIGHT ON

BEFORE OFF P005.

4E 34 1 1 (339)B

Figure 2-35

ANGLE TRACK

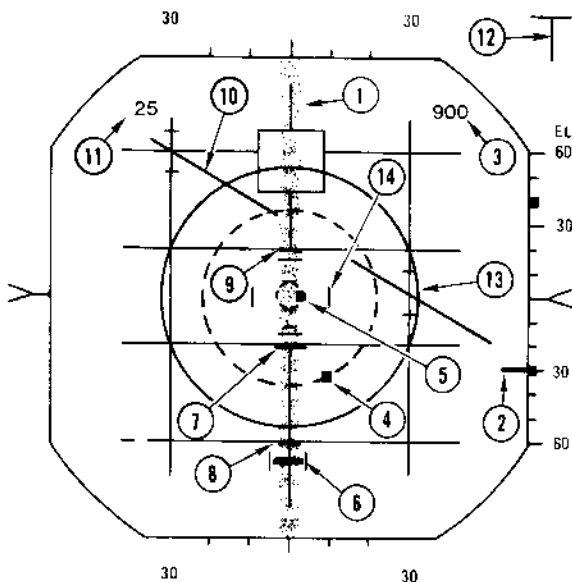
1. Test knob - 3 (figure 2-36).
 - a. B-sweep and EL strobe at 0° ± 2° (before lockon).
2. Lock on fourth target.
 - a. Aim dot rotates between ASE circle and the segmented circle (exceeding neither by more than 1/4 inch).

NOTE

On some aircraft, the aim dot rotation may cut through the circles. This should not be considered abnormal unless the tolerance is exceeded.

- b. Rmax and Rmin at 15 and 5 miles.
 - c. ASE circle as shown.
 - d. EL strobe goes 30° down (after lockon).
3. Break lock and lock on 10th target.
- a. Aim dot rotates inside ASE circle.
4. Maintain lockon for BIT 4.

BIT 3 DSCG



1. B-SWEEP (DITHERED, AT 0° WITH STRONG TEST TARGETS)
2. ELEVATION STROBE (-30°) AFTER LOCKON
3. DISREGARD RANGE RATE
4. AIM DOT (ROTATING) LOCKED ON 4th TARGET
5. AIM DOT (ROTATING) LOCKED ON 10th TARGET
6. RANGE STROBE ON 4th TARGET AND ACQ SYMBOL
7. RANGE STROBE ON 10th TARGET
8. Rmin STROBE AND 5th TARGET ALIGNED ON FIRST RANGE GRID LINE
9. Rmax STROBE AND 15th TARGET ALIGNED ON 3rd RANGE GRID LINE
10. HORIZON LINE
11. SELECTED RANGE
12. TRK LIGHT ON
13. ASE CIRCLE (INTERSECTS 10 AND 15 MILE GRID AT 30°)
14. OUTER LIMIT MARKS

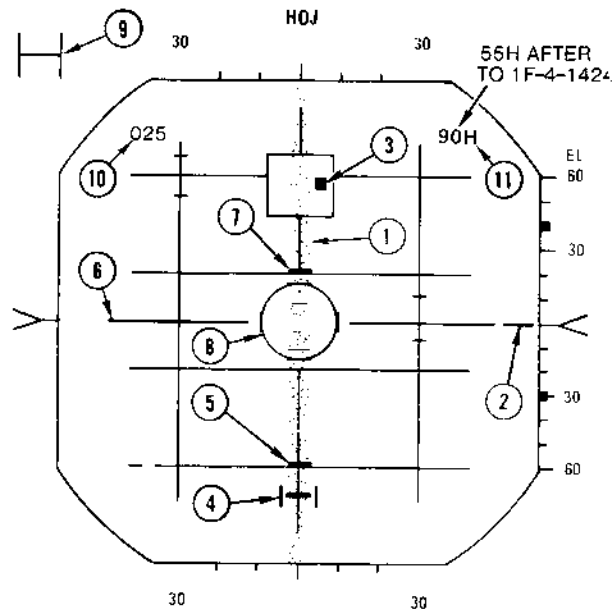
4E-34-1-1-(340)A

Figure 2-36

HOJ, ANGLE TRACK MEMORY, AOJ, PSEUDO & SIMULATED DOPPLER, CORRIDOR SCAN

1. Test knob - 4 (figure 2-36A).
 - a. All BIT targets disappear but lockon presentation remains.
 - b. H light ON.
 - c. Range rate readout flashing, indicates 900 ± 200 knots, and last digit is replaced with the letter H. (After TO 1F-4-1424, range rate is 550 ± 150 knots.)
2. (P) Radar missile power switch - OFF (or when AIM-7 missiles are turned)

BIT 4 DSCG



1. B-SWEEP (DITHERED, at 0°, NO VISIBLE TARGETS)
2. ELEVATION STROBE (0°)
3. AIM DOT IN TEST LIMIT BOX (NOT MANUALLY POSITIONABLE)
4. RANGE STROBE (AT 4 MILES) AND ACQ SYMBOL
5. Rmin STROBE 5 ± 1.25 MILES
6. HORIZON LINE
7. Rmax STROBE 15 ± 1.5 MILES
8. ASE CIRCLE - FIXED (.56" DIA)
9. HOJ LIGHT ON
10. SELECTED RANGE
11. RANGE RATE READOUT (FLASHING) LAST DIGIT DISPLAYS H

1 BEFORE OFF P005.

Figure 2-36A

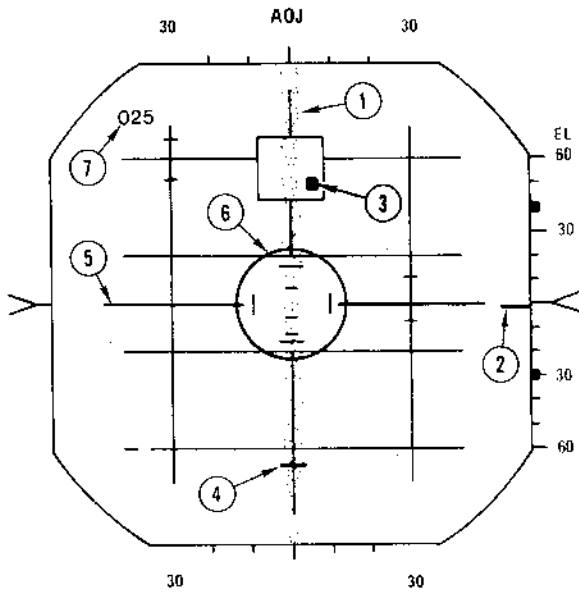
4E-34-1-1-(341)B

CAUTION

To prevent possible heat damage to the AIM-7 missile, the maximum ground time for radar missile power switch in STBY or CW ON should be limited to 10 minutes when the ambient temperature is 90°F or greater or 15 minutes when the ambient temperature is below 90°F.

3. Position B-sweep and EL strobe at 0° for reference.
4. Radar power knob - STBY.
 - a. B-sweep and EL strobe drift less than ±5° before unlock.
5. Radar power knob - TEST
6. Action switch - FA (figure 2-36B)
 - a. AOJ display appears.
 - b. Range rate readout disappears and H light OFF.
7. Track switch - AOJ OUT
 - a. System returns to search.
8. Track switch - AUTO
9. Display - VI
 - a. B-sweep before OFF P005, shifts ±2° from zero position, after OFF P005, covers 3 bars on selected CAA corridor.
 - b. EL-strobe scans from -21° to +57°
10. Display - B-wide

BIT 4 DSCG

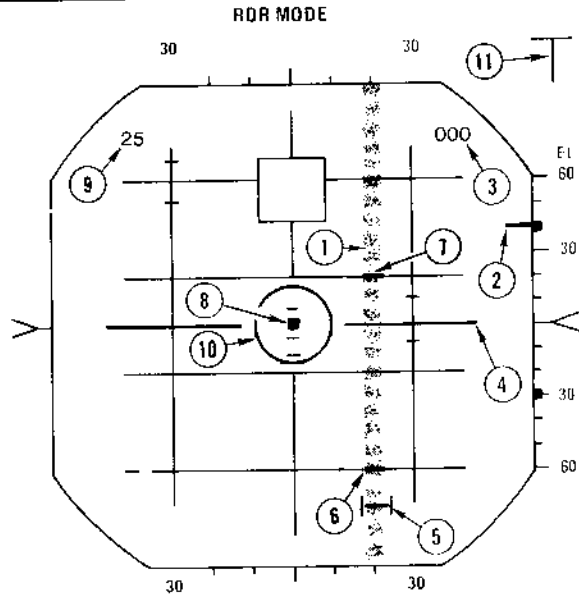


1. B-SWEEP (DITHERED, AT 0°, NO VISIBLE TARGETS)
2. ELEVATION STROBE
3. AIM DOT IN TEST LIMIT BDX (NOT MANUALLY POSITIONABLE)
4. RANGE STROBE (AT 4 MILES)
5. HORIZON LINE
6. ASE CIRCLE (1" DIA)
7. SELECTED RANGE

Figure 2-36B

4E-34-1-1-(342)A

BIT 5 DSCG



1. B SWEEP (DITHERED, AT 20° RIGHT WITH STRONG TEST TARGETS)
2. ELEVATION STROBE (40° UP)
3. RANGE RATE READOUT, 000 - 300°
4. HORIZON LINE
5. RANGE STROBE ON 3rd TARGET AND ACO SYMBOL
6. Rmin STROBE 5 + 1.25 MILFS
7. Rmax STROBE 15 + 1.5 MILFS
8. AIM DOT POSITION WANDERING WITHIN ASE CIRCLE
9. SELECTED RANGE
10. ASE CIRCLE - FIXED (1.56" DIA)
11. TRK LIGHT ON



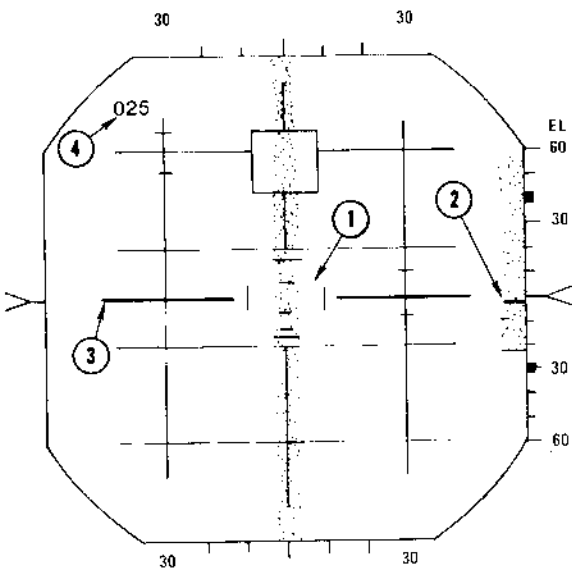
BEFORE OFF P005.

Figure 2-36D

4E 34 1 1 (344)C

BIT 4 DSCG

COMPUTER CONTROLLED SCAN MODE



1. B-SWEEP (SHIFTING BETWEEN 0 + 2° IN AZIMUTH)
2. ELEVATION STROBE (+57° TO -21° SWEEPING)
3. HORIZON LINE
4. SELECTED RANGE

Figure 2-36C

4E-34-1-1-(343)A

RANGE RATE NOISE, PLMS, CAA

NOTE

During PLMS check, it may be necessary to adjust the receiver gain to achieve a stable lockon.

1. Test knob - 5 (figure 2-36D)
2. Lock on third target.
 - a. Range rate readout 0 ± 300 knots.
 - b. Aim dot inside of ASE circle.
 - c. ASE circle 0.56 inch diameter.
3. Break lock.
4. Pulse switch - SHORT.
5. (P) Sight mode knob - A/A
6. Radar mode knob - BST
7. Range knob - AI 5
8. (P) Auto acq button - PRESS and RELEASE
 - a. Radar locks on first target.

WARNING

Check personnel are clear of nosewheel before actuating the auto acq button.

NOTE

The optical sight check (figure 2-21) may be incorporated at this point.

9. (P) Auto acq button - PRESS and RELEASE
 - a. Radar breaks lock, range gate sweeps to next target and locks on.
 - b. Repeat this step through all targets.
10. Air-to-air button - PRESS
 - a. Air-to-air light - OFF

- b. Radar control transfers to RCP.
11. Break lockon.
12. Radar mode knob - MAP
13. Range knob - AI 25
14. Pulse switch - LONG
15. Lock on fifth target.
 - a. RDR MAG indicates 1.4 to 1.8.
16. Pulse switch - AUTO
 - a. RDR MAG indicates 0.9 to 1.15 (PLMS).

After OFF P005

17. Aspect knob - TAIL
 - a. Range rate readout displays fighter heading (0°-360°)
18. Display knob - VI
 - a. Updates fighter heading display.
19. Display knob - B-WIDE
 - a. Discontinues fighter heading update.

)

)

)

)

)

)

)

)

)

DSCG BIT FAULT ANALYSIS (A/A)

Step	Problem	Additional Tests	Status
NOTE A continuous break X indicates ACM computer malfunction. No AIM-7 capability exists except a BST shot.			
RADAR TURNON			
3	Voltage(s) out of limits,	Check meter - VOLTS. Repeat check.	Possible degraded system. Perform remaining BIT checks to determine status.
5	TEMP light ON.	Check -6, +12, and -25 volts on monitor meter.	If any of these voltages are fluctuating or out of tolerance, continue BIT checks to determine status. If voltages are in tolerance, turn radar OFF. If radar operation is required, the engine power setting must be advanced to 85% rpm.
BIT 0			
3a	Aim dot not centered.		Aim dot not properly calibrated. Note new zero point reference for both BIT and operate.
3b	Range rate readout out of tolerance.	Check Vc - 2700	Possible degraded DSCG system. Perform remaining BIT checks to determine status.
5a	Aim dot not in calibration area		Aim dot not properly calibrated. Launch with aim dot as close to center as possible. BIT 5 may be affected. Possible ACM computer problem, perform remaining BITs.
5b	Range rate readout out of tolerance.	Check Vc - 2700	Possible degraded DSCG system. Perform remaining BIT checks to determine status.
BIT 6			
4a	Rmax not 15 ± 1.5 miles. Rmin not 5 ± 1.25 miles	Check pinky switch - RADAR Check range - AI 25. Check BIT 3.	Use SHOOT lights. Estimate missile range parameters.
5a	Aim dot not stationary in box	Check pinky switch - RADAR. Perform remaining BITs.	Same as above.
5c	SHOOT/IN RANGE lights inoperative.	Warning light - TEST	Use radar display for missile launch.

CONTINUED

DSCG BIT FAULT ANALYSIS (A/A) (CONT)

Step	Problem	Additional Tests	Status
RADAR SIGNALS CHECK			
3a	Needle deflects in CIR.	Check polar - LIN	Polarization plate stuck in CIR 1 position. No problem for missiles.
3b	No deflection in LIN.	Check needle in CIR. Check polar - LIN	If needle deflects in CIR, polarization plate stuck in CIR 1 position. If needle does not deflect in LIN or CIR, polarization plate may be stuck in CIR 2 position; minimal AIM-7 capability.
3c	Needle does not sweep in LOB.	Check radar mode - RDR.	No feedhorn nutation which precludes angle track capability. Alternate modes; MAN track, BST and ASPECT.
3d	No deflection in TP-1 and/or TP-2.	Repeat step after MAG time in (4 minutes).	If TP-2 is good and TP-1 is bad, temperature interlock is open. If TP-1 and TP-2 are bad, pressure interlock is open. Select EMER only under emergency conditions.
3e	XTAL out of limits.	Repeat check after MAG time in. Check targets in BIT 1.	Possible degraded receiver. May have weak or intermittent video.
BIT 1			
2a	RDR MAG out of tolerance.	Check pulse - AUTO	Degraded radar transmitter. Use SHORT pulse if capable. Alternate mode: BST.
2b	Horizon line not within limit markers.	Check stabilization in STBY mode. Check BIT 0 step 5 performed correctly.	Use STBY stabilization if capable. Roll and/or pitch stabilization may be erratic. Use STAB OUT.
3a	Less than 11 targets.	Check receiver gain full clockwise. Check MAG and XTAL current. Check targets in SHORT.	Possible degraded transmitter and/or receiver. Use SHORT pulse if capable. Alternate mode: BST and ASPECT.
3b	Video presentation not uniform.	Recheck receiver gain, contrast and brightness. Check SHORT pulse.	Scope(s) may be used. Use appropriate range with best presentation.
5a	System fails to lock on before passing seven targets.		Degraded lockon capability. Use SHORT pulse if capable. Alternate modes: MAN track, BST and ASPECT.
6a	System does not break lock in 5 seconds.	Check track - AUTO	Degraded memory circuit. Closely monitor skin track light inflight for memory indications.
8a	RDR MAG out of tolerance.	Check pulse - SHORT	Degraded transmitter. Use LONG pulse if capable. Alternate mode: BST.
8b	Less than eight targets in search.	Check receiver gain full clockwise. Check MAG/XTAL current. Check targets in LONG pulse.	Possible degraded transmitter/receiver. Use LONG pulse if capable. Alternate mode: BST and ASPECT.
10a	System fails to lock on before passing eight targets.		Degraded lockon capability. Use LONG pulse if capable. Alternate modes: MAN track, BST and ASPECT.

CONTINUED

DSCG BIT FAULT ANALYSIS (A/A) (CONT)

Step	Problem	Additional Tests	Status
11a	System does not reacquire lock on in range memory check.	If targets do not reappear before break lock occurs, check is invalid and should be performed again.	Degraded range memory circuit. Closely monitor skin track light for memory indications. If system goes into memory, reacquire lock with hand control.
14a	KLY drops to zero.	If missile previously tuned, place RDR MSL power sw to CW OFF for 1 minute to prevent possible damage to missile circuits. Then momentarily advance either engine RPM to 85% and place RDR MSL power sw to CW ON.	If KLY voltage returns and/or missiles tune, full AIM-7 capability is available.
	KLY out of limits HIGH.	None	With missiles tuned, full AIM-7 capability is probable.
	KLY out of limits LOW.	None	Marginal AIM-7 capability. If missiles tune, maximum missile range will be degraded.
15b	Range rate readout out of tolerance (ranging/coding/28V delayed)	Cycle radar missile power switch to STBY, then CW ON and observe range rate.	Ranging and/or coding is at fault and the mission may be flown with marginal AIM-7 capability.
BIT 2			
2a	(1) Range strobe does not drive off target; system does not break lock.		(1) Degraded range track acceleration capability in SHORT pulse. Alternate mode: LONG pulse, MAN track, BST and ASPECT.
	(2) Range strobe drives off but system does not break lock.		(2) Degraded target detection circuit and/or memory circuit. System may transfer lock to clutter altitude line. Monitor closely.
3a	System breaks lock on second target.		Degraded range track acceleration circuit. System may break lock on high velocity/accelerating targets. Alternate modes: MAN track, BST and ASPECT.
3b	Range rate readout out of tolerance (antenna position).		No AIM-7 capability. Select alternate weapon system.
6a	No beacon targets.	Check beacon in OPR.	If beacon works in OPR but not in TEST, MAG is not driving to correct beacon BIT frequency. No beacon capability if it does not work in OPR. Occasionally MAG motor drive will bind. Slowly cycle mode knob between BCN and RDR until targets appear.
BIT 3			
1a	B-sweep and/or EL strobe out of tolerance.		B-sweep and/or EL strobe calibration out of limits. Compensate for off center scope presentation.
2a	(1) Aim dot does not rotate.	Check track switch - AUTO. Check angle track in operate.	(1) Azimuth and/or elevation angle tracking is inoperative. Alternate mode: MAN track, BST and ASPECT.

CONTINUED

DSCG BIT FAULT ANALYSIS (A/A) (CONT)

Step	Problem	Additional Tests	Status
2b	(2) Aim dot rotates out of limits. Rmax and/or Rmin out of tolerance.	Check range - AI 25	(2) Automatic gain control is at fault, system may transfer lock to clutter/altitude line. Rmax and/or Rmin scope display out of alignment. Affects BIT 6. IN RANGE light and ASE circle not affected. Scope display out of alignment. SHOOT lights and ASE circle not affected.
2c	ASE circle size out of tolerance.		ASE circle scope display out of tolerance. Use interlocks OUT. Attempt to center aim dot prior to launch.
2d	EL strobe does not go 30° down.		EL strobe position will be unreliable during tracking.
BIT 4			
1b	No H symbol displayed.	Warning light - TEST	If light tests good, degraded HOJ capability.
1c	Range rate readout out of tolerance.	Before TO 1F-4-1424, check missile tuning in ARM and SAFE. After TO 1F-4-1424, no additional test.	If missiles tune in ARM, no missile degradation. If missiles do not tune in ARM, no AIM-7 capability. (After TO 1F-4-1424, if missiles do not tune in SAFE, no AIM-7 capability.)
4a	B-sweep/EL strobe drift more than $\pm 5^\circ$ during angle track memory check.		Degraded angle track memory circuit. Closely monitor skin track light for memory indication. If system goes into memory reacquire lockon with hand control.
6a	No AOJ display.	Check track - AUTO	Degraded AOJ capability.
7a	System does not return to search with AOJ OUT.		Aircrew cannot preclude AOJ function.
9a, 9b	No CAA scan.		No CAA capability.
BIT 5			
2c	ASE circle out of tolerance.	Check locked on third target.	ASE incorrect. Attempt to center aim dot. Use interlocks OUT.
8a, 9a	Range strobe does not sweep out and/or lockon in auto acq	Check BST/5 mi range selected. Check auto acq in operate. Check auto acq from rear cockpit.	No auto acq capability. Cage mode affected.
16a	PLMS does not occur	Check pulse - AUTO	System may PLMS late or not at all. Manually select SHORT pulse when target return is strong enough to maintain lockon.

3. After 5 seconds, FRZ button - PUSH ON
 - a. BDHI and HSI miles DECREASE
 - b. AOA lower indexer - PULL UP COMMAND
 - c. After 10 seconds, AOA center indexer - LEVEL COMMAND
 - d. After 5 seconds - GO/NO GO
 - e. After 5 seconds, AOA upper indexer - DIVE COMMAND

TARGET FIND/OFFSET BOMB MISSION

1. WRCS BIT selector - TGT FIND/OFFSET BOMB
2. BIT button - PUSH and HOLD
 - a. Alt indicator - ON
3. After 5 seconds, along track cursor control - MOVE
4. Cross track control - MOVE
5. Cursor intensity - ADJUST
6. Reset button - PUSH
 - a. Cursors return to zero range and azimuth.
7. Target insert button - PUSH ON
 - a. Along track cursor - 6.5 NM on 0° grid line (± 2000 feet)
 - b. Cross track cursor - $30^\circ \pm 1.5^\circ$ RIGHT
 - c. (P) HSI bearing pointer - $23^\circ \pm 2.5^\circ$ (right of lubber); HSI TGT light - ON
 - d. TGT INS light - ON
 - e. BDHI # 1 needle - $23^\circ \pm 5^\circ$ (right of top index)
 - f. (P-WSO) HSI and BDHI miles - 4.8 ± 1.0 NM
 - g. (P) Sight roll tabs - ROTATED CLOCKWISE
 - h. (P) ADI vertical pointer - DEFLECTS FULL RIGHT
8. After 5 seconds, FRZ button - PUSH ON
 - a. (P-WSO) HSI and BDHI miles - DECREASE TO ZERO, THEN INCREASE
 - b. (P) Sight roll tabs - ROTATES (as miles passes through zero)
 - c. After 15 seconds - GO/NO GO

BOMB RANGE CALIBRATION/INTEGRATION CHECK

1. INS mode - NAV
2. WRCS control panel - SET
 - a. Target distance N/S - N120
 - b. Target distance E/W - 000
 - c. Target altitude - SET PRESENT AIRCRAFT HSL (29.92)
 - d. Release advance - 000
 - e. Release range - 000
3. Weapons delivery panel - SET
 - a. Activate switch - NORM
 - b. Target find switch - HOLD
 - c. Range switch - X100
4. Front cockpit switches - SET
 - a. Delivery mode - T LAD
 - b. Weapon select - BOMBS

- c. Station select buttons - OFF
- d. Armament override - PUSH IN

NOTE

Tone and ADI steering indications are not available if ARM is selected.

5. Timers - SET (values for delivery)
 - a. Pullup timer
 - b. Release timer
6. Target insert button - PUSH ON
 - a. Along track cursor - Jumps to second BIT target
7. WRCS distance counters N/S - Increase or decrease until near edges of along track cursor and second BIT target coincide.
 - a. Note difference between counter and N120.
 - b. For larger counter value, correction is +; for smaller counter value the correction is -.
8. Target distance N/S - RESET
 - a. Set preflight release range adjusted for calibration error in step 7.
 - b. Release range switch - NORM or X100 (as required)
 - c. Activate switch - ON
9. Release range counter - INCREASE (slowly until 1/3 second tone)
 - a. Check timer accuracy.
 - b. (P) Check LABS indications.
 - c. Note difference between derived RR counter reading and preflight release/activation range and apply as correction to all ranges.
 - (1) For larger counter value, correction is +; for smaller counter value, the correction is -.

NOTE

This is a correction factor only and does not indicate a system malfunction or deficiency. Previous air-to-ground BIT checks will have verified the operational status of the INS, and FCS range cursor or will have isolated any system malfunction which may have existed.

WRCS TURN OFF

1. WRCS BIT selector - RELEASE and OFF
2. Target alt/range counter - 000
3. Weapons delivery panel
 - a. Activate switch - NORM
 - b. Target find switch - NORM
 - c. Range switch - NORM
4. WRCS control panel - RESET

BIT FAULT ANALYSIS (A/G)

Step	Problem	Additional Tests	Status
RANGE SLOPE AND ZERO			
5a	MAG does not indicate 0.9 to 1.15.	Manually select SHORT pulse and check MAG indication.	Use SHORT pulse if capable and continue mission.
5b	B-sweep drift stabilization is erratic or incorrect.	Check B-sweep scope calibration in bore-sight. Compare drift with BDHI indications while airborne.	If B-sweep scope calibration is shifted, use new reference and recheck drift. If drift is erratic or incorrect, use A/G with a CAGED sight and DRIFT OUT.
5c	Acquisition symbol not centered on B-sweep.	Recheck in BST.	Possible indication of deflection or display problem. Most likely Rmax and Rmin strobes will be affected. If lockon can be achieved, mission can be accomplished.
5d	Horizon line does not indicate 30° left bank and 30° dive.	Recheck horizon line in BIT 1, 3.	Roll & pitch stabilization may be erratic. Use STAB OUT.
6	System does not lock on in A/G.		Degraded A/G lockon capability. Manually track ground return with hand control in HA. Reduce receiver gain prior to manual track.
6a	B-sweep does not fade.		Automatic Gain Control (AGC) is degraded. Manually track ground return with hand control in HA. Reduce receiver gain prior to manual track.
6b 7a 8a	Range bar out of tolerance.	Check sight mode - A/G. Compare VI meter with range bar while locked on 1st target in A/A radar mode.	A/G range slope is out of alignment. Use alternate bombing mode. In this check the tolerances for the VI and/or range bar must be considered.
BOMB RANGE STROBE CALIBRATION			
5c	Bomb strobe mis-calibrated.		If slight inaccuracy can be accepted, adjust strobe with screwdriver adjustment on antenna hand control.
WRCS BITS			
Any or all	NO GO	Recheck switches and WRCS inputs; repeat check.	If NO GO repeats, select an alternate delivery mode.
BOMB RANGE CALIBRATION/INTEGRATION CHECK			
9	System does not integrate.	Recheck switches and WRCS inputs and repeat check.	Use alternate delivery mode.
9a	ARBACS timers out of tolerance.	Check timer settings; check timers in T LAD only.	Use stopwatch method of LADD delivery.

POST BIT (DSCG)

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Radar missiles power switch - OFF 2. Guns/missile switch - RADAR 3. Master arm switch - SAFE | <ol style="list-style-type: none"> 4. Weapon select knob - C 5. Delivery mode select knob - OFF 6. Sight mode knob - STBY |
|---|--|

SCRAMBLE BIT (DSCG)

PREBIT SWITCH SETUP

1. Radar missile power switch - OFF
2. Guns/missile switch - RADAR
3. Master arm switch - SAFE
4. Interlock switch - IN or OUT
5. Weapon select switch - C
6. Delivery mode knob - OFF
7. HSI mode knob - NAV COMP

FRONT SCOPE CONTROLS

1. Brightness control knob - MID POSITION
2. Contrast control knob - MID POSITION
3. Scale control knob - MAX CCW

REAR SCOPE CONTROLS

1. Mode control knob - OFF
2. Brightness control knob - MID (5) POSITION
3. Contrast control knob - MID (5) POSITION
4. Scale control knob - MAX CCW
5. Grid control knob - MAX CCW
6. Range control cursor knob - MAX CCW
7. Offset control cursor knob - MAX CCW

RADAR SET CONTROL PANEL

1. Radar power knob - OFF
2. Radar range knob - AI 25
3. Polar switch - LIN
4. Maneuver switch - HI G
5. Scan switch - 1 BAR
6. Aspect switch - OPTIONAL
7. Receiver gain knob - FULL CLOCKWISE
8. Track switch - AUTO
9. Display switch - B-WIDE
10. Manual Vc knob - 0
11. Pulse switch - AUTO
12. Radar mode knob - MAP
13. Air-to-air light - OFF

CONTROL MONITOR PANEL

1. Meter selector knob - -250VDC
2. Test knob - 1

3. Meter selector switch - SIGNALS
4. Vc switch - 2700 (900 is not used with the DSCG)
5. Stab switch - NOR

TURNON/SCRAMBLE BIT CHECK

1. Radar power knob - TEST
2. (After VDC in V area) Radar scopes - TURN ON
 - a. (WSO) (W/O DMAS) DSCG mode knob - RDR BIT
 - b. (WSO) (DMAS) SNSR SEL panel, radar SELECT button - PRESS
 - c. (P) (W/O DMAS) Scope display select switch - RADAR
 - d. (P) (DMAS) RDR SEL button - PRESS
3. (P) Missile power switch - STBY
4. (P) (MAG current present) Missile power switch - CW ON
5. Lock on third target.

If system breaks lock during test, relock on third target.
6. Aim dot stationary in limit box.
 - a. Range rate readout 900 ± 200 knots (ranging/coding).
 - b. Rmax and Rmin at 15 ± 1.5 miles and 5 ± 1.25 miles, respectively.
7. Maintain lockon and select BIT 2.
 - a. Range rate readout 900 ± 200 knots (antenna position).
8. Select BIT 3 and lock on 4th target.
 - a. Aim dot rotates.
9. Maintain lockon and select BIT 4.
 - a. Flashing range rate readout 900 ± 200 knots; last digit is letter H (pseudo/simulated doppler). (After TO 1F-4-1424, range rate is 550 ± 150 knots, simulated doppler.)
10. Maintain lockon and select BIT 5.
 - a. Range rate readout 0 ± 300 knots (filtered target velocity)
 - b. Aim dot inside ASE circle.
11. Select BIT 6, move range strobe between Rmax and Rmin.
 - a. Aim dot in limit box.
 - b. IN RANGE/SHOOT light ON.
12. (P) Check AIM-7 missile tuned.
13. (P) Radar missile power switch - STBY

DSCG BIT FAULT ANALYSIS (SCRAMBLE)

Step	Problem	Additional Tests	Status
SCRAMBLE BIT			
5a	Range rate readout out of tolerance in BIT 1 (ranging/coding/28 volts delayed).		If missiles do not tune in ARM no AIM-7 capability. If missiles tune in ARM, marginal AIM-7 capability due to ranging/coding faults.
6a	Range rate readout out of tolerance in BIT 2 (antenna position).		No AIM-7 capability; select alternate weapon system.
7b	Aim dot does not rotate.		Angle track inoperative. Alternate modes: MAN track, BST and ASPECT.
8a	Range rate readout out of tolerance in BIT 4 (simulated/pseudo doppler). (After TO 1F-4-1424, range rate out of tolerance, simulated doppler.)		If missiles tune in ARM, no mission degradation. If missiles do not tune in ARM, no AIM-7 capability. (After TO 1F-4-1424, if missiles do not, tune in SAFE, no AIM-7 capability.)
9b	Aim dot out of tolerance in BIT 5.		Degradation of range rate accuracy and missile envelope.

OPTICAL SIGHT CAMERA, KB-25/A

1. (P-WSO) Gun camera switches - OFF
2. Film magazine - INSTALLED
 - a. Push button (upward) in center of film magazine.
 - b. Slide magazine in and release button.
3. Frames per second switch (table) - 24 (down) or 48 (up)
4. Aperture control (table) - SET
5. Camera overrun switch - 0, 3, 10, or 20 seconds
6. Camera run button (right side) - PRESS
 - a. Observe motor knob (left side) - ROTATE
 - b. Observe magazine footage indicator.

NOTE

To conserve film, steps 6 and 6a may be accomplished without a magazine installed. With 100 feet of film, camera run time is 2.46 minutes at 24 fps, or 1.23 minutes at 48 fps.

BASED ON EKTACHROME MS FILM, ASA 64

Mission	Light Conditions	Frame Rate (fps)	Aperture
Air-to-air	Daylight	24	f/8
		48	f/5.6
Air-to-ground	*Subdued	24	f/2.8
	Daylight	24	f/11
		48	f/8
	*Subdued	24	f/4
		48	f/2.8

*Overcast, or just before dusk or dawn.

TIRS DATA TRANSFER

This procedure may be accomplished under one of two circumstances:

- a. Immediately after landing with left engine shutdown and radar still operating.
- b. After engine shutdown with external electrical power, hydraulic power and radar cooling connected to the aircraft.

To transfer preprogrammed TIRS data into the memory unit, use the following procedures.

1. TIRS memory unit connected to the aircraft by maintenance personnel at door 172.

2. Radar power knob - TEST
3. Test knob - 0
4. Radar mode knob - RDR
5. DSCG mode knob - RDR
6. Maintenance checks - COMPLETE
 - a. Receive thumbs up from maintenance personnel before proceeding.
7. Test knob - DOT BAL and RELEASE
8. TIRS memory unit - DISCONNECTED
9. Fire control system - OFF

AN/ALE-40 COUNTERMEASURE DISPENSER

INFLIGHT

NORMAL OPERATION

Automatic Operation

1. AN/ALE-40 programmer - SET
 - a. Chaff burst count and interval - SET
 - b. Chaff salvo count and interval - SET
 - c. Flare burst count and interval - SET
2. (WSO) Cockpit control unit:
 - a. Chaff mode knob - SET
If chaff dispensing is desired, set chaff mode knob to required mode. Chaff mode light illuminates.
 - b. Flare mode knob - SET
If flare dispensing is desired, set flare mode knob to required mode. Flare mode light illuminates.
3. Flares select switch - NORMAL
 - a. AN/ALE-40 power ON light - ON
 - b. FLARES light - OFF
4. (P or WSO) Dispense button - ACTUATE
Actuate either dispense button to initiate automatic chaff and/or flare dispensing. If additional programmed dispensing cycles are required after completion of the first, re-actuate

the dispense button.

5. (WSO) Chaff and flare counters - MONITOR
The counters count down as the individual chaff/flare cartridges are dispensed.

NOTE

The automatic dispensing programs may be terminated at any time by placing the chaff and flare mode knobs to OFF.

Manual Flare Operation

1. Flares select switch - FLARES
 - a. AN/ALE-40 power ON light - OFF
 - b. FLARES light - ON
2. Dispense button - ACTUATE
Actuate the dispense button as required to dispense individual flares.

EMERGENCY FLARE DISPENSING

1. (WSO) Ripple switch - ON
When there is a requirement to jettison the flares in an emergency, lift the ripple switch guard and place the switch to ON.

AN/ALE-38 CHAFF DISPENSER

C-9492A CONTROL PANEL (ANALOG OPERATION)

INFLIGHT

To dispense chaff -

1. Operate switch - OPR (as necessary)
2. I and/or II button - PRESS
 - a. A light(s) - ON (Each button controls one chaff dispenser)

To terminate dispensing -

3. Operate switch - STBY or OFF (or I/II button - DESELECT)

BEFORE LANDING

1. Operate switch - OFF

C-6631 CONTROL PANEL

INFLIGHT

To dispense chaff -

1. Operate knob(s) - XMIT 1, XMIT 2 or BOTH
 - a. XMIT 1, XMIT 2 or BOTH Light(s) - ON

To terminate dispensing -

2. Operate knob(s) - STBY or OFF

BEFORE LANDING

1. Operate knob(s) - OFF

AIM-7 MISSILE

PREFLIGHT

NOTE

Do not fly with a mixed load of AIM-7E and AIM-7F missiles.

OPERATIONAL CHECKS, AFTER START (Internal Power)

AIM-7 Tuneup

1. Missile interlock switch - IN
2. Master arm switch - SAFE

NOTE

Steps 1 and 2 are safety checks and are not required for missile tuneup. The missile interlock switch and master arm switch may be positioned as required when missile tuneup is accomplished while airborne.

3. (WSO) Radar power knob - TEST

WARNING

The missiles may be tuned with the radar power knob in any position except OFF; however, the cw transmitter creates a radiation hazard to ground crew unless radar power knob is in TEST.

CAUTION

For Radar Ground Operation With Engines Operating, refer to section I or radar BIT checks.

NOTE

More than 15 seconds warmup time is required for operation of the missile klystron during cold weather operation. If ambient temperature is below 90°F, the radar missile power switch should be placed in STBY for a minimum of 1 minute prior to selecting CW ON.

4. Radar missile power switch - CW ON
5. (WSO) Meter selector knob - KLY
 - a. Meter reads 0.75 +0.5.
6. RDR tuned lights - ON STEADY FOR 1 MINUTE (AIM-7E); ON STEADY (AIM-7F)

AIM-7E - Check that RDR tuned lights remain ON for 1 minute for proper operation of missiles and tuning drives. The applicable RDR light goes out if a missile detunes. All RDR lights go out when radar missile power switch is placed to STBY or OFF.

AIM-7F - Check that RDR tuned lights are ON indicating missiles have tuned. All RDR lights remain ON when the radar missile power switch is placed to STBY, but go out when placed OFF. After TO 12P2-2APQ120-537, all RDR lights go OFF when the missile power switch is placed to STBY or OFF. If a missile does not tune in 3 minutes, attempt tuning by selecting MSI, power OFF for 1 minute, then back to CW ON.

7. Radar missile power switch - STBY (or OFF if long ground time at high temperature).
 - a. RDR tuned lights - OFF (AIM-7E)

If RDR tuned light is ON while radar missile power switch is not in CW ON, a malfunction exists.
 - b. RDR tuned lights - ON (AIM-7F) After TO 12P2-2APQ120-537, RDR tuned lights - OFF. With AIM-7F, RDR tuned lights remain ON with the radar missile power switch in STBY. If RDR tuned light is ON while radar missile power is OFF, a malfunction exists. After TO 12P2-2APQ120-537, RDR tuned lights go OFF with the radar missile power switch in STBY or OFF. If a RDR tuned light is ON with the radar missile power switch is OFF, a malfunction exists.



To prevent possible heat damage to the AIM-7 missile, the maximum ground time for radar missile power switch in STBY or CW ON should be limited to 10 minutes when the ambient temperature is 90°F or greater or 15 minutes when the ambient temperature is below 90°F.

INFLIGHT

AIM-7 TUNEUP

If the radar missile power switch was OFF due to long ground time at high ambient temperature, the AIM-7 missiles should be retuned as soon as possible after airborne to prevent cold soaking.

AIM-7E:

1. Radar missile power switch - CW ON
 - a. RDR tuned lights - ON STEADY FOR 4 MINUTES

This ensures that the klystron tube is stabilized and will probably retune within 20 seconds after STBY operation.
2. Radar missile power switch - STBY
 - a. RDR tuned lights - OFF

AIM-7F:

1. Radar missile power switch - CW OFF FOR 1 MINUTE
2. Radar missile power switch - CW ON
 - a. RDR tuned lights - ON

This indicates that the AIM-7F has tuned and gone dormant. If the missile does not tune by 3 minutes, attempt to retune by going OFF for 1 minute and back to CW ON.
3. Radar missile power switch - STBY
 - a. RDR tuned lights - REMAIN ON

After TO 12P2-2APQ120-537, RDR tuned lights - OFF

AIM-7 MISSILE LAUNCH

NOTE

With a CL tank or MER aboard, or with the CL Aero-27A rack and a single bomb aboard, illumination of the CL tank aboard light indicates that the forward AIM-7 missiles cannot be launched. The forward missiles can be tuned and monitored regardless of CL tank aboard light condition.

1. (WSO) Radar power knob - OPR
2. (WSO) Radar mode - RDR, MAP-B or BST
3. (WSO) Polar switch - LIN or CIR 1

The AIM-7 missile will not guide if the polar switch is in CIR 2.
4. (WSO) Aspect knob - AS REQUIRED

NOTE

- On DVST aircraft before OFF P005, selecting NOSE aspect with a radar lockon will cause erroneous Vc gap indications.
- On DVST aircraft after OFF P005, the LRU-1 must be notified that the aircraft has a DVST using the procedures under Radar Turnon in section II. If these procedures are not used, the NOSE, FWD, and TAIL positions of the aspect knob will give erroneous Vc indications.

NOTE

- The WIDE position overrides all other switch settings and locks the missile speedgate in wide sweep.
- 5. (WSO) Maneuver switch — AS REQUIRED
LOW G provides velocity reject function. HI G allows tracking of a maneuvering target without breaking radar lockon.
- 6. (WSO) STAB switch — AS REQUIRED
- 7. (P) Radar missile power switch — CW ON
 - a. RDR tuned lights — ON
- 8. (P) Missile interlock switch — AS REQUIRED
If it is not tactically feasible to satisfy the range and allowable steering limits, the AIM-7 may be fired with a lower kill probability by firing with interlocks OUT.

NOTE

The weapon select knob should not be in TV or ARM. If TV/ARM is selected, press cage button for trigger transfer.

- 9. (P) Sight mode — A/A
A/G optical sight mode may be selected if cage button is pressed.
- 10.(P) Guns/missile switch — RADAR
 - a. Head-up RADAR light — ON
- 11.(P) Master arm switch — ARM
 - a. Head-up ARM light — ON

NOTE

With AIM-7F loaded and master arm ON, the head-up ARM light and RADAR light is ON with the radar missile power switch ON or in STBY. After TO 12P2-2APQ120-537, with an AIM-7F loaded and master arm in ARM, the head-up ARM light and RADAR light are ON with the missile power switch ON.

- b. Head-up RADAR light — REMAINS ON
The RADAR light remains ON with master arm switch in ARM if at least one AIM-7 missile is tuned and selected for firing. With the CL TK light ON, the forward fuselage missiles cannot be launched.

NOTE

With AIM-7F loaded, before missile launch (initial trigger squeeze), the head-up RADAR light must be ON steady.

- 12. Target lockon - ACCOMPLISH
 - a. Observe flashing SHOOT lights.
 - b. If radar lockon is available, fly the aim dot.
 - c. Without lockon, or to break lockon and select automatic acquisition mode:

(1) Cage button — PRESS AND RELEASE. The air to air button light in rear cockpit illuminates, BST and 5-mile range is selected, and optical sight is in A/A mode.

- (2) Before OFP P005, automatic acquisition button — PRESS (LOCKON). After OFP P005, select corridor to be scanned with pinky switch
- (3) After OFP P005, automatic acquisition — PRESS

NOTE

AIM-7E missiles should not be launched (initial trigger squeeze) until 4 seconds after radar lockon if the missile is armed before lockon, or 2 seconds after missile arming when preceded by a valid radar lockon. A minimum of 4 seconds is required between initial lockon and trigger squeeze. The delay time is caused by radar and speedgate settling. If the time delay is not observed, the AIM-7 missile may fail to acquire target doppler which would cause the missile to launch ballistically. AIM-7F missiles may be launched immediately (no delay) if the radar is locked onto a target and the master arm switch is subsequently positioned to ARM. If locked on after placing the master arm switch to ARM, wait 2 seconds for radar settling prior to launching an AIM-7F missile.

- 13. (P) Trigger - SQUEEZE and RELEASE
 - a. Head-up RADAR light - ON (next missile ready for launch)
If the interlock switch is in the IN position, the aim dot must be within the ASE circle and the SHOOT and IN RANGE lights ON to launch the AIM-7 missile. In interlocks OUT, the missile will be launched when the trigger is pressed.

NOTE

The SHOOT lights provide additional indications of valid launch parameters. These lights and the IN RANGE light should be used along with current tactical considerations to determine actions to be taken. Flashing operation and the high intensity of the SHOOT lights improve daylight visibility awareness. With a valid lock-on, the IN RANGE light and the SHOOT lights indicate that missile launch parameters are satisfied and the missile may be launched. When the instrument panel dimming control is used for night operation (intensity down) the SHOOT lights are OFF but the IN RANGE light operates at reduced intensity.

Second Missile Launch

Two tuned missiles can be launched by squeezing, releasing, and re-squeezing and holding the trigger. If the first missile fails to launch, the next tuned missile is automatically selected and committed approximately 2 seconds after the initial trigger squeeze. (Actual launch of the second missile occurs in 2 seconds plus 1.4 seconds launch delay.) To launch another missile in the event of a missile abort; release, squeeze and hold the trigger.

Snap-up Procedure

Center the aim dot in azimuth while the HOLD ALT light is ON. When the HOLD ALT light goes OFF, pull up and fly the aim dot smoothly to the center of the ASE circle and fire when the IN RANGE and SHOOT lights come ON. This indicates that the aircraft is within the firing envelope.

Visual Attack (BST Mode)

If AI transmitter failure occurs, the radar boresight mode can be used for cw illumination of the target during a visual attack. AIM-7 missiles can be launched visually as long as the optical sight and cw radar portions of the system are functional. To determine if the cw radar is transmitting, check the KLY position on the volt monitor

panel for a reading which indicates cw transmitter output. Without radar lockon, the firing interlocks are OUT in the BST mode, regardless of the position of the missile interlock switch, and the launch envelope must be visually estimated.

NOTE

- Automatic range and angle tracking is obtained after lockon in the boresight mode.
- If lockon is not obtained, smooth tracking is required just before missile launch in the BST mode to prevent erroneous head aim data being supplied to the missile.

POST LAUNCH

1. Master arm switch - SAFE
 - a. Head-up ARM light - OFF
2. Radar missile power switch - STBY

CAUTION

If AIM-7 missiles are still loaded during descent, the missile power switch should remain in STBY. This prevents condensation within the missile during descent.

3. Missile interlock switch - IN
4. Selective jettison knob - OFF

AIM-9 MISSILE

PREFLIGHT

OPERATIONAL CHECKS, AFTER START (Internal Power)

AIM-9 Seeker Check

1. Launcher safety pin - INSTALLED
2. Master arm switch - SAFE
3. Delivery mode - OFF
4. Weapon selector knob - NOT IN ARM or TV
5. Missile interlock switch - IN (with AIM-7 aboard)
6. Armament safety override - IN
 - a. Head-up display ARM light - OFF
7. Guns/missile switch - HEAT REJECT
 - a. HEAT select light - ON

Actuate guns/missile switch to HEAT REJECT to obtain one of four HEAT select lights on the multiple weapons panel.
8. Guns/missile switch - HEAT
 - a. Head-up HEAT light - ON

9. Aural tone - ADJUST

Rotate aural tone control knob to reduce noise (or growl) produced by random IR reflections.
10. Guns/missile switch - RADAR
 - a. Tone - OFF
 - b. Head-up HEAT light - OFF
 - c. Head-up RADAR light - ON

INFLIGHT

CAUTION

Chipping, cracking and/or breaking of the infrared dome may occur if the missile is flown through rain or hail.

AIM-9 AIRBORNE BORESIGHT CHECK**NOTE**

The pilot should establish the seeker boresight position relative to the pipper for each AIM-9 missile aboard.

1. Sight mode - A/A
2. Guns/missile switch - HEAT
 - a. Head-up HEAT light - ON
 - b. HEAT select light - ON
3. Master arm switch - SAFE
 - a. Head-up ARM light - OFF
4. (CALL) Inform fighter type aircraft of intended AIM-9 missile boresight check. Establish a 4000 to 6000-foot trail position.
5. Adjust aural tone to avoid conflict with UHF, intercom, RWR and to provide positive verification of IR target.
6. Place pipper on IR target. Then slowly maneuver to establish the center of the growl area relative to the pipper.
7. Guns/missile switch - HEAT REJECT
 - a. Next missile HEAT select light - ON
8. Repeat steps 6 and 7 for each AIM-9 to determine the average boresight position. Reject the missile not boresighted to end firing sequence.

AIM-9 MISSILE LAUNCH

CAUTION

Structural damage to the speed brake skin may result from missile exhaust if speed brakes are extended.

NOTE

- Audio tone is interrupted when the weapon selector knob is in TV or ARM, except when the cage button is pressed.
- The wing flaps must be UP and landing gear handle UP or armament safety override button IN to launch the missile.

1. Sight mode -A/A
If missile boresight is good, center of missile LOS is through the pipper. With the optical sight mode knob in A/A, (or the cage button pressed) the reticle is caged to the RBL.

2. Guns/missile switch - HEAT
 - a. Head-up HEAT light - ON
 - b. HEAT select light - ON

Momentary actuation of the guns/missile switch to HEAT REJECT allows the selection of any missile in the firing sequence as indicated by the illumination of missile HEAT select light for the selected station.
3. Missile aural tone - ADJUST
Check for increase in aural tone volume level which indicates the missile has discerned the target. The tone may be nulled if the target is directly in the center of the missile LOS.
4. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Head-up HEAT light - ON
5. To uncage seeker, ARR button - PRESS AND HOLD
 - a. All IR missile seekers uncage and begin self-tracking while the ARR button is pressed. The IR seeker returns (cage) to the missile boresight line when the ARR button is released. The use of the ARR button is determined by the tactical situation and pilot option.
 - b. Flashing SHOOT lights indicate the target is in missile launch parameters.
6. Trigger - SQUEEZE
 - a. Head-up HEAT light - OFF
 - b. HEAT select light - OFF

Squeezing the trigger automatically uncages the IR seeker of the selected missile if the ARR button was not pressed.
7. Trigger - RELEASE
 - a. Head-up HEAT light - ON
 - b. HEAT select light of next missile - ON

When the trigger is released, the sequencing switch steps to the next missile station as indicated by the illumination of the missile HEAT select light for that station.

POST LAUNCH

1. Master arm switch - SAFE
 - a. Head-up ARM light - OFF
2. Guns/missile switch - RADAR
 - a. Head-up RADAR light - ON

M61A1 NOSE GUN

INFLIGHT

1. Sight mode knob - A/G (or A/A unless CAGE is present)
2. Reticle depression knob - SET (A/G only)
3. Rate switch - HIGH/LOW
4. Rounds counter - SET
5. Delivery mode knob - OFF or DIRECT (DMAS aircraft - DIRECT)

NOTE

If the optical sight is to be used for air-to-ground guns, the OFF or DIRECT position should be selected on the delivery mode knob.

6. Weapon select knob - NOT TV or ARM (unless CAGE is present)
7. Gun station select - PRESS
 - a. Green GUN station light - ON

8. Guns/missile switch - GUNS
 - a. Head-up GUN light - ON
9. Master arm switch - ARM
 - a. Head-up GUN light - REMAINS ON
 - b. Head-up ARM light - ON
 - c. Gun station ARM light - ON
10. Trigger - SQUEEZE
 - a. Zero rounds remaining, station ARM light - OFF
 - b. Head-up GUN light - OFF

SAFE GUNS

1. Gun station select - PRESS
 - a. Green GUN station light - OFF
 - b. Gun station ARM light - OFF
2. Master arm switch - SAFE
 - a. Head-up ARM light - OFF

SUU-16/A, -23/A GUN PODS, GPU-5/A GUN POD ON CL STATION

NOTE

With the GPU-5/A gun pod on centerline station, the DCU-94/A station select plastic safety switch guard must be installed.

INFLIGHT

1. Sight mode knob - A/G (or A/A unless CAGE is present)
2. Delivery mode knob - OFF or DIRECT (DMAS aircraft - DIRECT)
3. Reticle depression knob - SET (A/G only)
4. Station select button(s) - PRESS
 - a. Green light(s) - ON (SUU-23 prestart)
5. Weapon selector knob - NOT TV or ARM (unless CAGE is present)
6. (SUU-16/23) Gun clear switch - NONCLEAR or AUTO CLEAR
7. Guns/missile switch - GUNS

8. Master arm switch - ARM
 - a. Head-up GUN light - OFF
 - b. Head-up ARM light - ON
 - c. Station ARM light(s) - ON (SUU-16, RAT OUT)
The SUU-16 RAT is deployed when master arm is placed to ARM.
9. Trigger - SQUEEZE

FINAL BURST SAFE GUNS (Rounds Remaining)

1. (SUU-16/23) Gun clear switch - AUTO CLEAR
2. (SUU-16/23) Trigger - SQUEEZE
3. Station select button(s) - PRESS
 - a. Green light(s) - OFF
 - b. Station ARM light(s) - OFF (SUU-16, RAT IN)
The SUU-16 RAT will retract when the station select button is pushed OFF.
4. Master arm switch - SAFE
 - a. Head-up ARM light - OFF

AGM-45 MISSILE

INFLIGHT

1. (WSO) INS mode knob - NAV
2. Sight mode - A/G (if desired)
The sight reticle may be used (if desired) as a flashing indicator regarding inertial navigation system failure.
3. (WSO) Bombing timer - SET AS REQUIRED
 - a. Pullup timer - seconds.
4. (WSO) Release angle - SET
 - a. Low angle (LOFT) - degrees.
5. (WSO) WRCS inputs - SET
 - a. Target altitude - feet MSL.
 - b. Release advance - msec.
6. Delivery mode - SET
 - a. For WRCS mode - AGM-45
 - b. For AN/AJB-7 mode - LOFT
 - c. For direct mode - DIRECT
7. Master arm switch - SAFE
8. Weapon select - ARM
9. Station select button(s) - PRESS
 - a. Green light(s) - ON
The missile tone signal and ADI pointers now indicate target detection for the leftmost selected missile. If one missile is to be fired, select only one station.

NOTE

When the AGM-45 system and the radar set are operated simultaneously, a distinct low frequency tone is heard and the ADI pointers move in a pattern corresponding to the antenna sweep pattern. Audible tone interference may be caused also by the tacan set in the T/R mode. Hence, when interference is encountered, place the radar set in STBY and the tacan set in REC until AGM-45 operations are complete.

CAUTION

To guard against the premature activation of missile thermal batteries, do not press the bomb

button until actual intent to launch.

10. Reject switch - SET
 - a. WRCS mode - DF REJ
 - b. LOFT mode - NORM

MISSILE LAUNCH

After target detection proceed as follows:

1. Master arm switch - ARM
 - a. Station ARM light - ON
 - b. Head-up ARM light - ON
2. ADI vertical director pointer - NULL
Steer aircraft to null the vertical pointer.
3. Delivery mode - EXECUTE

Computer Mode, AGM-45

With azimuth error at a null, begin a dive to null the horizontal pointer. With the dive stabilized, press the bomb button when one of the maneuver lights (in range indication) illuminates. Hold the pickle signal and begin the desired launch maneuver. The computer delivers the launch signal as the aircraft reaches an attitude compatible with the respective maneuver light. If another station is selected, the next missile is launched in approximately 1 second.

Loft Mode

During the approach toward the IP, steer out azimuth error by centering the vertical pointer. Over the IP, press the bomb button to begin timer countdown; the pullup light illuminates. At timer runout, the missile tone cutout circuits are energized, the LABS steady tone is energized, and the pullup and sight reticle lights go out. Begin the pullup maneuver, holding the vertical and horizontal needles centered. As the aircraft rotates to the preset angle, the missile fires, the pullup and reticle lights illuminate and the tone ceases.

AGM-65 MISSILE (DSCG AIRCRAFT)

PREFLIGHT

INTERIOR INSPECTION (BEFORE ELECTRICAL POWER)

1. Weapon selector knob - B or C (out of TV or ARM)

WARNING

Do not apply power to AGM-65 weapon with dome cover installed. FOD or personnel injury from flying glass could result when dome cover shatters.

INFLIGHT

CAUTION

Pointing AGM-65A, -65B seeker toward sun while operating in track mode will burn the vidicon.

1. Optical sight - SET
 - a. Sight mode - A/G
 - b. Reticle depression - 45 MILS

NOTE

The 45 mil setting is an average setting which will vary with individual aircraft.

2. Weapon select knob - TV (3-minute timer start)

CAUTION

- Before entering visible precipitation when carrying AGM-65D missiles with missile dome covers expended, reduce airspeed below 350 KIAS or 0.55 Mach (whichever is lower).
- (TGM (65A), 65B) Chipping, cracking, and/or breaking of the seeker dome may occur if the missile is flown through rain or hail.
- When on the ground or flying at less than 0.9 Mach, do not operate the AGM-65D missile in excess of 30 minutes in the activate mode (IR image displayed on cockpit video) or in excess of 60 minutes in the missile ready mode (gyro power applied, weapon selected). The total missile operational time is a summation of the activate mode and the missile ready times and will not exceed 60 minutes on any single mission. When flying at 0.9 Mach through and including 1.8 Mach, the maximum time is 5 minutes in the activate mode and 30 minutes in the missile ready mode, with a total operational time not to exceed 30 minutes.
- The AGM-65A, -65B missile must not be maintained in the ready mode (weapon select knob in TV) in excess of 30 minutes on any single mission.
- The AGM-65A, -65B missile must not be maintained in the full power mode (electrical alignment, slew, or track) in excess of 3 minutes on any single mission if the missile is to be launched.
- These missile operational time limits represent missile design capability. As a general rule, the missile may be operated for longer time periods if the image presented on the display is usable.

3. Delivery mode knob - DIRECT

NOTE

To activate a missile on the RI station, the LI station must be empty or deselected.

4. Station select button(s) - PRESS
 - a. Station green light(s) - ON
5. (WSO) DSCG scope mode - TV or STBY (as required)
6. (P) Weapon video - ON
 - a. Block 48 (71-237) and up; Scope display WPN SEL button - PRESS
 - b. Block 36 thru 48 (71-236); Scope display switch (pedestal panel) - TV

NOTE

- Block 48 (71-237) and up, if the WSO is in a TV sensor mode, the pilot can obtain video by pressing the AUTO display button. However, the WPN SEL button must be pressed to enable pilot control of slew and track functions.
- If a missile check is not necessary, proceed to missile launch.

MISSILE BORESIGHT CHECK

1. Master arm switch - ARM, then SAFE
 - a. Check station ARM light(s) ON (with Master arm in ARM) indicating 3-minute timer complete.

CAUTION

Failure to allow 3 minutes for the seeker head gyro to spin up to operating speed (indicated by amber station ARM light) may result in severe damage to the guidance unit.

2. (P or WSO) Trigger - SQUEEZE and RELEASE
 - a. Video - ON
 - b. Brightness/contrast controls - SET
 - c. Tracking window aligned (approximately) with sight pipper.
 - d. Perform any additional sight adjustment.

NOTE

- Pilot procedures for checking slew and lockon are contained in step 3. WSO procedures for checking slew and lockon are contained in step 3A.
 - If a malfunction exists, or if the pilot wishes to check the next missile(s) in sequence, select MSL REJ and perform steps 2 and 3.
3. (P) AGM slew/lockon - CHECK
 - a. Contrast switch (WHT/BLK) - SET (for random target) (Not in AUTO for AGM-65D)
 - b. ARR button - PRESS and HOLD
 - c. Move seeker head control and observe seeker slew in proper directions; position tracking window on target.
 - d. (AGM-65D) to select narrow FOV, trigger - SQUEEZE and RELEASE (if desired)
 - e. ARR button - RELEASE (lockon)
 - f. Check tracking window - STEADY (good lockon)

NOTE

AGM-65B and 65D will indicated bad lockon by a flashing pointing cross.

- 3A. (WSO) AGM-65 slew/lockon - CHECK
- Contrast switch (WHT/BLK) - SET (for random target). (NOT IN AUTO FOR AGM-65D)
 - Action switch - HA and HOLD
 - Move antenna hand control and observe seeker slew in proper directions; position tracking window on target.
 - (AGM-65D) To select narrow FOV, trigger - SQUEEZE and RELEASE (if desired)
 - Action switch - FA/RELEASE (lockon)
 - Check tracking window - STEADY (good lockon)

NOTE

AGM-65B and 65D will indicate bad lockon by a flashing pointing cross.

4. AGM-65D missile - SET BORESIGHT

NOTE

- Step 4 is procedure for setting boresight memory when at least one missile on selected launcher is AGM-65D and the AGM-65D is the priority missile. With LAU-88/A launchers, boresight memory is set in the missile electronics. With LAU-88A/A launchers, boresight memory is set in the launcher electronics and is utilized by any missile on the launcher. If the AGM-65D is launched, boresight memory is still available to the remaining missiles until the station is deselected.

- Omit step 4 when no AGM-65D missiles are on selected launcher or when any other type AGM-65 is the priority missile.

- Aircraft - POSITION PIPPER OVER TARGET (Sight mode - CAGE, A/G or A/A; RETICLE DEPR - 45 MILS)
- Contrast switch - AUTO
- ARR button - PRESS and RELEASE (boresight memory set)
- Contrast switch - As required.

NOTE

Perform substeps b, c, and d if missile is not on LAU-88A/A launcher.

- Trigger - SQUEEZE and RELEASE (confirm missile boresight set, if applicable)
- (P) Station select button (if necessary) - OFF then ON
 - Video - OFF
 - Seeker returns to mechanical cage.
 - Sequence returns to first missile.

MISSILE LAUNCH

- Master arm switch - ARM
 - Head-up ARM light - ON
 - Station ARM light - ON (3-minute timer)
- Trigger - SQUEEZE and RELEASE

NOTE

If launcher is LAU-88A/A, the second missile in priority sequence will be activated simultaneously with the first priority missile.

- Missile video - ON
- Contrast switch - SET (NOT IN AUTO FOR AGM-65D)

Observe target and select proper track contrast.
 - Position piper on target/aimpoint.
 - Locate target in video display and initiate lockon.
 - (P) Front cockpit lockon procedure:
 - ARR button - PRESS and HOLD
 - Use seeker control to position target in tracking window.
 - ARR button - RELEASE
 - Verify lockon.
 - (WSO) Rear cockpit lockon procedure:
 - Action switch - HA
 - Use antenna hand control and position target in tracking window.
 - Action switch - FA/RELEASE
 - Verify lockon.
 - (P or WSO) Bomb button - PRESS and HOLD

NOTE

- If launcher is LAU-88A/A, the dome cover squib of the next missile in priority sequence will be activated automatically. The video of the second missile will appear approximately 1 second after first missile umbilical separation.
 - If launcher is LAU-88A/A and both first and second priority missiles are AGM-65D, the seeker of the second missile will display the same line of sight and the same field of view (NFOV or WFOV) exhibited by the first missile at the instant of launch command initiation.
- Verify release - WPN VIDEO BLANK (only momentarily if launcher is LAU-88A/A and additional missile(s) remain on that launcher).

NOTE

- If launch is not completed, immediately press trigger and after pullout, momentarily deselect the missile station.
- If video from next priority missile is displayed and range and altitude permit, another missile may be launched on the same firing pass by repeating steps 5 and 6.

- For next missile, repeat steps 2 through 6.

AFTER LAUNCH (WITH MISSILES REMAINING)

- Master arm switch - SAFE
- AGM station select button - OFF
- Weapon selector knob - B or C (out of TV or ARM)

TGM (65) (TRAINING) MISSILE (DSCG AIRCRAFT)

PREFLIGHT

INTERIOR INSPECTION (WITH ELECTRICAL POWER)

WARNING

Do not operate TGM on the ground if the dome cover is installed. Flying glass from jettisoned cover could result in FOD or injury to ground personnel.

CAUTION

- For TGM (65A) and (65B), do not exceed 15 minutes ground operation (weapon select knob in TV).
- Pointing the seeker TGM (65A), (65B) toward sun while operating in the track mode will burn the vidicon.
- Do not operate the TGM (65A), (65B) in excess of 40 minutes in the TV mode (weapon select TV or ARM) or in excess of 30 minutes in the full power mode (video present). No single simulated attack (start to stop of camera operation) with the TGM shall be in excess of 3 minutes.
- When on the ground or flying at less than 0.9 Mach, do not operate the TGM(65D) missile in excess of 30 minutes in the activate mode (IR image displayed on cockpit video) or in excess of 60 minutes in the missile ready mode (gyro power applied, weapon selected). The total missile operational time is a summation of the activate mode and the missile ready times and will not exceed 60 minutes on any single mission. When flying at 0.9 Mach through and including 1.8 Mach, the maximum time is 5 minutes in the activate mode and 30 minutes in the missile ready mode, with a total operational time not to exceed 30 minutes.

TGM Boresight Check

1. Optical sight - SET
 - a. Sight mode - A/G
 - b. Reticle depression - 45 MILS

NOTE

The 45 mil setting is an average setting which will vary with individual aircraft.

2. All armament switches - OFF/SAFE
3. Armament safety override - PRESS
4. Weapon select knob - TV (3-minute timer start)
5. Delivery mode knob - DIRECT
The DIRECT mode is necessary for station ARM light functions.
6. Station select button (TGM station only) - PRESS
 - a. Station green light - ON
Select only the TGM station, especially if other munitions are aboard.
7. (WSO) DSCG scope mode - TV or STBY (as required)
8. (P) Weapon video - ON
 - a. Block 48 (71-237) and up; Scope display WPN SEL button - PRESS
 - b. Block 36 thru 48 (71-236); Scope display switch (pedestal panel) - TV

NOTE

Block 48 (71-237) and up, if the WSO is in a TV sensor mode, the pilot can obtain TGM video by pressing the AUTO select button. However, the WPN SEL button must be pressed to enable pilot control of TGM.

9. Master arm switch - ARM, then SAFE
 - a. Check TGM station ARM light ON (momentarily) indicating 3-minute timer complete.

CAUTION

Failure to allow 3 minutes for the seeker head gyro to spin up to operating speed (indicated by amber station ARM light) may result in severe damage to the guidance unit.

10. (P or WSO) Trigger - SQUEEZE and RELEASE
 - a. Video - ON
 - b. Brightness/contrast controls - SET
 - c. Tracking window aligned (approximately) with sight pipper.
 - d. Perform any additional sight adjustment.
 - e. When TGM recorder is operational; film is expended whenever missile video is present.

NOTE

Pilot procedures for checking slew and lockon are contained in step 11. WSO procedures for checking slew and lockon are contained in step 11A.

11. (P) TGM slew/lockon - CHECK
 - a. Contrast switch (WHT/BLK) - SET (for random target) (NOT IN AUTO FOR AGM-65D)
 - b. ARR button - PRESS and HOLD
 - c. Move seeker head control; observe seeker slew in proper directions; position tracking window on target.

- d. (TGM-65D) Trigger - SQUEEZE and RELEASE (to select narrow FOV) (if required).
- e. ARR button - RELEASE (lockon)
- f. Check tracking window - STEADY (good lockon)

NOTE

TGM (65B) and (65D) will indicate bad lockon by a flashing pointing cross.

- g. Repeat steps a thru f with contrast switch in BLK/WHT and check good lockon. With TGM (65A) or (65B), repeat steps a thru f with contrast switch in AUTO and check good lockon.
- 11A. (WSO) TGM slew/lockon - CHECK
- a. Contrast switch (WHT/BLK) - SET (for random target) (NOT IN AUTO FOR TGM 65D)
 - b. Action switch - HA and HOLD
 - c. Move antenna hand control; observe seeker slew in proper directions; position tracking window on target.
 - d. (TGM-65D) Trigger -SQUEEZE and RELEASE (to select narrow FOV) (if required).
 - e. Action switch - FA/RELEASE (lockon).
 - f. Check tracking window - STEADY (good lockon)

NOTE

TGM (65B) and (65D) will indicate bad lockon by a flashing pointing cross.

- g. Repeat steps a thru f with contrast switch in BLK/WHT and check good lockon. With TGM (65A) or (65B), repeat steps a thru f with contrast switch in AUTO and check good lockon.
12. TGM (65D) - SET BORESIGHT
- a. Aircraft - POSITION PIPPER OVER TARGET.
 - b. Contrast switch - AUTO
 - c. ARR button - PRESS and RELEASE
 - d. Contrast switch - AS REQUIREI (boresight memory set)
13. Trigger - SQUEEZE and RELEASE
- a. TGM (65A), (65B) - Seeker aligned to missile centerline
 - b. TGM (65D) - Confirm missile/launcher boresight remains as set
14. Station select button - DESELECT
- a. Green light - OFF
 - b. TGM video - OFF
15. Weapon select knob - B or C (out of TV or ARM)
16. Delivery mode knob - OFF (if required)
17. (WSO) Armament safety override - RESET (if required)
- a. Momentarily pull arm, bus cont. CB on No. 3 panel, C9.

CAUTION

- The TGM shall not be maintained in the full power mode (electrical alignment, slew, track) in excess of 30 minutes on any single mission, and the sum of the TV mode period (weapon select TV and gyros running) and the full power mode period on any single mission shall not exceed 40 minutes. No single simulated attack (start to stop of camera operation) with the TGM shall be in excess of 3 minutes.
- Do not fly within 20° of the sun when the TGM is uncaged.

INFLIGHT**CAUTION**

- Pointing TGM (65A), (65B) seeker toward sun while operating in track mode will result in burned vidicon.
- (TGM (65A), 65B) Chipping, cracking, and/or breaking of the seeker dome may occur if the missile is flown through rain or hail.
- Before entering visible precipitation when carrying TGM (65D) missiles with missile dome covers expended, reduce airspeed below 350 KIAS or 0.55 MACH (whichever is lower).
- Do not operate the TGM (65A), (65B) in excess of 40 minutes in the TV mode (weapon select TV or ARM) or in excess of 30 minutes in the full power mode (video present). No single simulated attack (start to stop of camera operation) with the TGM shall be in excess of 30 minutes.
- When on the ground or flying at less than 0.9 Mach, do not operate the TGM (65D) missile in excess of 30 minutes in the activate mode (IR image displayed on cockpit video) or in excess of 60 minutes in the missile ready mode (gyro power applied, weapon selected). The total missile operational time is a summation of the activate mode and the missile ready times and will not exceed 60 minutes on any single mission. When flying at 0.9 Mach through and including 1.8 Mach, the maximum time is 5 minutes in the activate mode and 30 minutes in missile ready mode, with a total operational time not exceed 30 minutes.

1. Delivery mode knob - DIRECT
2. Weapon selector knob - TV (3-minute timer start)
3. TGM station select button - PRESS
 - a. Station green light - ON
4. Master arm switch - ARM
 - a. Station ARM light - ON (3-minute timer complete)
 - b. Head-up ARM light - ON
5. Trigger - SQUEEZE and RELEASE
 - a. Video - ON
 - b. TGM recorder is functioning (when installed)
6. Target contrast switch - SET
7. Position pipper on target/aimpoint.
8. Locate target in video display and initiate lockon.
 - a. (P) Front cockpit lockon procedure:
 - (1)ARR button - PRESS and HOLD
 - (2)Use seeker control to position target in tracking window.
 - (3)ARR button - RELEASE
 - (4)Verify lockon.
 - b. (WSO) Rear cockpit lockon procedure:
 - (1)Action switch - HA
 - (2)Use antenna hand control and position target in tracking window.
 - (3)Action switch - FA/RELEASE
 - (4)Verify lockon.
9. (P or WSO) Bomb button - PRESS and HOLD (1 second minimum)
 - a. Verify release signal - WPN VIDEO BLANK
10. For next run, repeat steps 5 thru 9.

CAUTION

If the bomb button is not pressed, the trigger must be squeezed prior to pulling off the target during a simulated missile attack. This cages the seeker to preclude damage to the gyro, bumper rings, cables and optics. It also makes the TGM (65A), (65B) sun shutter operable precluding damage to the vidicon. After pullout, deselect station until next pass.

After last run -

11. Master arm switch - SAFE
12. TGM station select button - OFF
 - a. Green light - OFF
 - b. Video - OFF
13. Weapon selector knob - B or C (out of TV or ARM)

LASER TARGET DESIGNATOR (PAVE SPIKE) (BLOCK 36 THRU 45, SELECTED AIRCRAFT)

PREFLIGHT

TDS BIT CHECKS

PreBIT

1. (P) Delivery mode knob - TGT FIND
2. (P) Scope display switch - TV
3. (P) Slant range indicator mode knob - WRCS
4. WRCS BIT selector knob - OFF
5. Cursor control panel FRZ and TGT INS button lights - OFF
6. INS mode knob - ALIGN or NAV
7. Weapon delivery panel switches (3) - NORM
8. Radar power knob - STBY
9. Radar range knob - AI 10
The AI 10 range is used to tune the TV display during DSCG BIT check.
10. Display knob - B-WIDE

CAUTION

To prevent damage to the radar set control panel, do not select TV on the DSCG mode knob and the radar mode knob at the same time. The TV position on the radar mode knob is not used. AIM-7 missiles detune and cannot be tuned when the radar mode knob is in TV.

11. Radar mode knob - OUT OF TV
12. Scope mode knob - TV
13. Video select button - ASQ-153 ON
14. TDS BIT indicator - 0
The BIT selector pushbutton is functional with power off. Each actuation advances the indicator one unit.
15. TDS ACQ switch - 12 VIS

LASER TARGET DESIGNATOR (PAVE SPIKE) (BLOCK 36 THRU 45, SELECTED AIRCRAFT)

PREFLIGHT



TDS BIT CHECKS

PreBIT

1. (P) Delivery mode knob - TGT FIND
2. (P) Scope display switch - TV
3. (P) Slant range indicator mode knob - WRCS
4. WRCS BIT selector knob - OFF
5. Cursor control panel FRZ and TGT INS button lights - OFF
6. INS mode knob - ALIGN or NAV
7. Weapon delivery panel switches (3) - NORM
8. Radar power knob - STBY
9. Radar range knob - AI 10
The AI 10 range is used to tune the TV display during DSCG BIT check.
10. Display knob - B-WIDE

To prevent damage to the radar set control panel, do not select TV on the DSCG mode knob and the radar mode knob at the same time. The TV position on the radar mode knob is not used. AIM-7 missiles detune and cannot be tuned when the radar mode knob is in TV.

11. Radar mode knob - OUT OF TV
12. Scope mode knob - TV
13. Video select button - ASQ-153 ON
14. TDS BIT indicator - 0
The BIT selector pushbutton is functional with power off. Each actuation advances the indicator one unit.
15. TDS ACQ switch - 12 VIS

(WSO) TDS Turnon and BIT

1. POWER ON button - PUSH ON
 - a. All TDS lights - ON
 - BIT 0 tests the TD panel lamps. The LT BRT knob is not functional in BIT 0.
2. TDS BIT switch - 1
 - a. POWER ON light - ON
 - b. STOW light - ON
 - c. WRCS OUT light - ON
 - d. All other TDS lights - OFF

BIT 1 continuously monitors the TDS during normal operation. The MALF light comes ON to indicate a malfunction in the TV sensor, laser triggers, low voltage power supply, or the servo loop. The GO light is inoperative.

3. After 30 seconds from POWER ON, TDS STOW button - PUSH
 - a. STOW light - OFF
 - b. WRCS OUT light - OFF
 - c. MALF light - OFF
4. Adjust 12-VIS TV display for optimum picture.
5. TDS BIT switch - 2
 - a. TV scene should dim. After 15 seconds, either GO or MALF light - ON

The track mode and TV performance is checked in BIT 2. A TV display is produced to simulate low light level conditions. This is accomplished by driving the filter wheel to maximum density; the TV scene should dim. The track mode test starts when BIT 2 is selected. After approximately 15 seconds, either a GO or MALF is presented on the status of the track mode.

NOTE

- BIT 2 cannot be performed while taxiing or airborne. The aircraft must be stationary to receive the required INS inputs for a GO indication.
- Under high light levels, filter wheel operation may not be apparent; the TV scene may not dim.

6. TDS BIT switch - 3
 - a. Immediate GO or MALF light - ON
 - b. TV reticle rotates 180° clockwise.

WARNING

Check ground crew clear of the TDS pod while performing BIT 3 to prevent injury from laser energy. Refer to AFR 161-24 and AFM 161-32.

The laser systems are checked during the first part of BIT 3 to produce either a GO or MALF indication, and the TV reticle is rotated 180°. If a GO is received, the WSO fires the laser by holding the REJOVRD button pressed. The GO light goes out when REJOVRD is pressed. After approximately 5 seconds, either a GO or MALF light is presented and the REJOVRD button may be released.

7. After GO light ON, REJOVRD button - PRESS and HOLD
 - a. Immediate GO light - OFF
 - b. After approximately 5 seconds, GO or MALF light - ON
8. REJOVRD button - RELEASE
9. OVHT/INS OUT button - PRESS
 - a. INS OUT light - ON
 - b. WRCS OUT light - ON
10. TBS BIT switch - 4
 - a. (WSO) After 4 to 15 seconds, GO or MALF light - ON
 - b. (P) After 4 to 15 seconds, SRI displays 021 ±002.

Laser slat range computation is checked in BIT 4 by simulating a range input of 2100 ±200 feet. The SRI should display 021 ±002. Circuit operation is confirmed approximately 5 seconds after selecting BIT 4 by either a GO or MALF light.

11. OVHT/INS OUT button - PRESS
 - a. INS OUT Light - OFF
 - b. WRCS OUT light - OFF
12. TDS BIT switch - 1

TDS Functional Check

1. FOV button (IFF button) - PRESS and RELEASE
 - a. Narrow FOV selected.
2. Antenna hand control action switch - HALF ACTION and RELEASE
 - a. Track mode entered.
3. Move antenna hand control forward and aft, left and right.
 - a. TV LOS follows hand control movement.

NOTE

If track gimbal limits are reached, track mode is broken and should be re-entered to complete LOS movement check.

4. Antenna hand control action switch - HALF ACTION and RELEASE
 - a. 12-VIS scene appears.
5. (P) SRI TEST button - PRESS
 - a. (P) Digit readout check - 888

(WSO) Coder Control Unit Check

1. TDS coder control panel - SET 1688 (or as required)
2. Laser code enter button - PRESS and RELEASE
3. NO GO light ON for one-half second, then remains OFF

BEFORE TAKEOFF



1. TDS STOW button - PRESS
 - a. After approximately 5 seconds, STOW light - ON
 - b. WRCS OUT light - ON
 - c. (P) TDS LOS indicator pointer - +160°

TDS POWER ON is required to maintain pod stowed position which should prevent FOD damage to the optical glass dome during the takeoff run.

TDS BIT FAULT ANALYSIS

Step	Problem	Additional Tests	Status
BIT 0 1a	All indicators do not illuminate.		Mission may be flown with burned out lamps.
BIT 1 3c	MALF light ON.	Press WRCS OUT button ON.	If MALF light goes out when WRCS OUT light comes ON, operate TDS without WRCS. If MALF light remains ON, mission should not be flown until problem is corrected.
BIT 2 5a 5a	MALF light ON. TV scene does not dim.		Mission may be flown. TDS track mode may be severely degraded. Filter wheel malfunction. TV scene may washout in extreme high light level areas.
BIT 3 6a	MALF light ON immediately.		No laser fire capability.
BIT 4 10a, 10b	MALF light ON.	Check slant range indicator readout.	If 10a and 10b fail, ranging capability may be degraded. Perform inflight check of system operation.

INFLIGHT

TDS TURNON

1. Radar power knob - STBY or OPR
2. Scope mode knob - TV
3. Video select button - ASQ-153 ON
4. TDS BIT - 1

5. TDS ACQ switch - 12 VIS
6. TDS POWER ON button - PUSH
 - a. POWER ON light - ON
 - b. STOW light - ON
 - c. WRCS OUT light - ON
7. TDS STOW button - PUSH
 - a. STOW light - OFF
 - b. WRCS OUT light - ON (if WRCS not selected).

NOTE

Do not unstow TDS pod while in a right bank of 20° or greater. TDS pod head disorientation may occur, affecting TV scene.

The WRCS OUT light remains ON if WRCS integration with the TDS is not accomplished. To select WRCS, refer to TDS Boresight Check.

TDS BORESIGHT CHECK**Select WRCS/TDS Integration**

1. Weapon delivery panel target find switch — NORM
2. TDS illuminated WRCS OUT button — PUSH
3. (P) Optical sight mode knob — A/G
4. (P) Delivery mode knob — TGT FIND
 - a. (WSO) WRCS OUT light — OFF
5. (P) Scope display switch — TV

The WRCS OUT light goes off when the delivery mode knob is positioned to TGT FIND or DIRECT and the weapon delivery panel target find switch is in NORM; indicating WRCS/TDS integration is selected.

12-VIS Boresight Check

1. (P) Hold pipper on distant point. Advise WSO of pipper position and subsequent movements (CALL).
2. FOV button — PRESS
 - a. Narrow FOV selected.
3. Observe TV reticle position over distant object selected by pilot. Adjust TV reticle position as required using the AZ and EL 12-VIS boresight knobs. Inform pilot when boresight completed (CALL).

BEFORE ACQUISITION (WRCS IN)

The following aircrew inputs or switch positions should be accomplished prior to IP/target acquisition. If WRCS is OUT, proceed to Before Acquisition (WRCS OUT).

WRCS Auto Mode, Before IP

The WRCS is integrated with the following release modes when the WRCS OUT light is off and TDS POWER ON is selected:

- a. The WRCS automatic release mode is selected when the delivery mode knob is in TGT FIND and the slant range indicator mode knob is in WRCS.
- b. The ROR automatic release mode is selected when the delivery mode knob is in TGT FIND and the slant range indicator mode knob is in ROR.
- c. The DIRECT release mode is selected when the delivery mode knob is in DIRECT.
 1. (P) Slant range indicator mode knob — WRCS or ROR
 2. (P) Delivery mode knob — TGT FIND or DIRECT
 3. (P) Sight mode knob — A/G or CAGE
 4. (P) Reticle depression knob — SET AS DESIRED

During all TDS acquisition modes, the optical sight is caged 35 mils below FRL and 0° azimuth.

When the WSO selects TDS track mode, the optical sight depresses to the angle set in the RETICLE DEPR window, providing the A/G sight mode is selected. With CAGE sight mode selected, the sight reticle remains caged during TDS track mode.

5. (P) Navigation mode selector knob — COMP
6. (P) HSI mode switches — NAV COMP (if desired)

If the HSI indicators are to be used select NAV COMP.
7. (WSO) INS mode selector knob — NAV
8. (WSO) Navigation mode selector switch — NAV COMP.
9. (WSO) Weapon delivery panel — SET
 - a. Activate switch — NORM
 - b. Target find switch — NORM
 - c. Range switch — NORM

The position of the range switch has no effect because the release RANGE input on the WRCS panel is not accepted by the WRCS computer.
10. (WSO) WRCS input counters — SET
 - a. Target distance N/S — 100-foot increments (maximum 600).
 - b. Target distance E/W — 100-foot increments (maximum 600).
 - c. IP altitude MSL — 100-foot increments.

If an IP is not used, set N/S and E/W to 000 and set ALT to the target altitude MSL.
 - d. Drag coefficient.
 - e. Release advance — milliseconds (if desired).
11. (P) Weapon release controls — SET
 - a. Weapon selector knob — BOMBS
 - b. Nose/tail arm switch — SET
 - c. Interval switch — SET (if required)
 - d. Station select — LOADED STATION

NOTE

The ADI will not provide steering if the weapon selector knob is on AGM-45.

12. (WSO) Target designator panel:
 - a. WRCS OUT light — OFF
 - b. ACQ switch — WRCS
 - c. POWER ON light — ON
 - d. OVHT/INS OUT lights — OFF
13. (WSO) TDS LASER READY button — PUSH ON
 - a. LASER READY light — ON
14. (WSO) Radar controls:
 - a. Radar power — OPR
 - b. Radar display — PPI WIDE
 - c. Radar mode — MAP
 - d. Scope mode — RDR

BEFORE ACQUISITION (WRCS OUT)**ROR Mode**

The WRCS is removed from the TDS when the WRCS OUT light is ON. The following assumes the selection of the ROR automatic release mode with WRCS OUT and the delivery mode knob in TGT FIND. The DIRECT release mode can be used if desired. The level delivery profile is best suited for ROR mode.

NOTE

The TDS pod can be used with WRCS OUT and the delivery mode knob in any position (including OFF). However, TDS track mode is not available when the antenna hand control is nonfunctional, as in the WRCS Dive Toss delivery mode.

1. (P) Slant range indicator mode knob - SET
2. (P) Enter the release slant range to target, times 100 feet.
3. (P) Slant range indicator mode knob - ROR
4. (P) Delivery mode - TGT FIND
5. (P) Sight mode - A/G or CAGE

During all TDS acquisition modes, the optical sight is caged 35 mils below FRL and 0° azimuth. When the WSO selects TDS track mode, the optical sight depresses to the angle set in the RETICLE DEPR window providing the A/G sight mode is selected. With CAGE sight mode selected, the sight reticle remains caged during TDS track mode.

6. (WSO) Weapon delivery panel switches - NORM
7. (WSO) Target designator panel:
 - a. ACQ switch - 12 VIS or 9 VIS
 - b. POWER ON light - ON
 - c. OVHT/INS OUT lights - OFF
 - d. WRCS OUT light - ON

NOTE

If the INS is OUT, the ROR automatic release mode can be accomplished using the antenna hand control to manually track the target.

8. (WSO) TDS LASER READY button - PUSH ON
 - a. LASER READY light - ON

ACQUISITION

The following procedures assume the TDS to be in the acquisition mode of operation selected by the TDS ACQ switch. The TDS pod automatically enters the acquisition mode selected when initially turned on. The presence of the acquisition mode can be determined by the absence of the TT_G and T_O cues on the TV display.

(WSO) WRCS Visual Offset Aimpoint Acquisition

1. WRCS panel alt/range counter - ENTER OFFSET AIMPOINT ALTITUDE MSL
2. TDS ACQ switch - 12 VIS or 9 VIS
3. Scope - TV
4. Accomplish a 12-VIS or 9-VIS acquisition of the offset aimpoint and enter the track mode.

The horizontal range and bearing of the offset aimpoint from the aircraft are now supplied to the WRCS.
5. While accurately tracking the offset aimpoint, press the target insert button.

The offset aimpoint position is now memorized and the offset distances are added to slew the pod LOS to memory over the target.
6. WRCS panel alt/range counter - ENTER TARGET ALTITUDE MSL
7. When target is in TV FOV, enter TDS track mode

when desired.

NOTE

- The aircraft altitude must be greater than the offset aimpoint altitude during the tracking portion of the acquisition to ensure accurate range information to the WRCS.
- Laser slant range information is desired for accuracy but not required. If laser ranging is not used, degraded accuracy can be expected when operating at low altitude.

(WSO) WRCS Offset Radar IP Acquisition

1. TDS ACQ switch - WRCS
2. Operate the along track cursor to position the range cursor over the RIP.

NOTE

Do not position the range cursor below zero range. This can cause the cursor and the along track control to become 180° out of phase; i.e., forward knob motion (increasing range) produces downward cursor motion (decreasing range). Range steering information would be in error by 180°. If this condition occurs, push the reset button and roll the knob/cursor out to the desired range.

3. Operate the cross track cursor to position the offset cursor over the RIP.
4. Freeze button - PUSH ON

NOTE

The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursor can be moved to touchup the intersection location over the RIP after the freeze button is pushed on.

5. Target insert button - PUSH ON

The steering instruments display steering command when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT/RANGE counter and touchup the cursors over the target.
6. Scope mode - TV
 - a. TV reticle identifies cursor intersection.

Adjust TV display and touchup TV reticle position over target using WRCS cursor controls.
7. Radar display - B-WIDE

The PPI radar display must be deselected to obtain antenna hand control operation during track mode.
8. When target is in TV FOV, enter TDS track mode.

(WSO) WRCS Visual IP Flyover Acquisition

1. WRCS panel ALT/RANGE counter, set in target altitude MSL.
2. TDS ACQ switch - WRCS
3. Scope mode - TV
4. When over IP, target insert button - PUSH ON
Target elevation must be set in the ALT/RANGE control on the WRCS panel. When the aircraft is directly over the IP, press the target insert button. The steering instruments supply steering commands to the target, and the cursors position over and start tracking the target. If the target is visible on the scope, the WSO may touchup the cursor position.
5. When target is in TV FOV, enter TDS track mode when desired.

12-VIS/9-VIS IP/Target Acquisition

1. (WSO) TDS ACQ switch - 12 VIS or 9 VIS
2. (WSO) Scope mode - TV
 - a. TV reticle identifies pipper position.
3. (P) Position pipper on IP/target location (CALL).
The target designator pod LOS is boresighted to the pipper. Identify IP/target area for the WSO by pipper position. The WSO should enter TDS track mode at the call signal. After TDS track is established proceed to LGB release.
4. (WSO) When pipper is on IP/target area, enter TDS track mode.

(WSO) TDS TRACK AND LASER FIRE

1. Enter track mode: action switch - HA and RELEASE
 - a. TT_G and T_O cues appear on TV display and flash at 5 Hz.
Observe target in TV FOV and enter track mode. Correct minor tracking errors through movement of the antenna hand control.
2. TV field-of-view - AS DESIRED
3. Fire laser until bomb impact: action switch - FA and RELEASE (CALL)
 - a. TT_G and T_O symbols - NOT FLASHING

WARNING

Strict adherence to laser safety regulations must be observed at all times during non-combat operation. Refer to AFR 161-24 and AFM 161-32.

NOTE

If the TT_G symbol flashes at 2 Hz, laser range is not valid. If the TT_G flashes at 5 Hz, transmitter laser energy is low. If both the T_O and TT_G flash at 5 Hz, system is in track but laser is not operating.

Laser must be fired before weapon release and continued until bomb impact. Inform the pilot of laser fire and commence bomb run. Correct tracking errors during laser fire through movement of the antenna hand control.

4. After bomb impact, stop laser fire: action switch - FA or HA and RELEASE
 - a. TT_G and T_O cues flash at 5 Hz if FA selected.
TT_G and T_O removed if HA selected.

Observe TV scene of weapon impact. Laser fire stops and the track mode is retained when the action switch is pressed to FA and released. Laser fire stops and track mode is broken when the action switch is pressed to HA and released. Track memory is entered with WRCS IN when LOS gimbals limits are reached; track is broken and the laser stops firing. If TT_G is flashing at 2 Hz, the REJOVRD button must be momentarily pressed to use laser derived slant range data. TT_G and T_O cues flash at 5 Hz to indicate laser has stopped firing while in the track mode.

5. To break track and enter acquisition mode; action switch - HA and RELEASE
 - a. TT_G and T_O cues removed from TV display.
 - b. TV LOS returns to acquisition mode.

NOTE

With WRCS acquisition mode selected and WRCS OUT, the 12-VIS acquisition mode is automatically selected when track is broken.

6. When leaving target area, LASER READY button - PUSH OFF
 - a. LASER READY light - OFF

(WSO) Coder Control Unit Check

1. TDS coder control panel - CHECK CODE 1688 (or as required)
2. Laser code enter button - PRESS and RELEASE
3. NO GO light ON for one-half second, then remains OFF.

(P) LGB RELEASE

1. Master arm switch - ARM
 - a. Selected station amber light - ON
2. Observe laser tracking; TT_G and T_O cues steady (NOT FLASHING)
3. Bomb button - PRESS and HOLD
 - a. WRCS tone ON until bomb release.
 - b. After bomb release, pullup light - ON and TONE OFF
 - c. After station is empty, amber light - OFF
4. After weapon release, bomb button - RELEASE
 - a. After bomb button release, pullup light - OFF
5. LOS indicator pointer - IN LIMITS
Maintain target in TDS pod FOV until weapon impact.

WRCS Automatic Release Mode

Press and hold the bomb button after laser fire is confirmed and initiate delivery maneuver. (Various delivery maneuvers are described in section I.) Maintain a course through the target (or upwind aimpoint) until weapon release. TT_G cue moves toward T_O as weapon release point approaches. Weapon release occurs when TT

G reaches T_O, the optical sight range bar is at approximately 3 o'clock position, and the pullup light illuminates. After release, release the bomb button and maintain the target in TDS pod FOV until weapon impact.

ROR Automatic Release Mode

Confirm laser fire: TT_G and T_O cues not flashing. If the WRCS is integrated with the ROR mode, TT_G moves toward T_O as in the WRCS auto release; however, weapon release will not occur at T_O. If WRCS is OUT, TT_G remains stationary above T_O. As release slant range is approached, press and hold bomb button, and maintain a course through the target (or upwind aimpoint) while in level flight. Weapon release occurs when the slant range indicator displays the preset slant range (or any slant range less than the preset slant range), if the bomb button is pressed. After release, release the bomb button and maintain target in TDS pod FOV until weapon impact.

(WSO) BEFORE LANDING

(WSO) TDS Pod Stowed

1. TDS POWER ON light - ON
2. TDS STOW light - ON



TDS POWER ON is required to maintain pod stowed position. The pod should be stowed before landing to prevent FOD damage to the optical glass dome during the landing roll.

(WSO) BEFORE ENGINE SHUT DOWN

(WSO) TDS Turn-off

1. TDS POWER ON button - PUSH OFF
 - a. All TD panel lights - OFF

NOTE

When the illuminated POWER ON button is pressed, power remains ON to automatically complete the pod stow sequence if not previously accomplished.

TDS INFLIGHT TROUBLE GUIDE

MALFUNCTION FOLLOWED BY POSSIBLE SOLUTIONS

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Pod does not unstow with no MALF in BIT 1. | <ol style="list-style-type: none"> 1a. Reset all TGT DESIG PWR circuit breakers. 1b. Use INS OUT mode. 1c. Select 9-VIS mode. Press the lighted STOW button, in attempt to unstow the pod. Report malfunction after landing even if this procedure corrects the situation. |
| <ol style="list-style-type: none"> 2. No control of pod in track mode. | <ol style="list-style-type: none"> 2a. Check TGT ALT setting on WRCS panel. If TGT ALT is above aircraft altitude, track mode not possible with WRCS IN. 2b. Try WRCS OUT. 2c. Try INS OUT. 2d. Check radar display is out of PPI. |
| <ol style="list-style-type: none"> 3. Slant Range Indicator (SRI) displays wrong range. | <ol style="list-style-type: none"> 3a. Check BIT 4; observe readout (021 ±002) closely for fluctuations. 3b. Adjust TGT ALT to see if adjustment affects readout. 3c. Use INS OUT if 3b adjustment produces a large jump in slant range readout. 3d. Check slant range indicator not in SET mode. |
| <ol style="list-style-type: none"> 4. Cannot select WRCS IN. | <ol style="list-style-type: none"> 4a. (P) Check: delivery mode knob is in TGT FIND or DIRECT. 4b. Check: weapon delivery panel target find switch is in NORM. 4c. Check: INS OUT light must be off. |
| <ol style="list-style-type: none"> 5. With WRCS IN, pod slews in opposite direction of slew commands from cursor control. | <ol style="list-style-type: none"> 5a. Turn pod off and operate cursor controls to determine which direction each cursor moves. Press reset button on cursor control panel if necessary. |

CONTINUED

TDS INFLIGHT TROUBLE GUIDE (CONT)

MALFUNCTION FOLLOWED BY POSSIBLE SOLUTIONS (CONT)

6. With WRCS IN, wrong steering information supplied.
- 6a. (P, WSO) Check: NAV COMP selected in both cockpits.
6b. Check: compass control switch is in PRIMARY.
7. With WRCS IN, pod does not track target after FREEZE or TARGET INSERT.
- 7a. Check: TD panel ACQ switch is in WRCS.
7b. (P) Check: delivery mode knob is in DIRECT or TGT FIND.
7c. Check: TGT ALT setting on WRCS panel must be below aircraft altitude.
8. No TV display on scope.
- 8a. Check: pod STOW light must be off.
8b. (P) Check: scope display switch is in TV.
8c. Check: ASQ-153 light is ON.
8d. Check: scope mode knob is in TV.
9. No release in WRCS automatic mode.
- 9a. (P) Check: delivery mode selector is in TGT FIND.
9b. (P) Check: weapon selector knob is in BOMBS.
9c. (P) Check: SRI mode knob is in WRCS.
10. No release in ROR mode.
- 10a. (P) Check: SRI mode knob is in ROR.
10b. (P) Check: delivery mode knob is in TGT FIND.
10c. (P) Check: weapon select knob is in BOMBS.
11. Laser does not fire.
- 11a. Check: LASER READY light is on.
11b. Check: TDS is in track mode, action switch FA.
11c. Check: radar display not in PPI.
11d. (P) Cycle landing gear to reset nose wheel switch.
12. Cannot enter track.
- 12a. Select a radar mode and check hand control operation in FA.
12b. (P) Pod could be stuck in a gimbal limit; check LOS pointer indication.
12c. Check radar display is out of PPI.
13. Cannot break track.
- 13a. Run pod into a gimbal limit. Then select WRCS OUT to place TDS in correct acquisition mode.
13b. Check that half action is selected (not full action).
14. Cannot clear memory track.
- 14a. (P) Position delivery mode knob to OFF (or to any position other than DIRECT or TGT FIND).
14b. Press WRCS OUT button: WRCS OUT light goes out.
14c. Cycle target find switch on weapon delivery panel to HOLD, then back to NORM.
15. TT_G flashing 2 Hz.
- 15a. Laser fired. Laser range not accepted.
16. TT_G flashing 5 Hz.
- 16a. Attempted laser fire. No or low laser energy.
17. TT_G and T_O flashing 5 Hz.
- 17a. Track mode selected. Laser fire not attempted.
18. TT_G and T_O steady.
- 18a. Laser operation normal. Laser fired and laser range accepted.
19. TT_G and T_O removed.
- 19a. Acquisition mode selected or memory mode entered.

BOMBS & SUU-20 DISPENSER

INFLIGHT

NOTE

- There is no cockpit indication to determine that all bombs have been released from SUU-20 bomb/rocket dispenser. The intervalometers within the SUU-20 cannot be rehomed inflight for an attempt to release a hung bomb. Do not use an interval setting of less than 0.20 second when using the SUU-20.
- With the BRU-5/A rack on centerline, the following release procedures may be used to release the M118 or MK 84 GP bomb from the CL station. Without the BRU-5/A, the DCU-94/A procedures may be used.

DIRECT DELIVERY MODE

Bomb Release - Armed

1. Sight mode knob - A/G
2. Reticle depression knob - SET
3. Delivery mode knob - DIRECT
4. Weapon select - BOMBS
5. AWRU - SET
 - a. Interval controls - SET
 - b. Quantity knob - SET
6. Nose/tail arm switch - ON (as required)
7. Station select - LOADED STATION(S)
 - a. Green light(s) - ON
8. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light(s) - ON

NOTE

With the weapon select knob in BOMBS, the station ARM (amber) light illuminates only if the nose/tail arm switch is in one of the ON (armed) positions.

9. Bomb button - PRESS
 - a. Pullup light - ON
 - b. When station is empty, station ARM light - OFF

Emergency Bomb Release - Armed

1. AWRU Quantity knob - C or S

CAUTION

When selecting either C or S, observe minimum release interval between bombs released from the same aircraft station.

2. Repeat steps 5 thru 9; hold bomb button pressed 4 seconds.

If all bombs do not release:

3. Weapon select knob - RKTS & DISP
4. Weapon select knob - BOMBS
5. Bomb button - PRESS (hold 4 seconds)

DIVE TOSS/DIVE LAYDOWN

Before Bomb Run

1. Sight mode knob - A/G
The sight reticle is electrically caged to the radar boresight line and is drift stabilized.
2. Delivery mode knob - DIVE TOSS or DIVE LAY
3. HSI mode switches - NAV COMP
If the HSI indications are to be used, the NAV COMP position must be selected.
4. (WSO) INS mode selector knob - NAV
5. (WSO) Radar mode - AIR-GRD
6. (WSO) Radar range - AI 5 or AI 10
7. (WSO) Radar power - OPR
B-sweep, acquisition symbol, and el strobe centered on scope.
8. (WSO) Antenna stab switch - NOR
9. (WSO) WRCS drag coefficient counter - SET (DIVE TOSS only)
10. (WSO) WRCS release range counter - SET (DIVE LAY only)
 - a. Range switch - NORM or $\times 100$
11. (WSO) WRCS release advance - SET (if required)
12. Weapon select knob - BOMBS
13. AWRU - SET
 - a. Interval controls - SET
 - b. Quantity knob - SET
14. Nose/tail arm switch - ON (as required)
15. Station select - LOADED STATION(S)
 - a. Green light(s) - ON
16. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light(s) - ON

NOTE

- With the weapon select in BOMBS, the station ARM (amber) light illuminates only if the nose/tail arm switch is in one of the ON (armed) positions.
- The optical sight and the radar antenna are drift stabilized. Additional upwind correction must be made for the wind effect on the high drag bombs. Wind correction is not required for the low drag bombs (M117 etc.).

Bomb Run

During the initial dive toward the target area, the WSO reduces the receiver gain to obtain a single return, presses the action switch to Half Action, places the range strobe in the center of the return, and then presses the action switch to Full Action and releases. After lockon, the pilot places the pipper on target, presses and holds the bomb release button, and initiates the desired delivery maneuver. After the bomb is automatically released, the pullup light will illuminate and will go out when the bomb button is released. The station ARM light will go out when the station is empty.

1. (WSO) Receiver gain - MINIMUM
2. (WSO) Lock on target (CALL)
3. Bomb release button - PRESS AND HOLD
 - a. After bomb release, pullup light - ON
 - b. After station is empty, station ARM light - OFF

LAYDOWN**Before Bomb Run**

1. Sight mode knob - A/G
2. Delivery mode knob - LAYDOWN
3. Reticle depression knob - SET (if required)
Set the IP-to-target sight setting.
4. HSI mode switches - NAV COMP
If the HSI steering information is to be used, the NAV COMP position must be selected.
5. (WSO) INS mode selector knob - NAV
6. (WSO) WRCS target range counter - SET
Set the distance from IP to target.
7. (WSO) WRCS release range counter - SET
 - a. Range switch - NORM or $\times 100$
8. (WSO) WRCS release advance counter - SET (if required)
9. Weapon select knob - BOMBS
10. AWRU - SET
 - a. Interval controls - SET
 - b. Quantity knob - SET
11. Nose/tail arm switch - ON (as required)
12. Station select - LOADED STATION(S)
 - a. Green light(s) - ON
13. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light(s) - ON

NOTE

With the weapon select knob in BOMBS, the station ARM (amber) light illuminates only if the

nose/tail arm switch is in one of the ON (armed) positions.

Bomb Run

Approach the target at the preplanned release altitude and airspeed. When the aircraft is directly over the IP, or when the pipper is on target, press and hold the bomb release button. Maintain a constant airspeed, altitude, and course until the bomb is automatically released. The pullup light will illuminate to indicate bomb release and will go out when the bomb button is released. Wind corrections for the bomb must be applied prior to pressing the bomb button.

1. Bomb release button - PRESS and HOLD
 - a. At bomb release, pullup light - ON
 - b. When a station is empty, station ARM light - OFF

OFFSET BOMB/TARGET FIND**Before IP**

1. Sight mode knob - A/G
The optical sight reticle is electrically caged to the RBL and to 0° in azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
2. Delivery mode knob - OFFSET BOMB or TGT FIND
3. Navigation mode selector knob - NAV COMP
4. HSI mode switches - NAV COMP
If the HSI indications are to be used, the NAV COMP position must be selected.
5. (WSO) INS mode selector knob - NAV
6. (WSO) Navigation mode selector switch - NAV COMP
7. (WSO) Weapon delivery panel - SET
 - a. Activate switch - NORM
 - b. Target find switch - NORM
 - c. Range switch - AS REQUIRED

NOTE

The position of the range switch will affect the value placed in the release RANGE readout: times 10 (NORM), or times 100.

8. (WSO) WRCS input counters - SET
 - a. Target distance N/S - 100-foot increments.
 - b. Target distance E/W - 100-foot increments.
 - c. IP altitude MSL - 100-foot increments.
 - d. Release range - 10-foot or 100-foot increments (OFFSET BOMB)
 - e. Release advance - Milliseconds (OFFSET BOMB, if required)
9. Weapon select knob - BOMBS (OFFSET BOMB)

NOTE

The ADI will not provide steering if the weapon select knob is on ARM.

10. AWRU - SET
 - a. Interval controls - SET
 - b. Quantity knob - SET

11. Nose/tail arm switch - ON (as required)
12. Station select - LOADED STATION(S)
 - a. Green light(s) - ON
13. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light(s) - ON

NOTE

With the weapon select in BOMBS, the station ARM (amber) light illuminates only if the nose/tail arm switch is in one of the ON (armed) positions.

Bomb Run - Offset Radar IP

1. (WSO) Radar power - OPR
2. (WSO) Radar mode - MAP-PPI
3. (WSO) Antenna stab switch - NOR
4. (WSO) Cursor intensity - ADJUST
5. (WSO) Antenna elevation - ADJUST
6. (WSO) Scan switch - WIDE
7. (WSO) Radar range - AI 10 or AI 25
8. (WSO) Operate along track cursor to position range cursor over RIP

NOTE

Do not position the range cursor below zero range. This can cause the cursor and the along track control to become 180° out of phase; i.e., forward knob motion (increasing range) produces downward cursor motion (decreasing range). Range steering information would be in error by 180°. If this condition occurs, push the reset button and roll the knob/cursor out to the desired range.

9. (WSO) Operate cross track cursor to position offset cursor over RIP.
10. (WSO) Freeze button - PUSH ON

NOTE

The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touchup the intersection location over the RIP after the freeze button is pushed on.

11. (WSO) Target insert button - PUSH ON

The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touchup the cursors over the target.
12. Bomb release button - PRESS and HOLD (OFFSET BOMB)
 - a. At bomb release, pullup light - ON
 - b. When a station is empty, station ARM light - OFF

When the aircraft is on course to the target and at the preplanned release altitude and airspeed, press and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

NOTE

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run - Visual IP Flyover

1. (WSO) When over IP, freeze button and target insert button - PUSH ON

When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors start tracking the target. If the target is visible on the scope, the WSO may touchup the cursors when the target elevation is set in the ALT RANGE control.
2. Bomb release button - PRESS and HOLD (OFFSET BOMB)
 - a. At bomb release, pullup light - ON
 - b. When a station is empty, station ARM light - OFF

When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, press and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

NOTE

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

LABS/OFFSET BOMB/TARGET FIND

After Takeoff

1. Sight mode knob - A/G

The optical sight reticle is electrically caged to the RBL and to 0° azimuth. The roll tabs display aircraft attitude until target insert, then steering commands to the target.
2. Delivery mode knob - OFFSET BOMB or TGT FIND
3. (WSO) Target find switch - HOLD

Select HOLD on the weapon delivery panel.
4. Navigation mode knob - NAV COMP
5. HSI mode switches - NAV COMP

If the HSI indications are to be used, the NAV COMP position must be selected.
6. (WSO) INS mode knob - NAV
7. (WSO) Navigation mode selector switch - NAV COMP
8. (WSO) WRCS input counters - SET
 - a. Target distance N/S - 100-foot increments
 - b. Target distance E/W - 100-foot increments
 - c. IP altitude MSL - 100-foot increments
 - d. Release range - 10-foot or 100-foot increments (OFFSET BOMB)
 - e. Release range - LABS pullup range, 10-foot or 100-foot increments

NOTE

The $\times 100$ factor is selected through the range switch on the weapon delivery panel.

- f. Release advance - Milliseconds (OFFSET BOMB, if required)
- 9. Weapon select knob - BOMBS (OFFSET BOMB)

NOTE

The ADI will not provide steering if the weapon select knob is on AGM-45.

- 10. AWRU - SET
 - a. Interval controls - SET
 - b. Quantity knob - SET
- 11. Nose/tail arm switch - ON (as required)
- 12. Station select - LOADED STATION(S).
 - a. Green light(s) - ON
- 13. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light(s) - ON

NOTE

With the weapon select in BOMBS, the station ARM (amber) light illuminates only if the nose/tail arm switch is in one of the ON (armed) positions.

- 14. (WSO) Dual timers - SET
 - a. Pullup timer - T_1
 - b. Release timer - T_2
- 15. (WSO) Release gyro - SET
 - a. Low angle (LOFT) - DEG

Before Bomb Run

- 1. (WSO) Radar power - OPR
- 2. (WSO) Radar mode - MAP PPI
- 3. (WSO) Antenna stab switch - NOR
- 4. (WSO) Cursor intensity - ADJUST
- 5. (WSO) Antenna elevation - ADJUST
- 6. (WSO) Scan switch - WIDE
- 7. (WSO) Radar range - AI 10 or AI 25

Bomb Run - Offset Radar IP

- 1. (WSO) Operate along track control to position range cursor over RIP.

NOTE

Do not position the range cursor below zero range. This can cause the cursor and the along track control to become 180° out of phase i.e., forward knob motion (increasing range) produces downward cursor motion (decreasing range). Range steering information would be in error by 180° . If this condition occurs, push the reset button and roll the knob/ cursor out to the desired range.

- 2. (WSO) Operate cross track control to position offset cursor over RIP.
- 3. (WSO) Freeze button - PUSH ON

NOTE

The along track cursor must be moved first to initiate cursor control. Position the intersection of the cursors over the RIP and then push the freeze button ON; the cursors begin tracking the RIP. The cursors can be moved to touchup the intersection location over the RIP after the freeze button is pushed on.

- 4. (WSO) Target insert button - PUSH ON

The steering instruments display steering commands when the target insert button is pushed ON, and the cursor intersection will position over the target location and track the target. If the target is on the scope, set the target elevation on the ALT RANGE counter and touchup the cursors over the target.
- 5. Bomb release button - PRESS and HOLD (OFFSET BOMB)
 - a. At bomb release, pullup light - ON
 - b. When a station is empty, station ARM light - OFF

When the aircraft is on course to the target and at the preplanned release altitude and airspeed, press and hold the bomb release button until the bomb is released, as indicated by illumination of the pullup light.

NOTE

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run - Visual IP Flyover

- 1. (WSO) When over IP, freeze button and target insert button - PUSH ON

When the aircraft is directly over the IP, the freeze button and the target insert button are pushed ON simultaneously. The steering instruments supply steering commands to the target, and the cursors start tracking the target. If the target is visible on the scope, the WSO may touchup the cursors when the target elevation is set in the ALT RANGE control.
- 2. Bomb release button - PRESS and HOLD (OFFSET BOMB)
 - a. At bomb release, pullup light - ON
 - b. When a station is empty, station ARM light - OFF

When the aircraft is on course to the target and at the preplanned release altitude and true airspeed, press and hold the bomb release button until bomb release occurs, indicated by the illumination of the pullup light.

NOTE

The roll tabs rotate as the target is passed, and the BDHI and HSI distance-to-target counters will approach zero and then start increasing in value.

Bomb Run LABS/TGT Find

1. Delivery mode knob (LABS) - AS REQUIRED
Select the planned delivery mode.

NOTE

With the target find switch on HOLD, the delivery mode selector may be positioned to any LABS mode without losing WRCS function.

2. (WSO) Along track and cross track controls - AS REQUIRED (Visual or Radar IP)
3. (WSO) Freeze button - PUSH ON
4. (WSO) Target insert button - PUSH ON
5. (WSO) After target insert, activate switch - ON
Select the ON position only after steering instruments have transitioned to target.
6. At warning tone (T₁ start) - INITIATE PULLUP
7. Bomb button - PRESS and HOLD

LOFT BOMBING**Before Bomb Run**

1. (WSO) Activate switch - NORMAL
When the WRCS is not used with the LABS modes, the target find switch and/or the activate switch on the weapons delivery panel must be positioned to NORMAL.
2. (WSO) Low angle knob - SET
3. (WSO) Pullup timer - SET
4. (WSO) Release timer - SET ZERO
5. Delivery mode knob - LOFT
6. Weapon select knob - BOMBS
7. AWRU - SET
 - a. Interval controls - SET
 - b. Quantity knob - SET
8. Nose/tail arm switch - ON (as required)
9. Station select button(s) - PRESS
 - a. Green light(s) - ON
10. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light(s) - ON

At IP

1. Bomb button - PRESS and HOLD
The bomb button must be energized until the final bomb is released.
2. At pullup point - INITIATE PULLUP

Loft Bomb Delivery

Approach the IP at the preplanned altitude and true airspeed. When over the IP, press and hold the bomb button energized until the final bomb is released. When the bomb button is pressed, the pullup light will illuminate, the pullup timer will begin, and the ADI pointers will center. Upon completion of the pullup timer, the pullup light and the reticle light will go out and the horizontal pointer will begin programming a 4-G pullup. This is the signal to the pilot to begin rotation into the pullup maneuver by flying the ADI pointers (4-G pullup) or the accelerometer. Since the sight reticle is pitch stabilized, it will not be in view above loft angles of 20°. When the aircraft attitude is at the preselected release angle, the pullup light and the reticle light illuminate, and the bombs will begin releasing in a ripple sequence. After the final bomb is released, the bomb button is released and the pilot initiates a wingover escape maneuver to achieve a 120° turn while diving toward minimum escape altitude. When the bomb button is released, a pullup light will go out and the horizontal pointer will move out of view.

After Escape Maneuver

1. Master arm switch - SAFE
2. Station select (5) - OFF
3. Delivery mode knob - OFF
Placing the delivery mode selector knob to OFF removes power from the bombing timers.

SUU-20 BOMB DISPENSER (DCU-94/A)

PREFLIGHT**BEFORE EXTERIOR INSPECTION**

1. AFTO 781 entries:
 - a. Bomb rack ejector cartridges - REMOVED
Check that cartridges are not installed in the Aero 27/A, BRU-5A, or MAU-12 bomb rack supporting dispenser.
 - b. SUU-20 ejector cartridges - INSTALLED
2. Weapon select knob - BOMBS
3. Reject switch - NORM
4. Generator switches - OFF
5. DCU-94/A control monitor:
 - a. Station select switches (5) - OFF (AFT)
 - b. Option selector switch - OFF
 - c. Control arm - OS

- d. Master release lock switch - OFF (AFT), COVER DOWN
- e. Station select switch guard - INSTALLED

WARNING

If jettisonable stores or a centerline tank are carried, the DCU-94/A plastic station select switch guard must be installed to prevent inadvertent release

6. Multiple weapons control panel.
 - a. Delivery mode selector knob - OFF
 - b. Nuclear push to jett button - CHECK
Check to insure the button is not stuck in the energized position.
7. (WSO) Nucl store consent switch - SAFE

EXTERIOR INSPECTION

1. Normal exterior preflight inspection — ACCOMPLISH
2. Aero 27/BRU-5A preflight:
 - a. Ground safety pin — REMOVED
 - b. Access panels — SECURE
 - c. Ejector feet — DOWN
 - Check that ejector feet are within 1/8" of dispenser.
 - d. Sway braces — SECURE
3. MAU-12 B/A (-12C/A) preflight:
 - a. Inflight safety lockout pin — REMOVED
 - b. Inflight safety lock indicator — LOCKED
 - c. Hook latch linkage indicator — RED SHAFT NOT VISIBLE
 - d. Ground safety pins — REMOVED
 - The ground safety pins may remain installed or be removed depending on command policy.
 - e. Ejector feet — DOWN
 - Check that ejector feet are within 1/8" of dispenser.
 - f. Sway braces — SECURE
4. SUU-20 preflight:
 - a. Red-flagged circuit disconnect safety spring — INSTALLED
 - b. Red-flagged ejector gun safety pins (6) — INSTALLED
 - c. Dispenser — CHECK SECURE, FREE OF DAMAGE
 - d. Practice bomb installation — SECURE
 - e. MK-106 safety clips — REMOVED
 - f. BDU-33B/B safety pins/clips — REMOVED
 - g. BDU-33D/B safety blocks — REMOVED.
 - h. Bomb intervalometer — SALVO/SAFE
 - i. SMU-75 selector switch — G/A

POWER ON CHECKS

1. External power — APPLY
2. Generator switches — EXT ON
3. (WSO) Inst grd pwr switch — TEST
4. Pull up light — OFF, PRESS TO TEST
5. Wing station unlocked lights (loaded stations) — OFF
 - If the inflight safety lockout pin is installed in any wing station, the corresponding unlocked light remains on continuously whether or not the station is loaded.
6. DCU-94/A lamp test button — DEPRESS, ALL UNLOCKED AND WARN LIGHTS ON
 - The lamp test button is depressed to verify the condition of the unlocked and warn light bulbs. If any unlocked or warn light fails to come on when the lamp test button is depressed, replace the bulb.

NOTE

If any station select switch is on (forward) when the DCU-94/A option select switch is placed in SAFE position, the warn light for that station comes on and remains on until the option select switch is placed in OFF position.

7. DCU-94/A option select switch — SAFE
8. DCU-94/A warn light — OFF
9. DCU-94/A bomb test button — DEPRESS, LOADED STATION WARN LIGHT ON
 - The warn light for each loaded station comes on and remains on while the bomb test button is

depressed to indicate bomb/aircraft electrical continuity.

10. DCU-94/A option select switch — OFF

BEFORE TAKEOFF

1. Engine start — COMPLETE
2. Normal before takeoff/system checks — COMPLETE
 - Complete engine start, taxi, and system checks in accordance with the appropriate flight/weapons delivery checklists.
3. SUU-20 dispenser:
 - Signal the crew chief to remove the circuit disconnect spring and ejector gun safety pins from the SUU-20 dispenser.
 - a. Red-flagged circuit disconnect spring — REMOVED
 - b. Red-flagged ejector gun safety pins (6) — REMOVED
 - c. Bomb intervalometer — ARM (BOMBS SINGLE)

INFLIGHT**PRIOR TO BOMB RUN**

1. (WSO) Armament and spl wpns circuit breakers — IN
2. DCU-94/A option select switch — OFF
3. Delivery systems check — COMPLETED
4. Optical sight — A/G, MILS SET
5. Tail hook — UP
6. Delivery mode selector knob — SET AS REQUIRED
7. Weapons selector knob — BOMBS
8. Reject switch — NORM
9. (WSO) Bombing timers — SET
10. (WSO) WRCS control panel — SET
11. (WSO) Weapon delivery panel (non-integrated mission):
 - a. Activate switch — NORM
 - b. Tgt find switch — NORM
 - c. Range switch — NORM or X 100
12. (WSO) Weapon delivery panel (WRCS/LABS integrated delivery):
 - a. Activate switch — NORM
 - b. Tgt find switch — HOLD (OUTBOARD)
 - c. Range switch — NORM or X 100

ON RANGE

1. DCU-94/A option selector switch — SAFE
2. DCU-94/A station select switch — ON (FORWARD), SELECTED WARN LIGHT ON
3. (WSO) Nucl store consent switch — REL/ARM, SELECTED WARN LIGHT OFF
4. DCU-94/A control arm — S ARM
5. DCU-94/A option selector switch — BOMB GRD or BOMB AIR
6. Applicable DCU-94/A warn light — FLASHING, THEN OFF
7. DCU-94/A master release lock switch — ON (FORWARD)
8. Selected station unlocked light — ON
9. Cockpit mirrors — TURNED AWAY
10. Helmet visor — AS REQUIRED
11. Delivery — EXECUTE

AFTER LAST BOMB RUN

1. Optical sight — A/A

CAUTION

The sight should be caged (STBY or CAGE) for take-off and landing to prevent damage to the mirror drive assembly.

2. DCU-94/A control monitor:
 - a. Option selector switch — SAFE
 - b. Applicable warn light — FLASHING, THEN OFF
 - c. Control Arm — OS

- d. Option selector switch — OFF
- e. Station select switches — OFF (AFT)
- f. Master release lock switch — OFF (AFT)
3. (WSO) Nucl store consent switch — SAFE
4. Delivery mode selector knob — OFF

AFTER LANDING

1. Red-flagged circuit disconnect spring — INSTALLED
2. Red-flagged ejector gun safety pins (6) — INSTALLED (LOADED STATIONS)
3. Bomb intervalometer — SAFE

BOMBS - SUU-21/A (MODIFIED)

1. (P-WSO) All DCU-94/A and consent switches - OFF/SAFE
2. Sight mode knob - A/G
3. Reticle depression knob - SET
4. Delivery mode knob - DIRECT
5. Weapon selector knob - BOMBS
6. AWRU - SET
 - a. Interval controls - (not applicable)
 - b. Quantity knob - 1
7. Station select button(s) - PRESS
 - a. Green light(s) - ON
8. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light(s) - OFF
9. Nose/tail arm switch - NOSE & TAIL
 - a. Station ARM light(s) - ON (doors open)
10. Bomb button - PRESS

To Close Doors

1. Nose/tail arm switch - NOSE
 - a. Station ARM light(s) - OFF (doors closed)

STRAFE - SUU-16/A, -23/A, AND M61A1 NOSE GUN

1. Sight mode knob - A/G
2. Delivery mode knob - OFF or DIRECT

3. Reticle depression knob - SET
4. (Nose Gun) Rate switch - HIGH/LOW
5. (Nose Gun) Rounds counter - SET
6. Station select button(s) - PRESS
 - a. Green light(s) - ON
7. Weapon selector knob - NOT IN TV or ARM (unless CAGE is selected)
8. (SUU-16/23) Gun clear switch - NONCLEAR or AUTOCLEAR
9. Guns/missile switch - GUNS
 - a. Head-up GUN light - ON
10. Master arm switch - ARM
 - a. Head-up GUN light - (gun pods) OFF, (nose gun) ON
 - b. Head-up ARM light - ON
 - c. Station ARM light(s) - ON
11. Trigger - SQUEEZE
 - a. (Nose gun) Zero rounds remaining, station ARM light - OFF
 - b. (Nose gun) Head-up GUN light - OFF

RANGE DEPARTURE

1. Sight mode knob - STBY or CAGE
2. Delivery mode knob - OFF
3. Station select - OFF
4. Master arm switch - SAFE

A/A 37U-15 TOW TARGET SYSTEM (MODIFIED)

PREFLIGHT

INTERIOR INSPECTION

To reduce rolling tendencies immediately after takeoff, the following aileron trim positions are recommended. Trim settings are the same with or without centerline tank.

1. Aircraft trim - SET
 - a. Dart system on station 1, station 9 empty: 2.5 inches left aileron down (trim 2.5 seconds to right of neutral), 1.5 inches right rudder (trim 1.5 seconds to right of neutral).
 - b. Dart system on station 1, external fuel tank on station 9: 3.5 inches right aileron down (trim 3.5 seconds to left of neutral), 1.0 inch left rudder (trim 1.0 seconds to left of neutral).

PRE-TAKEOFF

With the aircraft on a known runway heading:

1. Compass controller - DG

NOTE

The tow target system, carried on the left outboard wing station, may induce 20° to 30° errors in the remote compass transmitter. Due to this effect, the DG mode on the compass controller should be selected.

TAKEOFF

NOTE

With the A/A 37U-15 target system and stowed dart aboard, a crosswind component of 15 knots should be regarded as maximum for takeoff and landing operations.

Initiate a slow pitch rotation at 140 KIAS to obtain 5° pitch attitude indicated on the ADI for liftoff at 180 to 190 KIAS. Decrease thrust after gear and flap retraction to ensure that 275 KIAS is not exceeded.

NOTE

Refer to TO 1F-4E-1 External Store Limitations for A/A 37U-15 Tow Target System inflight limitations.

INFLIGHT

TARGET DEPLOYMENT

1. Establish 200-220 knots deployment speed, straight and level 1G flight.
2. Delivery mode knob - DIRECT
3. Weapon select - A
4. Station select - LO
 - a. LO green light - ON
5. Nose/tail arm switch - SAFE
6. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light - ON
7. Bomb button - PRESSED

Pressing the bomb button once deploys the target.

WARNING

Do not attempt to deploy a damaged dart target. Motion of the damaged target after release is unpredictable. Possible contact with the aircraft could be hazardous.

8. Master arm switch - SAFE
 - a. ARM lights - OFF

CABLE CUT

1. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. Station ARM light - ON
2. Tow cable - CUT
 - a. Nose/tail arm switch - NOSE
3. Chase plane, acknowledge cable cut.

Emergency Cut

1. If cable does not cut, nose/tail arm switch - NOSE and TAIL or TAIL
2. Chase plane, acknowledge cable cut.

LANDING WITH STOWED TARGET (DAMAGED OR UNDAMAGED)

1. Flaps/slat switch - OUT and DOWN
2. Angle of attack - 17 to 18 UNITS

(With wing tank use less than 17 units).

3. Touch down beyond barrier cables if possible.

cable/dart contact and damage to the dart and/or cable.

CAUTION

Rolling over approach end barrier cables upon landing with a stowed dart usually results in

A/A 37U-33 AERIAL GUNNERY TARGET SYSTEM

PREFLIGHT

INTERIOR INSPECTION

Before Electrical Power

1. Arm nose/tail switch - SAFE

NOTE

Check arm nose/tail switch is in SAFE before applying electrical power to the aircraft.

Gunnery Target Control Panel

NOTE

The following check can be performed using either ground power or 28vdc aircraft power.

1. PWR switch - ON
 - a. Panel lights - ON
 - b. INNER and OUTER window - 88 FOR 3 SEC THEN 00 (lights blink if no RF energy is received)
2. Scoring field - SET AS REQUIRED
3. Altitude selector - SET AS REQUIRED
4. Reset button - PRESS
 - a. INNER and OUTER windows - 88 FOR 3 SEC THEN 00 (lights blink if no RF energy is received).
5. PWR switch - OFF

BEFORE TAKEOFF

To reduce rolling tendencies immediately after takeoff, the following aileron trim settings are recommended. Trim settings are the same with or without centerline tank. The following trim settings are based upon tow set on station 9 and Target Set on station 8.

1. Aircraft trim - SET
 - a. With station 1 empty:
 - (1) 2 inches right aileron down (trim 2 sec left of neutral)
 - (2) 1 inch left rudder (trim 1 sec to left of neutral)
 - b. With external fuel tank on station 1:
 - (1) 5 inches right aileron up (trim 5 sec right of neutral)
 - (2) 1 inch right rudder (trim 1 sec to right of neutral)

INFLIGHT

TARGET DEPLOYMENT

1. PWR switch - ON
2. Reset button - PRESS
3. INNER and OUTER windows - 00
4. Establish 200 to 250 KCAS deployment speed

CAUTION

Landing gear and speed brakes must be retracted during target deployment.

5. Delivery mode knob - DIRECT
6. Weapon select knob - BOMBS
7. AWRU Qty knob - 1
8. Arm nose/tail switch - SAFE

NOTE

If the arm nose/tail switch is not in SAFE when the master arm switch is placed to ARM, the tow cable release mechanism will actuate.

9. Station select button - RI
 - a. RI green light - ON (check all other station lights OFF)
10. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. ARM light - ON
11. Bomb button - PRESS
12. Master arm switch - SAFE
 - a. Head-up ARM light - OFF
 - b. RI ARM light - OFF
13. RI Station select - OFF
 - a. RI green light - OFF

NORMAL CABLE RELEASE

1. Establish 220 to 250 KCAS at 800 to 1000 feet AGL if release is over planned recovery area.
2. Delivery mode knob - DIRECT
3. Weapon select knob - BOMBS
4. AWRU Qty knob - 1
5. Arm nose/tail switch - SAFE

NOTE

If the arm nose tail switch is not in SAFE when the master arm switch is placed to ARM, the tow cable release mechanism will actuate.

6. Station select button - RO
 - a. RO green light - ON (check all other station lights OFF)
7. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. RO ARM light - ON
8. Bomb button - PRESS AND HOLD 3 SEC
Hold bomb button pressed until after cable release, approximately 3 seconds.
9. Master arm switch - SAFE
 - a. Head-up ARM light - OFF
 - b. RO ARM light - OFF

BACKUP CABLE RELEASE

1. If cable does not release, return master arm switch to ARM and arm nose:tail switch to NOSE & TAIL, or NOSE, or TAIL.

NOTE

Use of arm nose:tail switch will activate both cable release mechanism if two are installed.

2. Master arm switch - SAFE

A/A 37U-36 AERIAL GUNNERY TARGET SYSTEM

PREFLIGHT**INTERIOR INSPECTION****Control/Display Unit**

Refer to TO 1-1M-34 for a description of the control/display unit.

NOTE

The following check can be accomplished using either ground power or aircraft power.

1. Power switch - ON
 - a. Panel lights - ON
 - b. Score display - 888 FOR 2 SECONDS, THEN 000 (display flashes if no rf energy is received)
 - c. AIR light - ON FOR 2 SECONDS
 - d. IN/LOCK light - ON
2. Reset button - PRESS
 - a. Score display - 888 FOR 2 SECONDS, THEN 000 (display flashes if no rf energy is received)
3. Power switch - OFF

CABLE RELEASE FAILURE

If still no release, establish 250 to 300 KCAS and jettison tow set.

1. Selective jettison knob - STORES
2. Station select button - RO or LO as required
 - a. Station select green light - ON
3. Selective jettison knob - PUSH TO JETT

EMERGENCY JETTISON**WARNING**

- If simultaneous emergency jettison of both Tow Set and Target Set is attempted using the external stores emergency release button, the landing gear and speed brakes must be up to preclude possible catastrophic damage to the aircraft.
- Jettison of the tow set with target set still on the inboard pylon could cause catastrophic damage to aircraft because of cable arrangement.

NOTE

For any emergency that terminates use of the gunnery target scoring system, position the control panel PWR switch to OFF.

INFLIGHT**TARGET DEPLOYMENT**

1. Power switch - ON
2. Reset button - PRESS
3. Score display - 000
4. Establish 230-250 KCAS, 1000-25,000 feet, straight and level 1-g flight.

CAUTION

Landing gear and speed brakes must be retracted during target deployment.

5. Tension/length switch - LG
6. Function control switch - OUT

NOTE

Deployment is automatic and takes approximately 3 minutes.

7. Towline display - APPROXIMATELY 2000
8. Function control switch - STOP

TARGET RECOVERY**CAUTION**

When target has been shot off, cable recovery is initiated as usual. When cable length reaches 25 feet or if the cable starts whipping and balling (observed by secondary tow plane or chase panel), the cable should be cut immediately.

1. Establish 230-250 KCAS, 1000-25,000 feet, straight and level 1-g flight.
2. Tension/length switch - LG
3. Function control switch - IN

NOTE

Recovery is automatic and takes approximately 3 minutes.

After recovery -

4. IN/LOCK light - ON
5. Towline display - 0000
6. Power switch - OFF

TARGET RECOVERY FAILURE**If IN/LOCK light not ON -**

1. Function control switch - OUT
2. Towline display - APPROXIMATELY 0100
3. Function control switch - STOP, THEN IN Red-in is automatic.

If target is recovered -

4. IN/LOCK light - ON
5. Towline display - 0000
6. Power switch - OFF

If IN/LOCK light still not ON -

4. Function control switch - OUT
5. Towline display - APPROXIMATELY 0100
6. Function control switch - STOP

When over jettison area -

7. Emergency cut switch - CUT

NOTE

Cable cut is not possible when operating on battery power.

8. Chase plane, acknowledge cable cut.
9. Emergency cut switch - NORMAL, COVER DOWN
10. POWER switch - OFF

LANDING

BEFORE LANDING

1. Master arm switch - SAFE
 - a. Head-up ARM light - OFF
2. Station select - OFF
3. Delivery mode knob - OFF
4. Radar missile power switch - OFF
5. Selective jettison knob - OFF
6. All DCU-94/A station select switches (5) - AFT
7. Sight mode knob - STBY or CAGE

AFTER LANDING

1. (WSO) Radar power knob - OFF
2. (P) Optical sight mode - OFF
3. (P) Optical sight shutter lever - CL

ARMAMENT AREA - DEARMING

1. Armament switches - OFF/SAFE/NORMAL
2. Aircrew - HANDS IN VIEW

The aircrew will place both hands in view as a signal to the load crew to approach the aircraft, safe all weapons, and install all safety pins.
3. Load crew - SAFE ALL WEAPONS, INSTALL SAFETY PINS, REPLACE AIM-9 NOSE COVERS.

ALPHABETICAL INDEX

Subject	Page No.	Subject	Page No.
A			
A/A 37U-15 Tow Target System (Modified)	2-106	Attitude Reference and Bombing Computer Set (ARBCS)	1-19
A/A 37U-33 Aerial Gunnery Target System	2-107	Automatic Acquisition and Cage	1-77
A/A 37U-36 Aerial Gunnery Target System	2-208	Auto Acquisition Button	1-50
ACM Display (AIM-7)	1-80	B	
ACM Display (AIM-9)	1-81	Ballistic Computer	1-16
Acquisition	1-76	BIT Checks (DSCG)	2-52
Acquisition-On-Jam (AOJ)	1-76	BIT Checks (DVST)	2-19
Activate Switch	1-19	Bomb Button	1-13
Aero-3B Launcher, AIM-9	1-165	Bomb Button Transfer Relay	1-13
Aero 7A Launcher, AIM-7	1-165	Bomb Release Angle Computer	1-22
AGM-45 Missile	2-83	Bombing Range Strobe	1-86G
AGM-45 Controls	1-150	Bombing Timers	1-22
AGM-45 Delivery Modes	1-147	Bombs & SUU-20 Dispenser	2-94
AGM-65A/-65B Delivery	1-140A	Bombs - SUU-21/A (Modified)	2-103
AGM-65 Controls	1-142	Break X	1-82
AGM-65 Missile (DSCG Aircraft)	2-83	C	
Aim Dot	1-80	Cage Button	1-12A
AIM-7 Missile	2-73	Cage Mode Check	2-34
AIM-7 Missile Launch	2-74	CBU and Flare Dispensers	2-99
AIM-7 Missile Tuning	1-86	Centerline Tank Aboard Light	1-12
AIM-7 Tuning Status	1-86	Chaff Dispenser, AN/ALE-38	2-72
AIM-9 Missile	2-80	Coder Control Unit	1-99
AIM-9 Missile Launch	2-81	Computer Automatic Acquisition Mode	1-37
AIM-9 Missile Launch Sequence	1-154	Computer Control Panel	1-14
Airborne Video Tape Recorder	1-174A	Cursor Controls	1-17
Aircraft Weapons Release Unit (AWRU)	1-7	Cursor Control Panel	1-17
Air-To-Air BIT Checks (DSCG)	2-54	D	
Air-To-Air BIT Checks (DVST)	2-21	DBM-4C Camera (Aft Looking)	1-170
Air-To-Air Gunnery	1-152	DCU-94/A Jettison and Release Circuits	3-2
Air-To-Air Light	1-50	Delivery Methods, Air-To-Ground Weapons	1-116
Air-To-Air Missiles	1-154	Delivery Mode Knob	1-2
Air-To-Ground BIT Checks (DSCG)	2-63	Display Knob	1-34A
Air-To-Ground BIT Checks (DVST)	2-30	Dive Delivery Considerations	1-116
Air-To-Ground Ranging	1-86C	Dive Laydown	1-122
Allowable Steering Error (ASE) Circle	1-80	Dive Toss Delivery	1-119
Altitude Switching	1-86C	DVST Radar Scope, Rear Cockpit	1-47
AN/ALE-38 Chaff Dispenser	2-72	DVST Range Rate Circle and Vc Gap	1-79
AN/ALE-40 Countermeasure Dispenser	2-72		
AN/ALE-40 Dispenser Set	1-104		
Angle of Attack Indexers	1-19		
Antenna Control Panel	1-50		
Antenna Hand Control	1-50		
Antenna Radiation Pattern	1-57		
ARBCS Indicators	1-23		
Armament Pylons	1-158		
ARR Button	1-12A		
Aspect Knob	1-34		
Attitude Director Indicator (ADI)	1-17, 1-21		

Subject	Page No.
E	
Emergency Release Procedures	3-1
English Bias	1-86
F	
Fast Erect Switch	1-22
FCS Controls and Indicators	1-32
Fire Control System, Radar Set	1-31
Fire Fighting and Evacuation	3-5
Flight Director Bombing Computer	1-22
Freeze Button	1-17
G	
Gun Clear Switch (Gun Pods)	1-10
Gun Firing	1-119
Guns/Missile Switch	1-12
Gun Rate Switch and Rounds Counter	1-10
H	
Head Aim Command	1-84A
High/Low Drag Weapons, Level Delivery	1-123
Hold Altitude Light	1-83
Home-On-Jam (HOJ)	1-78
Horizontal Situation Indicator (HSI) And Bearing Distance Heading Indicator (BDHI)	1-17
Hung Ordnance	3-1
I	
Identification Point, Radar or Visual	1-128
Intercept Computations (BEFORE OFP P005)	1-80
Intercept Computations (AFTER OFP P005)	1-82
Interlock Switch	1-12
K	
KB-18A Strike Camera System	1-168
KB-21B/C, Camera (Aft Looking)	1-170
L	
Laser Target Designator (Pave Spike)	1-87
	2-86B
LAU-34/A Launcher, AGM-46	1-165
LAU-88/A Launcher, AGM-65	1-165
LAU-88A/A Launcher, AGM-65	1-165
Laydown Delivery	1-124
Lead Computing Optical Sight System	1-23
Level Delivery Considerations	1-122
Line of Sight (LOS) Indicator	1-97
Loft Bombing	1-133

Subject	Page No.
LRI Display (AIM-7)	1-82
LRI Display (AIM-9)	1-83
M	
Manual Vc Control Knob	1-35
Maneuver Switch	1-34
Master Arm Switch	1-6
Map Mode (PPI Display)	1-86F
Meter Selector Knob	1-46
Meter Switch	1-46
Missile Firing Computations	1-84
Missile Firing Interlocks	1-84
Missile Reject Switch	1-10
Missile Speedgate and Interlock Selection	1-86A
Missile Status Lights	1-12
Monitor Meter	1-46
Multiple Ejector Rack (MER)	1-164
M61A1 Nose Gun	2-82
N	
Nose Gear Steering Button	1-12A
Nose Gun Controls	1-30
Nose Gun System	1-28
Nose/Tail Arm Switch	1-6
N-9 Camera (Forward Looking)	1-170
O	
Offset Bomb Delivery	1-128
Offset Cursor	1-86G
Optical Sight Bit Fault Analysis	2-36
Optical Sight Camera, KB-25/A	1-173
	2-67
Optical Sight Check	2-35
Optical Sight Controls	1-23
Optical Sight Reticle	1-19
P	
PLMS Switching	1-60
Polar Switch	1-32
Protective Circuits	1-51
Pulse Switch	1-35
Pullup Tone Switch	1-22
R	
Radar Camera	1-172
Radar Missile Power Switch	1-10
Radar Mode Knob	1-35
Radar Operation (Air-To-Air)	1-66A
Radar Operation (Air-To-Ground)	1-86C
Radar Operation (Beacon Mode)	1-86G
Radar Operation (Visident Mode)	1-86J
Radar Power Knob	1-32
Radar Range Knob	1-33
Radar Set Control Panel	1-32
Radar Scope, Front Cockpit	1-50B
Radar Transponder SST-181X	1-175
Range Cursor	1-86G
Range Switch	1-19

Subject	Page No.
Range (Visident) Indicator	1-50
Receiver Gain Knobs.	1-34
Release Advance Control.	1-16
Release Range Control.	1-16
Reset Button	1-17
Rmax and Rmax2 Strobes	1-82
Rocket Launch	1-119
Rockets & SUU-20 Dispenser	2-99
Roll Command	1-86
Rounds Counter	1-30
Rounds Limiter	1-30
S	
Scan Switch.	1-34
Scope Display Panel DSCG	1-50C
Scope Display Switch.	1-50C
Scope Display Switch, DSCG	1-10
Scramble BIT (DSCG)	2-66
Scramble BIT (DVST)	2-33
Shoot/In Range Lights	1-12, 1-50C, 1-80
Skin Track Light	1-35
Slant Range Indicator (SRI)	1-97
SST-181X, Radar Transponder	1-175
Stab Switch	1-47
Station Select Buttons	1-6
Steering Instruments and Indicators (WRCS)	1-17
Stick Grip Controls	1-12A
SUU-16/A, -23/A Gun Pod; GPU-5/A Gun Pod on CL Station	2-82
SUU-20 Bomb Dispenser (DCU-94/A)	2-98
SUU-21/A Bomb Dispenser (Modified)	2-103
SUU-21/A Bomb Dispenser (DCU-94/A)	2-102

Subject	Page No.
T	
Tactical Information Retrieval System (TIRS)/Snapshot Function	1-66
Target Contrast Switch.	1-10
Target Designator Panel, Pave Spike	1-95
Target Designator Pod, AN/AVQ-23A/B.	1-92
Target Find Mode	1-130A
Target Insert Button.	1-17
Target Range Controls.	1-14
TDS Associated Controls.	1-99
TDS Bit Checks	2-86B
TDS Controls and Indicators	1-92
Temp Light.	1-47
Test Knob	1-41
TGM-65 (Training) Missile.	2-85
TGT Find Switch	1-19
Throttle Controls	1-12
Track Switch	1-34
Trigger	1-13
Triple Ejector Rack (TER)	1-164
TV Display	1-86J, 1-146
V	
Vc Switch	1-47
W	
Weapon Delivery Panel.	1-19
Weapons Release Computer Set (WRCS)	1-14
Weapon Selector Knob	1-3
Weapon Suspension Equipment	1-157
Wingspan vs. Target Range.	1-152B
WRCS Tone.	1-19

SECTION III

EMERGENCY PROCEDURES

TABLE OF CONTENTS

EMERGENCY RELEASE PROCEDURES...	3-1	Hung Ordnance.....	3-1
Emergency Release - Bombs, Launchers, and Dispensers.....	3-1	FIRE FIGHTING AND EVACUATION.....	3-5

EMERGENCY RELEASE PROCEDURES

The term Emergency Release is applied here to denote the use of the normal release controls to jettison-release empty launchers/dispenser equipment, or to release a munition which cannot be returned to base. Time is not particularly a factor. Any live store would normally be released SAFE, normally in a designated area, and with the intent of retaining the suspension equipment (MER, TER, etc). If suspension equipment is not involved (singles carriage) then those procedures have no particular application. In any case, if the aircraft is involved in an emergency and time is an important factor, the airplane jettison system should be used. If the pilot has already attempted to release bombs (unsuccessfully) in a strike situation, the pilot should home the MER or TER before repeating the following procedures. With launchers or dispensers aboard the MER/TER, the homing procedure is unnecessary.

EMERGENCY RELEASE (BOMBS, LAUNCHERS & DISPENSERS)

1. Delivery mode knob - DIRECT
2. Station select button(s) - PRESS
 - a. Green light(s) - ON
3. Weapon selector knob - BOMBS
 - a. To home MER/TER (if necessary); select RKTS/DISP, then return to BOMBS
4. AWRU Qty knob - C or S
 - a. Interval - SET AS REQUIRED
5. Nose/tail arm switch - SET
 - a. With bombs aboard - SAFE
 - b. With RKTS or DISP aboard - (ON)

6. Master arm switch - ARM
 - a. Head-up ARM light - ON
 - b. (RKTS/DISP aboard) Station arm light - ON
7. Bomb button - PRESS
 - a. RKTS/DISP aboard) ARM light(s) - OFF (Stations Empty)
 - b. Bombs aboard, place nose/tail arm switch ON and observe ARM lights OFF

HUNG ORDNANCE

Hung ordnance is the term used when an unsuccessful attempt has been made to release or jettison a weapon from the aircraft.

WARNING

Following an attempted release or jettison, any non-nuclear weapon that does not separate from the aircraft should be considered armed and susceptible to inadvertent release during landing. Under these circumstances, the aircrew should be prepared to make an immediate go-around in the event an inadvertent release of a hung store occurs during landing.

)

)

)

)

)

)

)

)

)

)

)

controls are used, stations can only be jettisoned individually.

Jettison With the DCU-94/A Release Circuit

The bomb release button, the DCU-94/A control panel, the DIRECT bombing mode, and consent switch may be used as an alternate method of jettisoning the suspension equipment. However, the LO MER when shifted aft and RO store cannot be bombed off with nuclear release circuit. The following procedures also apply for bombs that are suspended directly from the armament pylons or the centerline bomb rack.

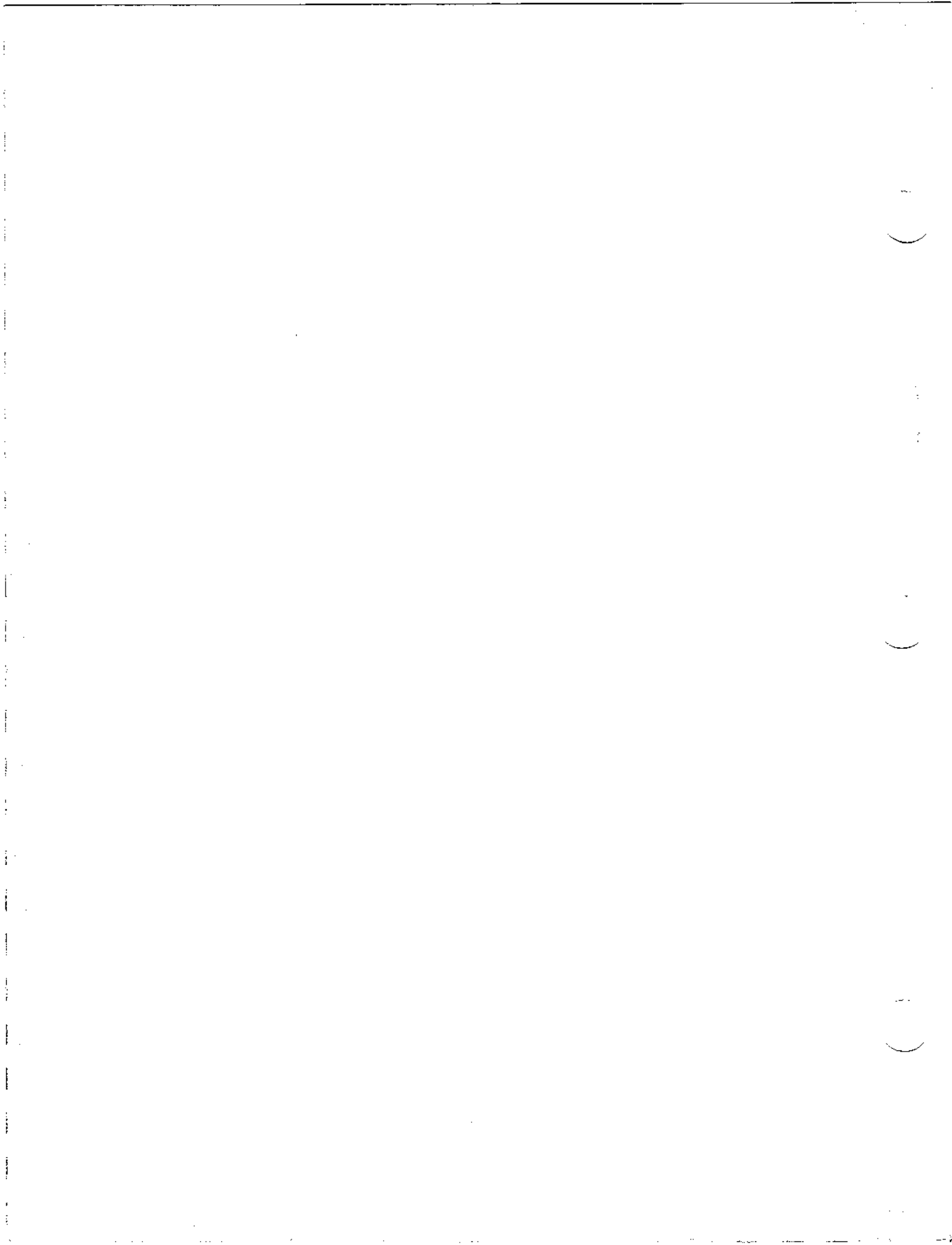
1. Delivery mode knob - DIRECT
2. DCU-94/A station select switch - FORWARD
3. Master release lock switch - FORWARD
4. (WSO) Consent switch - REL or REL/ARM
 - a. CL UNLOCKED light (if the CL station is selected) - ON

5. Bomb button - PRESS
The suspension equipment or the single suspended bomb on the selected station is released when the bomb button is pressed.
6. For remaining station(s), place the station selector AFT and repeat steps 2 and 5.

Jettison With DCU-94/A Jettison Circuit

The following procedures apply to bombs and MER/TERs that are suspended directly from the armament pylon or the centerline bomb rack.

1. DCU-94/A station select switches (loaded stations) - FORWARD
2. Master release lock switch - FORWARD
3. (WSO) Consent switch - REL or REL/ARM
 - a. CL UNLOCKED light, if the CL station is selected - ON
4. Nuclear store jettison button - PUSH



FIRE FIGHTING AND EVACUATION

Aircraft fires involving conventional munitions cannot be definitized to any one set of circumstances and environmental conditions. This precludes development of reliable standardized test criteria and reliable specific item fire fighting and withdrawal times. The conclusion to be reached from available data is that a munitions reaction to fire is a function of case thickness and type of explosive filler which can be varied by environmental conditions.

Normally, aircraft fires involving munitions will occur under a set of circumstances wherein it will be impossible to know immediately the specific missile, bomb, or CBU model number. Such information is absolutely essential for specific fire fighting and withdrawal times. Therefore, these times are presented only for the following family groups.

a. Bombs: Bombs normally react in a deflagration to explosion between two and four minutes. Fuzes and boosters may be ejected and function as separate explosions. There is a major hazard to environmental and fire fighting capability after two minutes. Withdrawal distance should be no less than 2000 feet for personnel and equipment. Take whatever cover is available.

b. CBUs: CBUs normally react in a deflagration to explosion between two and five minutes with the exception of the Rockeye and BL-755 which can be expected to detonate within one minute. Some munitions (bomblets) will be expelled by the force of the explosion to 1000+ feet. These bomblets can detonate upon impact. There is major hazard to environment and fire fighting capability after two minutes in all cases, less with the Rockeye and BL-755. Withdrawal distances should be no less than 2000 feet for personnel and equipment. Re-enter after EOD approval only.

c. Missiles: Missiles normally react in propulsion, detonation or both between 45 seconds and two minutes. A propulsion hazard (missile flight) exists within 45 seconds and a major hazard to environment and fire fighting capability after one minute. Approach the fire, if necessary, from the side of the aircraft.

d. Rockets: Rockets and missiles are identical in reaction. Difference in designation is attributable to missile having guidance and control systems; rockets do not.

Fire fighting guidance provided in AFR 127-100 will be used in all instances. There is no specific withdrawal time for items which do not align into one of the four family groups.

All data on pages 4-1 thru 4-14 and 5-1 thru 5-30, including

TO 1F-4E-34-1-1

figures 4-1 thru 4-9 and 5-1 thru 5-16, deleted.

SECTIONS IV, V, AND VI DELETED.

All data on page 6-2 deleted.

Change 4

6-1/(6-2 blank)

GLOSSARY

A

A/A - Air-to-Air

ADC - Air Data Computer

ADI - Attitude Director Indicator

ADL - Armament Datum Line. Same as RBL

A/G - Air-to-Ground

AGC - Automatic Gain Control

AGL - Altitude above Ground Level

AGM - Air to Ground Missile

AI - Airborne Intercept

AIM - Air Intercept Missile

Aimpoint - The preplanned point near or on the target that is used to align the pipper.

AN - A prefix to a Mark or Model designation to denote use by Army/Air Force and Navy

Angle of Gun Fire (AGF) - The angle formed between the timed barrel line and the aircraft flight path (or relative airflow). The angle is used to determine trajectory shift.

Antenna Train Angle - The angle between interceptor heading and the bearing to the target.

ARM - Anti-Radiation Missile.

ARR - Air Refueling Release

AOA - Angle of Attack

AOJ - Acquire-On-Jam

AOD - Aim Off Distance. The Ground Distance subtended by the sight depression angle below flight path.

API - Armor Piercing Incendiary

ASE - Allowable Steering Error

Aspect Angle - The sum of Antenna Train Angle and Track Crossing Angle.

AWRU - Aircraft Weapon Release Unit

B

BDHI - Bearing Distance Heading Indicator

BDU - Bomb Dummy Unit

BFD - Battery Firing Device

BIT - Built In Test

Blind Bombing - Bombing with the aid of radar and the WRCS Offset Bomb mode or DMAS without visual reference to the target.

BLU - Bomb Live Unit

Bore Line (BL) - A line through a gun barrel bore extending to infinity.

Boresighting - See Harmonization

BST - Boresight

C

CAA - Computer Automatic Acquisition

CAS - Knots Calibrated Airspeed. The airspeed read on the calibrated airspeed indicator when the Air Data Computer is operating properly.

C_B - Drag Coefficient

CBU - Cluster Bomb Unit

CEP - Circular Error Probability

CG - Center of Gravity

CL - Centerline (Station 5)

D

DEP - Deflection (Cross Track) Error Probability

DF - Direction Finding

DMAS - Digital Modular Avionics System, AN/ARN-101.

DRSC - Direct Recording Scope Camera.

DSCG - Digital Scan Converter Group

DST - Destructor

DVST - Direct View Storage Tube

E

ECM - Electronic Countermeasures

EO - Electro-Optical

EOD - Explosive Ordnance Disposal

F

FFAR - Folding Fin Aircraft Rocket

Flight Path - Aircraft attitude minus fuselage angle of attack.

GLOSSARY (CONT)

Fire Bomb - Napalm, Anti-PAM (Personnel and Materiel), an incendiary munition.

FRL - Fuselage Reference Line.

FPS - Feet Per Second

Fuselage Angle of Attack - The angle in mils between the aircraft flight path and the fuselage reference line.

Fuselage Reference Line - The horizontal plane of the aircraft. The same as zero water line.

G

GBU - Guided Bomb Unit

GP Bomb - General Purpose bomb.

Ground Speed - The speed of the aircraft relative to the ground. (True airspeed plus or minus the rangewind component.)

Ground Track - The path of the aircraft over the ground.

H

Harmonization - The adjustment (or boresighting) of the gun barrel so that, when the guns are fired at the most effective range (2250 feet) the pipper will be on the bullet impact point.

HE - High Explosive

HEI - High Explosive Incendary

HEAT - High Explosive Anti-tank (2.75 Rocket)

HOB - Height of Burst

HOJ - Home-on-Jam

HSI - Horizontal Situation Indicator

HVAR - High Velocity Aircraft Rocket

I

IAS - Indicated Airspeed, as read on the calibrated airspeed indicator when the Air Data Computer is inoperative.

INS - Inertial Navigation System

IP - Identification Point, visual or radar

IR - Infrared

K

KMU - Kit, Modification Unit

L

LABS - Low Altitude Bombing System

LADD - Low Altitude Drogue Delivery

LCOSS - Lead Computing Optical Sight System

LAU - Launcher Unit

Launch Factor (F) - A decimal value representative of rocket trajectory (a function of several variables). The production of (F) and launcher line angle of attack represents the angular rotation of the rocket from the launcher line toward flight path (mils).

Launcher Line (LL) - The projected longitudinal axis of the launching tube, or the CL of the rocket in the tube.

Launcher Line Angle of Attack - The angle between the launcher line and relative airflow or aircraft flight path.

LDGP - Low Drag General Purpose Bomb

LGB - Laser Guided Bomb

LI - Left Inboard (station 2).

LO - Left Outboard (station 1).

Line of Departure (LOD) - The initial path of a projectile after firing. This includes trajectory shift but not gravity drop.

LOS - Line of sight.

LRI - Long Range Intercept

M

Mean Fixed Bore Line (MFBL) - An average of all bore lines in a common gun system and extending to infinity. The MFBL for gatling guns may also be defined as centerline of cluster.

Mean Parallax - When more than one gun is contained in a common system; mean parallax is the average linear distance or separation between sight and guns.

MER - Multiple Ejector Rack (six ejector racks).

MIL - Milliradian. One mil = 0.573°. 1° = 17.45 mils. Approximately one foot at 1000 feet.

MK - Mark. A designation for model.

MN - Mach Number

Mod - Modification

MSEC - Milliseconds, 1 msec. = 0.001 second.

MSL - Mean Sea Level

GLOSSARY (CONT)

N

NM - Nautical Mile (6076.1 feet)

O

O/S - Over the Shoulder. The bomb is released at an angle greater than 90° so that the bomb will fall back onto the target.

P

P - Pilot. Formerly referred to as Aircraft Commander (AC).

Parallax Error - The error induced by the horizontal and vertical distance between the optical sight to gun, launcher, or bomb rack.

Passive Homing - The missile guides upon energy waves transmitted by the target. The missile does not transmit a signal that can be detected by the target, e.g., AIM-9 missiles.

Pickle - The bomb release button, or the action of pressing the bomb release button.

Pipper - The 2-mil diameter dot in the center of the optical sight reticle.

P_k - Probability of kill in percentage.

PLMS - Power Level Mode Switching.

PMI - Pearlite, Malleable Iron

PPI - Plan Position Indicator

Pressure Altitude - The altitude read on the pressure altimeter when set on 29.92 inches Hg.

Pulse Length - The transmission time or ON time of a radar pulse measured in microseconds.

R

Radar Boresight Line (RBL) - The position of the radar antenna when in BST (Boresight) and A/G (Air-to-Ground). 2° below the Fuselage Reference Line.

Radar Mile - One radar mile equals 6000 feet. The radar mile is the unit of time (12.4 microseconds) required for one pulse of radar energy to be transmitted 6000 feet and be reflected back to the receiver.

RAT - Ram Air Turbine

Radar Silence - The radar is not transmitting, is in standby.

RBL - Radar Boresight Line. 2° below the fuselage reference line.

Rehoming - The act of positioning the release pulse to the first loaded station.

REP - Range Error Probability

RI - Right Inboard (station 8)

RIP - Radar Identification Point

RO - Right Outboard (station 9)

S

S & A - Safing and Arming Mechanism

Semiactive Homing - A guidance concept where a missile receives and homes on reflected energy transmitted by the missile launching aircraft.

Sight Depression from Flight Path - The optical sight depression value in mils minus fuselage angle of attack.

Sight Picture - The relationship of the pipper position to the target.

Sight Setting - The value in mils that the optical sight is depressed.

Signal Strength - Level or size of the return on the radar scope.

SPM - Shots Per Minute

SPC - Static Pressure Correction

SUU - Suspension and release Unit.

SW - Sidewinder and the abbreviation for switch.

T

Target Elevation - The height of the target or IP above mean sea level (MSL).

TAS - True Airspeed. Calibrated airspeed corrected for temperature and pressure.

TDD - Target Detecting Device

TER - Triple Ejector Rack

Timed Barrel Line (TBL) - A line extending to infinity through the bore in a timed barrel position. This line is used as a reference during gun/tracking index harmonization.

TIRS - Tactical Information Retrieval System

TISEO - Target Identification System Electro-Optical

Track Crossing Angle - The angle between headings of the interceptor and the target.

Tracking Index (TI) - Optical Sight Pipper

GLOSSARY (CONT)

Trajectory - Flight path of a projectile/bomb from firing/release to impact.

Trajectory Shift (TS) - The term used to define the amount of shift or angular rotation of a projectile when the timed barrel line and aircraft flight path (relative airflow) are not coincident.

TSO - Tow System Operator

TV - On certain aircraft, selects EO weapons and the television display.

V

Velocity Jump - The angle through which a rocket rotates (in the vertical plane) as it shifts into the relative airflow. The magnitude of the angle determines the line of Departure (LOD), which is obtained by taking the product of the launch factor (F) and the launcher line angle of attack.

VA - Approach Velocity

Ve - Ejection Velocity

Video - Referring to the intelligence displayed on the radar scope.

VIP - Visual Identification Point

W

WRCS - Weapons Release Computer Set.

WSO - Weapons System Officer

WP - White Phosphorous

Z

Zero Sight Line - When the optical sight is set on zero mils depression, the pipper line of sight is parallel to the fuselage reference line, or zero water line.

ALPHABETICAL INDEX

Subject	Page No.	Subject	Page No.
A			
A/A 37U-15 Tow Target System (Modified)	2-106	Attitude Reference and Bombing Computer Set (ARBCS)	1-19
A/A 37U-33 Aerial Gunnery Target System	2-107	Automatic Acquisition and Cage	1-77
ACM Display (AIM-7)	1-80	Auto Acquisition Button	1-50
ACM Display (AIM-9)	1-81	B	
Acquisition	1-76	Ballistic Computer	1-16
Acquisition-On-Jam (AOJ)	1-76	BIT Checks (DSCG)	2-52
Activate Switch	1-19	BIT Checks (DVST)	2-19
Aero-3B Launcher, AIM-9	1-165	Bomb Button	1-13
Aero 7A Launcher, AIM-7	1-165	Bomb Button Transfer Relay	1-13
AGM-45 Missile	2-83	Bomb Release Angle Computer	1-22
AGM-45 Controls	1-150	Bombing Range Strobe	1-86G
AGM-45 Delivery Modes	1-147	Bombing Timers	1-22
AGM-65A/-65B Delivery	1-140A	Bombs & SUU-20 Dispenser	2-94
AGM-65 Controls	1-142	Bombs - SUU-21/A (Modified)	2-103
AGM-65 Missile (DSCG Aircraft)	2-83	Break X	1-82
Aim Dot	1-80	C	
AIM-7 Missile	2-73	Cage Button	1-12A
AIM-7 Missile Launch	2-74	Cage Mode Check	2-34
AIM-7 Missile Tuning	1-86	CBU and Flare Dispensers	2-99
AIM-7 Tuning Status	1-86	Centerline Tank Aboard Light	1-12
AIM-9 Missile	2-80	Chaff Dispenser, AN/ALE-38	2-72
AIM-9 Missile Launch	2-81	Corder Control Unit	1-99
AIM-9 Missile Launch Sequence	1-154	Computer Automatic Acquisition Mode	1-37
Airborne Video Tape Recorder	1-174A	Computer Control Panel	1-14
Aircraft Weapons Release Unit (AWRU)	1-7	Cursor Controls	1-17
Air-To-Air BIT Checks (DSCG)	2-54	Cursor Control Panel	1-17
Air-To-Air BIT Checks (DVST)	2-21	D	
Air-To-Air Gunnery	1-152	DBM-4C Camera (Aft Looking)	1-170
Air-To-Air Light	1-50	DCU-94/A Jettison and Release Circuits	3-2
Air-To-Air Missiles	1-154	Delivery Methods, Air-To-Ground Weapons	1-116
Air-To-Ground BIT Checks (DSCG)	2-63	Delivery Mode Knob	1-2
Air-To-Ground BIT Checks (DVST)	2-30	Display Knob	1-34A
Air-To-Ground Ranging	1-86C	Dive Delivery Considerations	1-116
Allowable Steering Error (ASE) Circle	1-80	Dive Laydown	1-122
Altitude Switching	1-86C	Dive Toss Delivery	1-119
AN/ALE-38 Chaff Dispenser	2-72	Drag Coefficient Control	1-16
AN/ALE-40 Countermeasure Dispenser	2-72	DSCG Display Symbols	1-62A
AN/ALE-40 Dispenser Set	1-104	DSCG Radar Scope, Rear Cockpit	1-49
Angle of Attack Indexers	1-19	DVST Display Symbols	1-60
Antenna Control Panel	1-50	DVST Radar Scope, Rear Cockpit	1-47
Antenna Hand Control	1-50	DVST Range Rate Circle and Vc Gap	1-79
Antenna Radiation Pattern	1-57		
ARBCS Indicators	1-23		
Armament Pylons	1-158		
ARR Button	1-12A		
Aspect Knob	1-34		
Attitude Director Indicator (ADI)	1-17		
	1-21		

TO 1F-4E-34-1-1

Subject	Page No.
E	
Emergency Release Procedures	3-1
English Bias	1-86
External Stores Emergency Release Button	1-155
F	
Fast Erect Switch	1-22
FCS Controls and Indicators	1-32
Fire Control System, Radar Set	1-31
Fire Fighting and Evacuation	3-5
Flight Director Bombing Computer	1-22
Freeze Button.	1-17
G	
Gun Clear Switch (Gun Pods)	1-10
Gun Firing	1-119
Guns/Missile Switch.	1-12
Gun Rate Switch and Rounds Counter.	1-10
H	
Head Aim Command.	1-84A
High/Low Drag Weapons, Level Delivery	1-123
Hold Altitude Light	1-83
Home-On-Jam (HOJ)	1-78
Horizontal Situation Indicator (HSI) And Bearing Distance Heading Indicator (BDHI).	1-17
Hung Ordnance	3-1
I	
Identification Point, Radar or Visual.	1-128
Intercept Computations (BEFORE OFP P005)	1-80
Intercept Computations (AFTER OFP P005)..	1-82
Interlock Switch	1-12
J	
Jettison Controls	1-10
K	
KB-18A Strike Camera System	1-168
KB-21B/C, Camera (Aft Looking).	1-170
L	
Laser Target Designator (Pave Spike).	1-87
	2-86B
L AU-34/A Launcher, AGM-45.	1-165
L AU-88/A Launcher, AGM-65.	1-165
L AU-88A/A Launcher, AGM-65	1-165
Laydown Delivery	1-124
Lead Computing Optical Sight System.	1-23
Level Delivery Considerations	1-122
Line of Sight (LOS) Indicator	1-97
Loft Bombing	1-133

Subject	Page No.
LRI Display (AIM-7).	1-82
LRI Display (AIM-9).	1-83
M	
Manual Vc Control Knob	1-35
Maneuver Switch	1-34
Master Arm Switch	1-6
Map Mode (PPI Display)	1-86F
Meter Selector Knob.	1-46
Meter Switch.	1-46
Missile Firing Computations.	1-84
Missile Firing Interlocks.	1-84
Missile Reject Switch	1-10
Missile Speedgate and Interlock Selection	1-86A
Missile Status Lights	1-12
Monitor Meter	1-46
Multiple Ejector Rack (MER).	1-164
M61A1 Nose Gun	2-82
N	
Nose Gear Steering Button	1-12A
Nose Gun Controls.	1-30
Nose Gun System	1-28
Nose/Tail Arm Switch	1-6
N-9 Camera (Forward Looking).	1-170
O	
Offset Bomb Delivery	1-128
Offset Cursor.	1-86G
Optical Sight Bit Fault Analysis.	2-36
Optical Sight Camera, KB-25/A.	1-173
	2-87
Optical Sight Check	2-35
Optical Sight Controls	1-23
Optical Sight Reticule.	1-19
P	
PLMS Switching.	1-60
Polar Switch	1-32
Protective Circuits	1-51
Pulse Switch	1-35
Pullup Tone Switch	1-22
R	
Radar Camera	1-172
Radar Missile Power Switch	1-10
Radar Mode Knob.	1-35
Radar Operation (Air-To-Air).	1-66A
Radar Operation (Air-To-Ground).	1-86C
Radar Operation (Beacon Mode).	1-86G
Radar Operation (Visident Mode)	1-86J
Radar Power Knob.	1-32
Radar Range Knob.	1-33
Radar Set Control Panel	1-32
Radar Scope, Front Cockpit	1-50B
Radar Transponder SST-181X.	1-175
Range Cursor.	1-86G
Range Switch	1-19

Subject	Page No.
Range (Visident) Indicator	1-50
Receiver Gain Knobs.	1-34
Release Advance Control.	1-16
Release Range Control.	1-16
Reset Button	1-17
Rmax and Rmax2 Strobes	1-82
Rocket Launch	1-119
Rockets & SUU-20 Dispenser	2-99
Roll Command	1-86
Rounds Counter	1-30
Rounds Limiter	1-30

S

Scan Switch.	1-34
Scope Display Panel DSCG	1-50C
Scope Display Switch.	1-50C
Scope Display Switch, DSCG	1-10
Scramble BIT (DSCG)	2-66
Scramble BIT (DVST)	2-33
Selective Jettison	1-155
Shoot/In Range Lights	1-12, 1-50C, 1-80
Skin Track Light	1-35
Slant Range Indicator (SRI)	1-97
SST-181X, Radar Transponder	1-175
Stab Switch	1-47
Station Select Buttons	1-6
Steering Instruments and Indicators (WRCS)	1-17
Stick Grip Controls	1-12A
SUU-16/A, -23/A Gun Pod; GPU-5/A Gun Pod on CL Station	2-82
SUU-20 Bomb Dispenser (DCU-94/A)	2-98
SUU-21/A Bomb Dispenser (Modified)	2-103
SUU-21/A Bomb Dispenser (DCU-94/A)	2-102

Subject	Page No.
T	
Tactical Information Retrieval System (TIRS)/Snapshot Function	1-66
Target Contrast Switch.	1-10
Target Designator Panel, Pave Spike	1-95
Target Designator Pod, AN/AVQ-23A/B.	1-92
Target Find Mode	1-130A
Target Insert Button.	1-17
Target Range Controls	1-14
TDS Associated Controls	1-99
TDS Bit Checks	2-86B
TDS Controls and Indicators	1-92
Temp Light.	1-47
Test Knob	1-41
TGM-65 (Training) Missile	2-85
TGT Find Switch	1-19
Throttle Controls	1-12
Track Switch	1-34
Trigger	1-13
Triple Ejector Rack (TER)	1-164
TV Display	1-86J, 1-146

V

Vc Switch	1-47
---------------------	------

W

Weapon Delivery Panel.	1-19
Weapons Release Computer Set (WRCS)	1-14
Weapon Selector Knob	1-3
Weapon Suspension Equipment	1-157
Wingspan vs. Target Range	1-152B
WRCS Tone	1-19

Handwritten marks and symbols, possibly bleed-through from the reverse side of the page, including several curved lines and a vertical dash.

()
()
()
()
()
()
()
()
()
()