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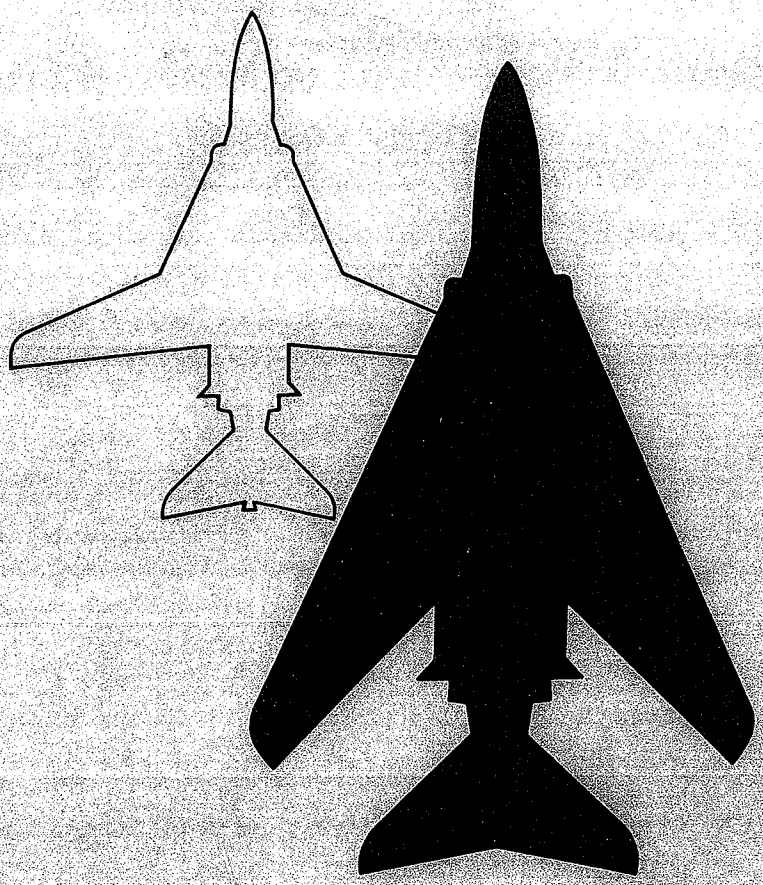
REPORT NO. E790



USN F-4 (FVS) AIRCRAFT

TECHNICAL DEVELOPMENT PLAN

MCDONNELL

[redacted]

CHARGED TO

[redacted]

DATE 10 AUGUST 1966

REVISED

TECHNICAL DEVELOPMENT PLAN

FOR

MODEL F-4(FVS) AIRPLANE (U)

CONTROL NO. C-122333

REPORT REPORT E790 COPY NO. 34

MCDONNELL AIRCRAFT CORPORATION
LAMBERT - ST. LOUIS MUNICIPAL AIRPORT, BOX 516, ST. LOUIS 66, MO.

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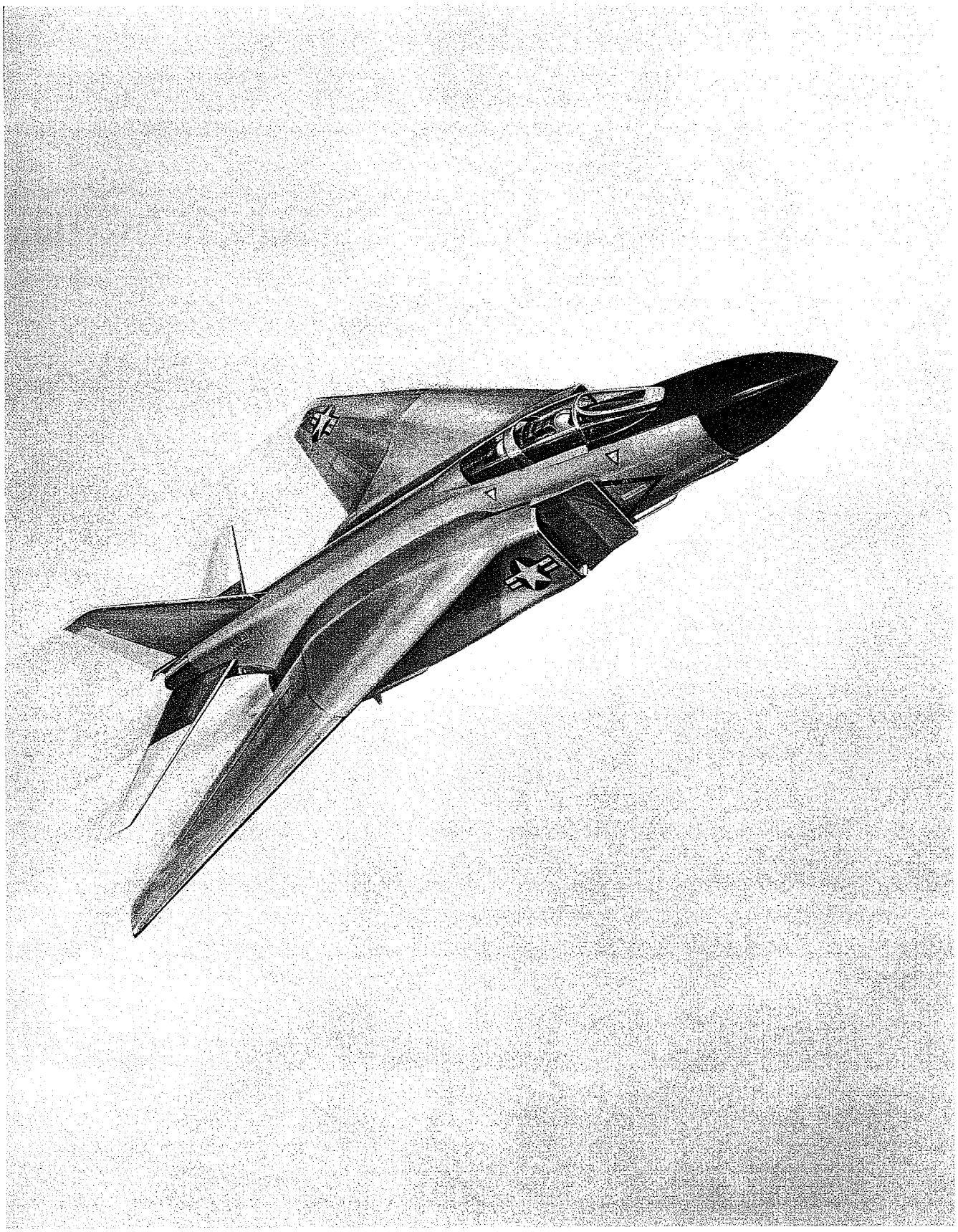

ABSTRACT

McDonnell Aircraft has conducted an eight month study of an advanced version of the F-4 all-weather fighter identified as the F-4(FVS) Weapon System. The primary features provided in this advanced model include:

- Variable-sweep wing
- AWG-10/Sparrow missile multi-shot
- Improved air-to-ground weapons delivery capability
- Improved carrier suitability
- Nose gear catapult tow
- Major increases in combat range and CAP time on station
- Increased maneuverability

With these improvements to the current F-4J model, the F-4(FVS) Weapon System is proposed for introduction into the Fleet in 1969, with early go-ahead for production. First flight is scheduled for 22 months after go-ahead.

The primary purpose of this study was to provide the Navy with sufficient detailed data to permit a logical decision on procurement of an Advanced Fleet Air Defense and Ground Attack Weapon System for the 1969-1975 time period. McDonnell's basic approach to provision of these data with respect to the F-4(FVS) has been to develop a configuration which requires minimum design changes from the base F-4J aircraft, yet provides maximum improvements in Fleet performance, manufacturing suitability, operating reliability, service maintainability, and overall program costs. A total of 1511 hours of wind tunnel testing have been accomplished since March 1966 toward firming up the aerodynamic configuration.

Introduction of the F-4(FVS) Weapon System into the Fleet would follow a series of F-4 models that have been highly successful in performing the missions of fleet air defense, air-to-ground attack and tactical reconnaissance.

SECTION 1

TECHNICAL DEVELOPMENT PLAN

Supports

Project Title: F-4(FVS) Weapons System
Element Number:
Project Number:

Original Issue -

Naval Air Systems Command
Department of the Navy
Washington, D. C. 20360

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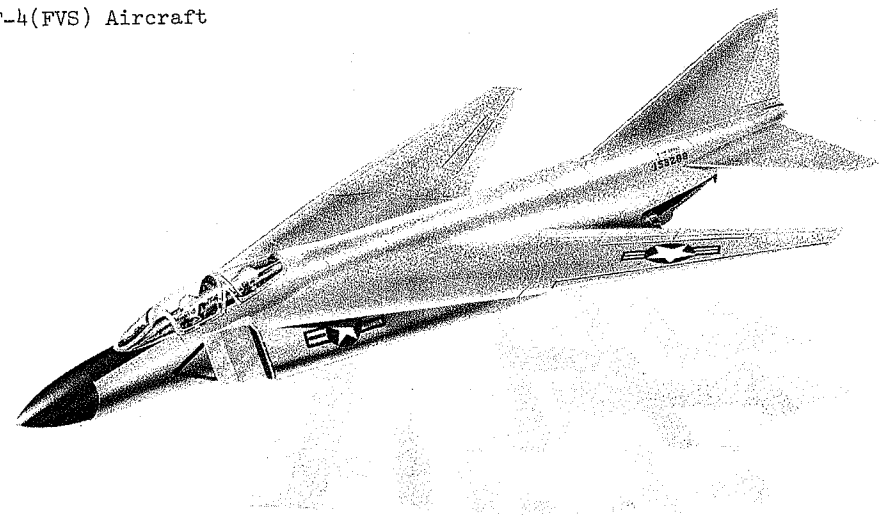
T D P SUMMARY *(Page 2.1)*
OPNAV FORM 3910-3 (8-62)

OPNAV REPORT SYMBOL 3910-3 | CLASSIFICATION STAMP

1. IDENTIFICATION AND PICTURE

F-4(FVS) Aircraft



2. DESCRIPTIVE HIGHLIGHTS

Mission: Air-to-air missile combat under all weather conditions and air-to-ground attack missions with conventional and special external weapons.

Type: Fighter Aircraft

Performance:

Vmax - 2.32 Mach
Acceleration (.8M to 1.8M) - 2.65 Minutes
Supersonic Ceiling - 59,800 Ft.
Area Intercept Radius - 1185 Miles
150 Nautical Miles CAP Mission with External Fuel (Time on Station) - 5.37 Hours
Ferry Range - 2,774 Miles
Time to Climb (0 to 35,000 Ft.) - 1.58 Minutes
Stall Speed - 102 Knots

Reliability: CAP mission (2.88 hr.) success probability goal = .91 (excludes GFAE)

Maintainability:

Total direct maintenance manhours per flight hour goal = 19.6

3. MAJOR SUB-SYSTEMS

FY 67 (1 2 3 4) | FY 68 (1 2 3 4) | FY 69 (1 2 3 4) | FY 70 (1 2 3 4) | FY 71 (1 2 3 4) | FY 72 (1 2 3 4) | FY (1 2 3 4) | FY (1 2 3 4)

Aircraft	Design & Devel — Test; Fabrication — Deliveries
Radar	Design & Devel — Test; Fabrication — Deliveries
Missile	Dsn & Dev — Test; Fabrication — Deliveries

5. LEAD BUREAU

Naval Air Systems Command

6. TECHNICAL DIRECTOR

7. PRINCIPAL CONTRACTORS

Aircraft:
McDonnell Aircraft Corporation
MCS:
Westinghouse Electric Company
Missile:
Raytheon Company

4. RDT & E FUNDING (000,000)

		FY (and prior)	FY (current)	FY (budget)	FY	FY	FY	FY	TO COMPLETE
FY	1. ANNUAL								
	2. CUMULATIVE								
		FY (current)	FY (budget)	FY	FY	FY	FY		TO COMPLETE
	3. ANNUAL								
FY	4. CUMULATIVE								

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8. MAJOR MILESTONES		FY 66 1 2 3 4	FY 67 1 2 3 4	FY 68 1 2 3 4	FY 69 1 2 3 4	FY 70 1 2 3 4	FY 71 1 2 3 4	FY 72 1 2 3 4	FY 73 1 2 3 4
1. F-4(FVS) Design Studies Started	11/65	O							
2. Wind Tunnel Tests Started	3/66	O							
3. Ground Development Tests Started	3/66	O							
4. Initial Tech & Cost Data Sub'td to NAVAIRSYSCOM	5/66	O							
5. Design & Cost Data Reviews Std to NAVAIRSYSCOM	6/66	O							
6. AWG-10 Multi-Shot Study Accelerated	7/66	O							
7. Maintainability & Support Planning Started	7/66	O							
8. Contract Proposal Received	8/66	O							
9. Production Contract Awarded	12/66		O						
10. Aircraft Configuration Established	12/66		O						
11. IMM Planning Conference	4/67		O						
12. Mission Success Probability Model Received	4/67		O						
13. Tube and Cable Mockup Started	11/67			O					
14. Major Assemblies Started	12/67			O					
15. Design Completed	2/68			O					
16. Engines Required for Installation	7/68				O				
17. Final Assembly of First A/C Complete	8/68				O				
18. First Flight	10/68				O				
19. Training Devices & Materials Delivered	10/69					O			
20. BIS Trials Started	11/69					O			
21. Factory Training Complete	11/69					O			
22. OPTEVFOR Started	12/69					O			
23. Initial Fleet Delivery to CRAW	1/70					O			
24. Navy Logistics Support Started	3/70					O			

Ø COMPLETED O NOT COMPLETED Ø- - -O TIME SLIP

9. FY 67 MILESTONES	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUN.
1. Production Contract Awarded						Ø	Ø					
2. Aerodynamic Configuration Established						Ø	Ø					
3. Aircraft Specification Approved							Ø	Ø				
4. IMM Planning Conference							Ø	Ø				
5. Aircraft Tooling Started							Ø	Ø				
6. IMM Plan Approved										Ø	Ø	
7. Mission Success Probability Model Received										Ø	Ø	
8. Electronic Equipment Purchase Order's Placed										Ø	Ø	
9. Supplier Reliability Program Initiated											Ø	Ø
10. Aircraft Parts Fabrication Started											Ø	Ø
11. Engine Order Placed												Ø

CLASSIFICATION STAMP

OP-701

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SECTION 3

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SECTION 4

NARRATIVE OF REQUIREMENT AND BRIEF DEVELOPMENT PLAN

4.0 GENERAL

The F-4B is currently employed as the Navy's prime all-weather interceptor to insure a high level of anti-air warfare (AAW) capability in the Fleet. An increase in F-4 effectiveness is scheduled with the incorporation of the APG-59 pulse doppler radar in the F-4J aircraft, which will permit the interceptor to use a look-down mode of operation for detection and destruction of low-altitude targets. However, for countering the threat expected during the 1970 time period, additional improvements beyond those scheduled for the F-4J are desired, primarily in the capability for simultaneous employment of missiles against multiple targets and in increased aircraft range and low speed performance.

4.1 STATEMENT OF REQUIREMENT

The Southeast Asia situation indicates the need for a versatile high-performance fighter which can provide improved fleet defense capability and greater air-to-ground attack capability. The development time associated with this fighter must be sufficiently short to give the Navy preparedness to confront an expansion of the current Viet Nam conflict. Unit cost must be sufficiently low to permit purchase of the additional aircraft quantities necessary for increased effectiveness in larger-scale conventional warfare.

The primary requirement of this airplane will be to defend the Fleet task force from enemy air action. The threat to the Fleet is expected to consist of raids which saturate the defenses and which employ air-to-surface missiles against the carriers at stand-off ranges out to 100 nautical miles. The hostile forces, consisting of subsonic and supersonic penetrators arranged in either clustered or dispersed formations, will use altitudes ranging from sea level to 40,000 feet and perhaps higher. The nature of this threat demands a capability for simultaneous launching and guiding of multiple missiles in co-altitude, shoot-up, or shoot-down environments. The enemy aircraft will also make substantial use of electronic countermeasures (ECM) to degrade the effectiveness of the interceptor's fire control system and missile operation.

Another required air-to-air warfare capability involves the distant air superiority mission. This mission requires the aircraft to operate at extended ranges to control airspace over beachhead and inland operations and for escort of strike aircraft. Long range air superiority and escort requires the aircraft to have capability for autonomous operation.

A secondary role of this airplane requires its operation as an attack fighter-bomber at ranges over 600 miles. The capability is needed to deliver nuclear weapons plus a large quantity of conventional air-to-ground weapons under adverse weather conditions.

This fighter will also be required to work in conjunction with various control elements of the Navy and Marine Corps, such as Airborne Early Warn-

ing aircraft, shipboard CIC, and land-based radar systems. These operations necessitate compatibility with the various tactical data link command and control systems, such as the Airborne Tactical Data System (ATDS), Naval Tactical Data System (NTDS), and Marine Tactical Data System (MTDS) now being introduced into the fleet.

To achieve the above-mentioned tactical requirements, it is necessary that the fighter possess improved high speed intercept and range-payload capabilities in conjunction with the low speed performance needed for a high degree of carrier suitability. This combination of varied performance capabilities creates the desirability for a variable-sweep wing.

The required weapon system characteristics are listed below:

(1) Maximum speed over 2.2 Mach No.
(2) Time to climb to 35,000 ft. less than 2 min.
(3) Acceleration from .8M to 1.8M less than 3 min.
(4) Up to triple carrier deck cycle operation (based on 1.5 hour cycle)
(5) Ferry range over 2500 N.M.
(6) Improved carrier spotting factor.
(7) Nose gear catapult tow.
(8) Improved air-to-air weapon delivery capability to meet supersonic raids.
(9) Ability to deliver the present stockpile of nuclear and conventional air-to-ground weapons.
(10) Improved navigation equipment.
(11) Growth capability for advanced engines, electronics, and for range-payload increases.
(12) Maximum utilization of existing support equipment and facilities.
(13) Compatibility with VAST.
(14) Maintenance manhours per flight hour less than 20.
(15) Mission success probability over .80.
(16) Unit cost in quantity of 300 less than 4M.
(17) Initial Fleet delivery in calendar 1969.

4.2 EXISTING AND FUTURE CAPABILITIES

The existing capability of the F-4J has been developed from the F-4B through a series of improvements and technological advancements that have been incorporated with minimum change to the basic F-4 aircraft. The primary improvements included in the F-4J are the incorporation of AWG-10 MCS, drooped ailerons, and automatic approach power compensation. These changes result in an improved radar search and weapon system effectiveness and a decrease in approach speed.

Advanced design studies have been conducted to further exploit the potential of the F-4. These studies have resulted in the F-4(FVS) version, which is a modification of the F-4J. The F-4(FVS) provides major improvements in missile control and multi-launch, carrier suitability, radius of action, high altitude maneuverability, time on station, and bombing and navigation capability. The following sections describe the characteristics that provide these improvements.

4.2.1 Aircraft

Although the F-4(FVS) is somewhat changed in external configuration, its structural design philosophy and subsystem design remain unchanged from the F-4J. Figure 4.1 compares the aircraft and mission performance of the F-4(FVS) and the F-4J.

The variable-sweep outer wing is the primary airframe difference compared with the F-4J. The wing pivots at 28% span and provides utilization of any sweep angle between 23° and 70°. In addition to improved high-speed and low-speed characteristics, the wing also provides 2.0G buffet-free maneuvering at Mach .85, 35,000 ft., and combat gross weight. The larger stabilizer with zero dihedral provides increased supersonic maneuverability.

Nose gear catapult tow produces a faster, safer, and more efficient carrier launch operation.

4.2.2 Electronic Systems

The F-4(FVS) electronic systems provide significant increases in air-to-air performance and air-to-ground weapon delivery accuracy over the F-4J. The systems which are not changed or changed only slightly to provide this improvement retain current fabrication techniques. New systems or those requiring major changes will take advantage of the present state of the art in miniaturized packaging.

The primary intercept with two-way data link improvement results from the addition of a multiple target attack capability. The F-4(FVS) Multiple Target Weapon System is based on minimum changes to the F-4J aircraft, the Westinghouse AN/AWG-10 missile control system, and the Raytheon Sparrow missile. Normal evolution of these basic components produces an Airborne Weapon Control System (AWCS) capable of detecting and tracking multiple targets, both clustered and widely spaced. Detection and tracking of targets, preparation of the missile for launch, missile launch, and missile guidance to target impact are inherent in this system. It is planned that the AWCS will have data handling capabilities for up to six missiles in flight simultaneously.

To achieve this multiple target capability, the AWG-10 analog computer is replaced by a digital computer to provide the increased computing capability required. The Radar Intercept Officer is provided with a small indicator in addition to a larger main display tube and a synthetic display for complete attack information. A new (terminal illuminate) antenna is added immediately below the AWG-10 antenna to provide guidance at a high data rate for up to two missiles during their terminal flight period.

PERFORMANCE SUMMARY

Model		F-4J	F-4(FVS)
Engine		J79-GE-10	J79-GE-10
Internal JP-5 Fuel	Gal.	1,998	2,514
Takeoff and Climb Performance			
Takeoff Gross Weight	Lb.	46,439	51,750
Takeoff Distance Over 50 Ft.	Ft.	2,550	1,720
Time to Climb to 35,000 Ft.	Min.	1.33	1.58
Speed Performance			
Combat Gross Weight (60% Int. Fuel)	Lb.	41,005	44,903
Maximum Level Flight Speed	Mach	2.27	2.32
Acceleration (.8M to 1.8M at 36,089 Ft.)	Min.	2.35	2.65
Supersonic Ceiling (Combat Weight at Maximum Thrust)	Ft.	58,700	59,800
Carrier Suitability			
Catapult Performance			
Takeoff Gross Weight	Lb.	56,000(1)	69,000(1)
W.O.D. C-7 Catapult	Knots	21	22
a/g at End of Cat.		.236	.248
Arresting Performance			
Landing Gross Weight (4,000 Lb. Fuel)	Lb.	36,852	38,655
Arresting W.O.D.-MK-7, Mod. 2	Knots	8	2
Stall Speed at Landing Gross Weight (V_{SPA})	Knots	113	102
Mission Performance(2)			
Area Intercept Radius	NM	806	1,185
Takeoff Gross Weight	Lb.	56,000(1)	65,334
External Fuel	Gal.	1,340	1,800
C.A.P. (150 NM Radius)			
Time on Station/Total Mission Time	Hr/Hr	2.61/3.71	5.37/6.62
Takeoff Gross Weight	Lb.	56,000 (1)	65,334
External Fuel	Gal.	1,340	1,800
Hi-Lo-Hi (6) MK-82 S.E., Radius	NM	343	898
Takeoff Gross Weight	Lb.	55,800	69,400
External Fuel	Gal.	740	1,800
Hi-Lo-Lo-Hi (1) MK-28 Weapon, Radius	NM	385	790
Takeoff Gross Weight	Lb.	54,146	62,968
External Fuel	Gal.	740	1,200
Q.R.I. (4) Sparrow Missiles, Radius	NM	250	333
Takeoff Gross Weight	Lb.	46,439	51,750
Ferry Range Retain/Drop Tanks	NM	1,778/1,964	2,502/2,774
Takeoff Gross Weight	Lb.	54,615	63,374
External Fuel	Gal.	1,340	1,800

NOTES: (1) Basic Catapult Design Gross Weight
(2) All Mission Performance Based on MIL-C-5011A Takeoff and Landing Reserves and a 5% Fuel Flow Safety Factor

Figure 4.1

4.2.3 Missile

The Advanced Sparrow missile is compatible with either intermittent pulse doppler or CW RF illumination. An improved missile seeker, together with the increased effective illumination power of the AWG-10 AWCS and a higher-impulse motor provide an increase in the effective range of the missile. Effectiveness of the missile is also improved through use of a larger warhead, an active fuze, and target discrimination techniques.

Dispersed targets can be resolved by the AWG-10, and by appropriate coding a selected missile is guided to an assigned target. For clustered targets (those not resolvable by the AWG-10), the Sparrow missile itself provides target discrimination.

4.2.4 Additional Features

In addition to the Multiple Target Weapon System, the F-4(FVS) incorporates a Lead Computing Optical Sight Set (LCOSS), miniaturized AN/ASW-27 Data Link, a new Inertial Navigation/Digital Bombing Set, and a Radar Warning and Homing Set. These units permit accurate lead-computed air-to-air gunnery; continuously computed delivery of conventional weapons and LABS and LADD nuclear weapon delivery; launch of anti-radiation missiles; accurate aircraft velocity, attitude, position determination; 360-degree azimuth warning of airborne interceptor radars; forward hemisphere warning; homing against ground based S- and C-band SAM and AAA radars; and attack direction through NTDS and MTDS command links.

The F-4(FVS) capability to deliver a large variety of air-to-air and air-to-ground weapons is indicated by Figure 8.1.

4.3 DESIGN CHARACTERISTICS

Primary design characteristics of the F-4(FVS) weapon system are contrasted with those of the F-4J and summarized below:

(a) 23°-70° variable-sweep wing.
(b) Multi-shot capability with two-way data link.
(c) Approximately 50% increase in area intercept radius.
(d) Approximately 100% increase in Combat Air Patrol on-station time.
(e) 516 gallons of additional internal fuel.
(f) Stall speed reduction of 11 knots.
(g) Nose gear catapult tow.
(h) Carrier spotting factor improvement from 1.65 to 1.56.
(i) Minimum change to existing weapon systems support requirements.
(j) High reliability due to minimum change resulting from the use of existing hardware.

4.4 HISTORICAL BRIEF

For over four years, McDonnell Aircraft Corporation has been studying the effects of various improvements to the F-4B aircraft. Previously proposed configurations have generally provided greatly improved functional

capability and mission performance, but without a major improvement in carrier suitability. An F-4 with a modified wing for high lift was presented to BuWeps in MAC Report A379 in December 1963. A detailed comparison of this aircraft to the F-4J and three additional configurations (F-4La, F-4Lb, 98FHA, and 98FOa) was made in August 1964 and presented in MAC Report A884.

The decision was made to consider the F-4Lb configuration defined in Report A884 with further revised wing geometry and the General Electric J79-JIB(J79-GE-10) engine. This configuration was designated the F-4(FV) (MAC model number 98FV). Characteristics of this aircraft were described in MAC Report B177 and presented to BuWeps in October 1964. Following general concurrence by BuWeps on the F-4(FV) configuration, exploratory studies were started in November 1964 in the MAC polysonic wind tunnel. Further polysonic tunnel tests were conducted in April and August 1965. Starting in June 1965, tests with regard to jet effects, and lateral and longitudinal stability and control were conducted in the MAC low speed wind tunnel, followed by tests on high lift characteristics in August 1965. Results of the F-4(FV) studies were submitted in November 1965 in MAC Reports E001 through E023 and the WR-30 Addendum.

Preliminary discussions between MAC and Westinghouse Electric Company began in 1960. In February 1963, Westinghouse reviewed their studies on a multi-shot capability for the AWG-10 radar with MAC. Approximately a year later, this was followed with a feasibility report and review. The Raytheon Company was also working during this time period on improvements to the Sparrow missile. The first studies performed by Raytheon concerned the improvement of the Sparrow III (AIM-7E) missile to provide multiple launch, and proposals on this subject were made to the Navy in April 1961. Detailed discussions with MAC on an improved Sparrow began in February 1964.

Preliminary design studies of the F-4(FVS) variable-sweep airplane began in December 1965 and have resulted in approximately 165,000 man hours of McDonnell effort to date. Wind tunnel tests were initiated in March 1966 and the following tunnel testing has been accomplished:

Tunnel	Model	Time
MAC Polysonic	5% Scale	430
Cornell	5% Scale	121
MAC Low-Speed	13% Scale	960
Total		1511 Hours

Initial data packages defining the airframe, systems, testing, and costs were submitted and discussed with NAVAIRSYSCOM personnel in June 1966. Preliminary copies of the F-4(FVS) Detail Specification (SD-513-2), Flight Demonstration Requirements (MIL-D-8708A, Addendum 48), Engineering Data and Ground Test Requirements (MIL-D-8706A, Addendum 257) were submitted to NAVAIRSYSCOM in July. A February 1966 meeting at NADC with Westinghouse, Raytheon, and McDonnell discussed the CCM capabilities of the AWG-10 AWCS and Sparrow missile. The Sparrow III AIM-7F development contract has recently

been awarded and the design will provide space for multi-shot electronics. On 4 August at NAVAIRSYSCOM, Westinghouse conducted the formal technical briefing on the AWG-10 multi-shot AWCS.

4.5 DEVELOPMENT PLAN

Primary test requirements for the F-4(FVS) will be in the areas of Flight Tests, Airframe Ground Tests, Qualification Tests, Subsystems and Development Ground Tests, and Maintenance Engineering Inspections. Maximum concurrent testing will be utilized to expedite completion of the development program. Commonality with the F-4J will greatly reduce time and effort required to design and develop the forward and center fuselage, power plant installation, and most of the associated equipment. Test and development programs will be closely coordinated between the Test Facilities and Project Management through a Project Development Organization.

4.5.1 Flight Tests

Flight test requirements are based on the policy of demonstrating only those configuration items not now similar to the F-4J. For instance, engine and inlet commonality with the F-4J will noticeably shorten and expedite the flight test program. Performance, structural, armament and stores, aerodynamic, spin, avionic, and carrier suitability demonstrations will be necessary. Seven aircraft for contractor testing, four for BIS trials, and five for OPTEVFOR tests are necessary in order to meet scheduled squadron deliveries. Section 12 describes BIS and OPTEVFOR programs. The seven aircraft allocated to contractor testing are assigned as shown below:

Airplane No.	Tests
1	Stability & Control and Spins
2	Performance and Autopilot
3	Corner Suitability
4	Structural and Armament
5	Armament and Stores
6	AWCS and Equipment
7	Bomb-Navigation and Data Link

Two modified F-4's, currently involved in AWG-10 MCS development, will be assigned for Westinghouse AWG-10 AWCS multi-shot development. One of these aircraft will subsequently be utilized for missile integration testing.

4.5.2 Airframe Ground Tests

Airframe Ground Test requirements include structural, wind tunnel, and ground vibration tests. The static test aircraft will be taken to ultimate loading, through drop tests, and finally to failure. The fatigue airframe tests will be based on 6000 flight hours and 6000 landings. To reduce costs, existing test fixtures and test specimens could be used or modified to satisfy the F-4(FVS) configuration. Wind tunnel testing will be required to evaluate various sweep positions, store effects, high lift devices, flutter, stability and control, spins, and aeroelasticity. Ground vibration tests and static proof load tests will be performed on the first flight airplane prior to flight.

4.5.3 Qualification Tests

Qualification Testing will be required for all newly designed equipment for use on the F-4(FVS). Equipment previously used on F-4 models need not be retested. Testing of modified equipment will be required only to the extent necessary to prove adequacy of the modification. In most cases, design changes may be qualified by similarity to the other F-4 type equipment.

4.5.4 Subsystem and Development Ground Tests

Subsystem and development ground tests and qualification tests will be required on those components peculiar to the F-4(FVS). Also, those systems previously used on other F-4 models and modified for use on the F-4(FVS) will require ground testing. Systems developed and evaluated on other F-4 programs and used without modification on the F-4(FVS) will not require re-evaluation. Among the new and modified items which require further testing on the F-4(FVS) are fuel system sequencing and fuel quantity, hydraulics and controls, landing gear, electronic systems, and environmental control systems.

Antenna model tests will evaluate effect of wing position and will test antenna patterns for the various RF equipments.

SECTION 5

MANAGEMENT PLAN

5.1 MANAGEMENT METHOD

Since the F-4(FVS) Weapons System is a follow-on development of the existing F-4 Phantom II program, proven operating management methods currently in use will be carried forward to the F-4(FVS). The prime contractor of this weapon system is McDonnell Aircraft Corporation, and the management techniques employed by that contractor include Line-of-Balance and Milestone/Cost methods as submitted to NAVAIRSYSCOM in McDonnell status reporting on Phantom II. This report is continually updated as changes occur in any portion of schedules or program costs relating to the aircraft or support equipment. In addition, cost information and status will be submitted quarterly to NAVAIRSYSCOM in Report DD1097, which gives detailed information showing anticipated increases or decreases in total program costs and detailed analysis of these changes.

To implement Performance Evaluation Review Technique Cost (PERT Cost) on this weapon system would create an added expense to overall program costs without achieving an associated gain in program control. In view of the fact that a smooth running and effective management method now exists on the Phantom II program, the decision has been made to continue with that method.

5.2 RESPONSIBILITY ASSIGNMENTS

5.2.1 Program Management

The Naval Air Systems Command is responsible for the overall program management of this weapons system. This management is administrative in nature, as designated in NAVAIRSYSCOM Instruction 5200.16A of 16 November 1964. Actions include planning, pricing of plans, issuing of program directives, direction of funds, coordination of Command effort, monitoring of progress, and centralizing of information. Program organization and management lines are shown in Figures 5.1 and 5.2, respectively.

5.2.2 RDT&E Project Management

An assistant project manager, appointed from the appropriate office in NAVAIRSYSCOM, will have prime responsibility for the RDT&E project management as designated in NAVAIRSYSCOM Instruction 5200.16A of November 1964. In this capacity the RDT&E project manager will perform the basic technical planning of the development program and will supervise the efforts of the system developers and associated agencies to assure that the system, when developed, will meet the operational requirement.

The objectives of the RDT&E Project Manager are to conduct the various component and system development programs through the point where a production article has been approved by CNO for inclusion in the Naval arsenal inventory, and thereafter to provide continuing development support and design assistance as may be necessary through the life of the system. One of the prime functions to be performed during the development phase will be to

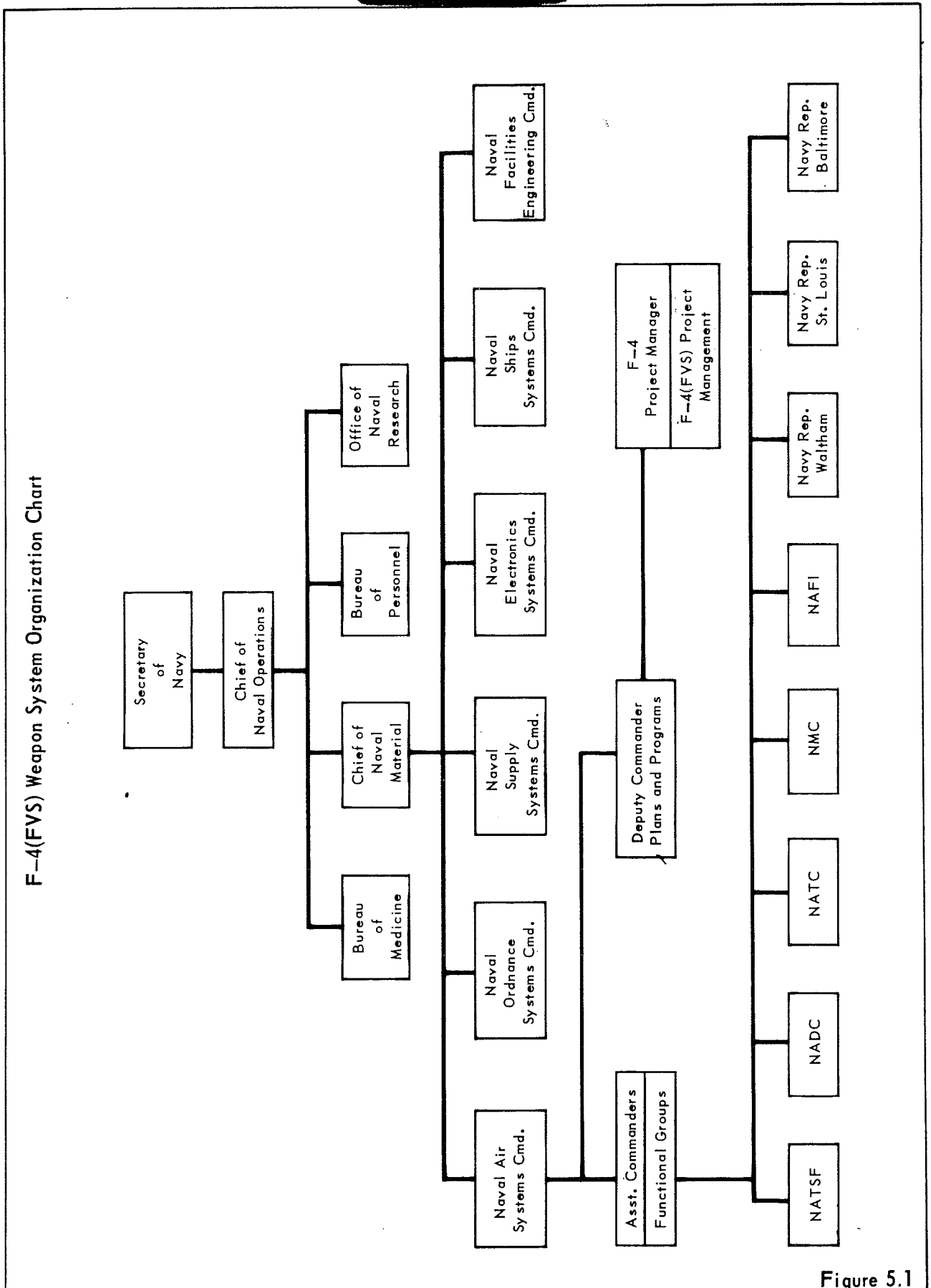

F-4(FVS) Weapon System Organization Chart
Secretary of Navy
Chief of Naval Operations
Office of Naval Research
Bureau of Personnel
Chief of Naval Material
Bureau of Medicine
Naval Facilities Engineering Cmd.
Naval Ships Systems Cmd.
Naval Electronics Systems Cmd.
Naval Supply Systems Cmd.
Naval Ordnance Systems Cmd.
Naval Air Systems Cmd.
F-4 Project Manager
F-4(FVS) Project Management
Deputy Commander Plans and Programs
Asst. Commanders
Functional Groups
Navy Rep. Baltimore
Navy Rep. St. Louis
Navy Rep. Waltham
NAFI
NMC
NATC
NADC
NATSF

Figure 5.1

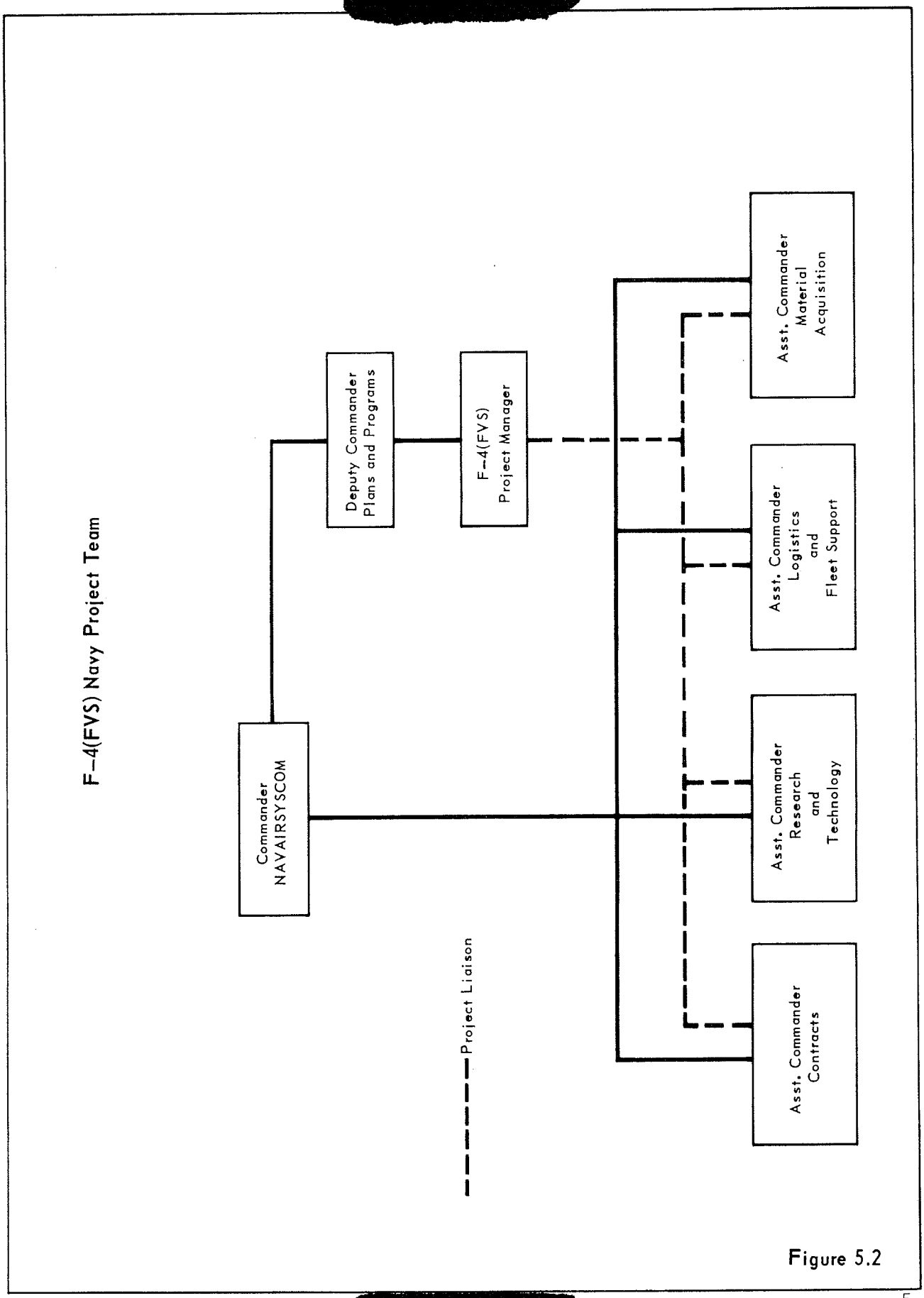

F-4(FVS) Navy Project Team
Commander NAVAIRSYSCOM
Deputy Commander Plans and Programs
F-4(FVS) Project Manager
Asst. Commander Material Acquisition
Asst. Commander Logistics and Fleet Support
Asst. Commander Research and Technology
Asst. Commander Contracts
Project Liaison

Figure 5.2

convene with the Program Manager, as required or necessary, to provide technical progress and program achievement information, fund expenditures, and supporting data for comparison with the established program goals.

5.2.3 Systems Integration

McDonnell Aircraft Corporation, under the direction of NAVAIRSYSCOM, will act as Weapon System Manager responsible for systems integration. Systems integration involves the performance of the necessary coordination, engineering and scientific studies, and weapon system tests to insure operational workability and compatibility of all elements in the system, as well as compatibility of the system with other airborne equipment with which it may interact. These actions are accomplished in whole or in part by various Naval field activities and/or contractors, as illustrated by the Responsibility Matrix shown in Figure 5.3.

F-4(FVS) Weapons System Responsibility Matrix

Work Breakdown Structure \ Activity	NAVAIRSYSCOM	ASO	NTDC	NATC	NATSF	McDonnell	General Electric	Westinghouse	Raytheon	NMC	BUPERS	NATRA
Aircraft	X					X						
Structures	X					X						
Propulsion	X					X	X					
Missile Control System	X					X		X				
Armament	X					X			X			
Mockup	X					X						
Test	X			X		X				X		
Support	X					X	X	X	X			
IMM	X					X						
Maintainability	X					X						
Personnel and Training	X		X			X					X	X
Publications	X				X	X						
Support Equipment	X	X				X						
Spares	X	X				X						
Facilities	X					X						

Figure 5.3

5.2.4 Work Breakdown Structure

The work breakdown structure for the F-4(FVS), as shown in Figures 5.4 and 5.5, is similar to those used for the F-4 aircraft now in service.

5.2.5 Contractual Structure

McDonnell Aircraft Corporation is to perform the necessary functions and assume the responsibilities of a prime contractor under a fixed price incentive contract administered directly by an Assistant Project Manager for contracts, reporting to the Program Manager. Various systems such as power plants, missile control system, and selected avionics will be supplied to the prime contractor as Government Furnished Aeronautical Equipment (GFAE).

F-4(FVS) Work Breakdown Structure – Aircraft

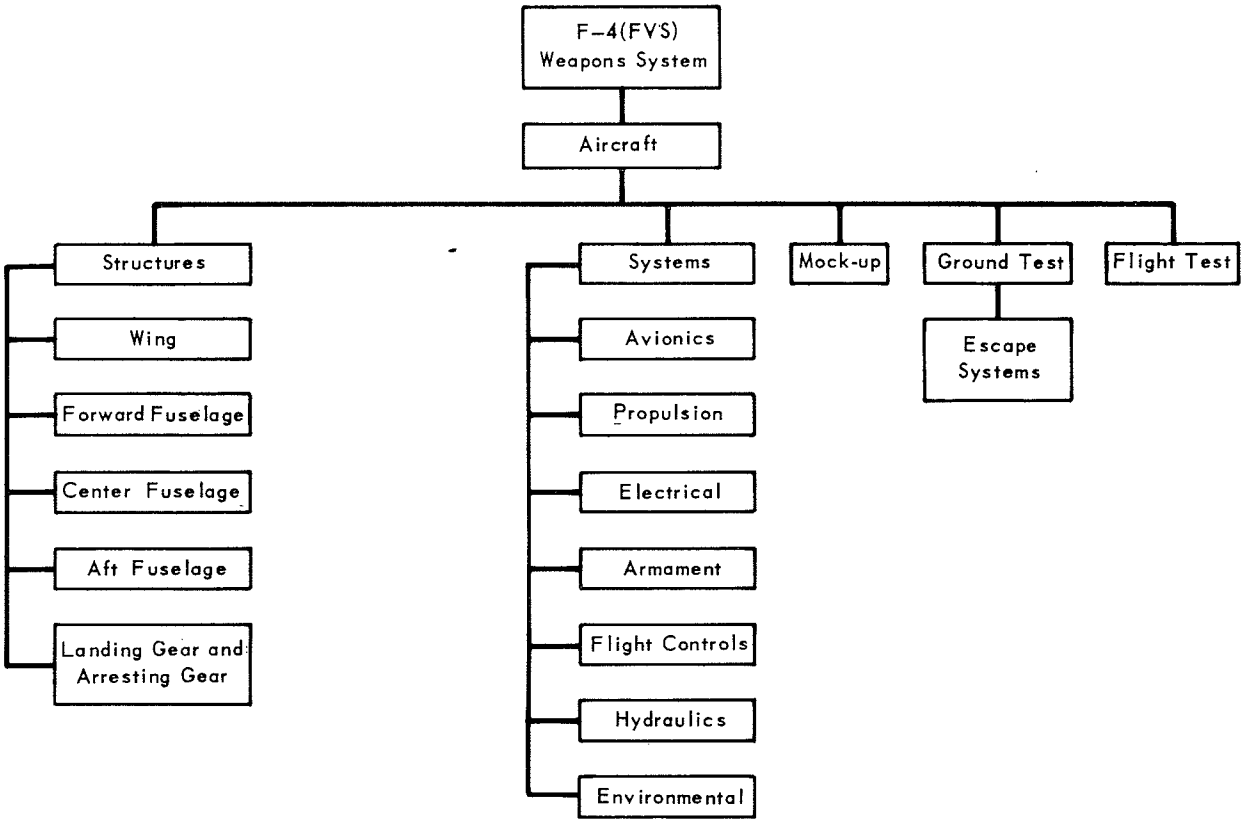


Figure 5.4

Work Breakdown Structure – Support

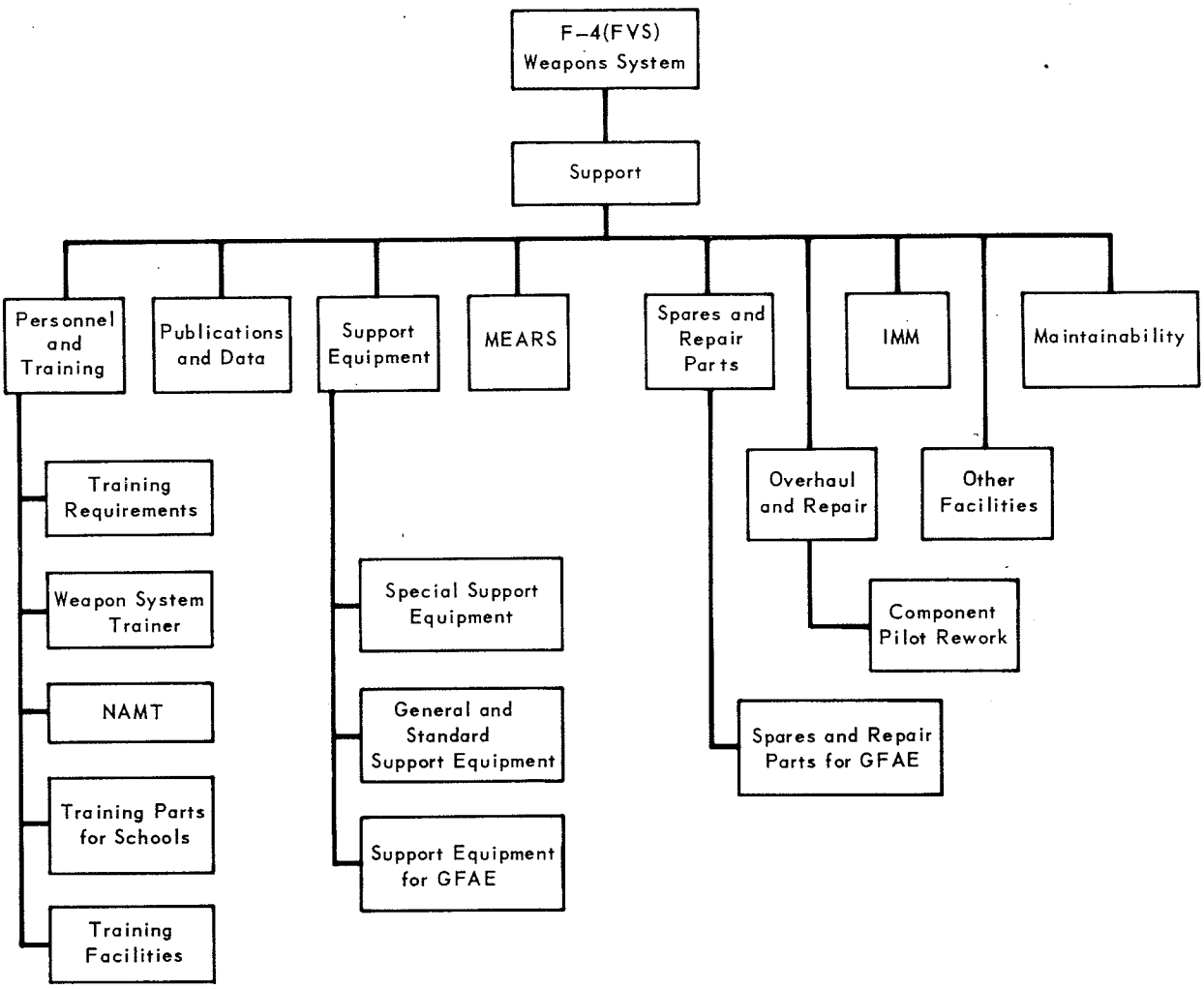


Figure 5.5

SECTION 6

FINANCIAL PLAN

The preparation of the Financial Plan will be accomplished by Naval Air Systems Command personnel in general accordance with Navy Report NAVMAT P3910 "Guide for the Preparation of Technical Development Plans" utilizing cost information submitted by McDonnell in MAC Report E793 "Model F-4(FVS) Aircraft Multiple Year Procurement Price and Delivery Proposal" dated 10 August 1966.

Estimated costs by Fiscal Year are presented in MAC Report E793 as follows:

Fiscal Year	1967	1968	1969	1970	Total
Aircraft Quantity					
Nonrecurring					
Airframe & CFE					
GFAE					
Total					
Recurring					
Airframe & CFE					
GFAE					
ECP's					
Total					
Recurring Unit Flyaway					
Special Support Equipment					
CFE - Organ. & Intermediate					
CFE - Depot					
GFAE - Organ, & Intermediate					
GFAE - Depot					
Total					
Spare Parts					
CFE					
GFAE					
Total					
NAMT's, Simulators & Trng					
CFE					
GFAE					
Total					

[redacted]

Publications

CFE
GFAE
Total

Total CFE - All Items
Total GFAE - All Items
Total Program Price

Recurring Unit Program Price

SECTION 7

BLOCK DIAGRAM

7.0 GENERAL

The relationship between major components of the F-4(FVS) weapons system and the relationship of the F-4(FVS) to other systems and functions of Naval operations in the 1970 time period are illustrated in this section. Pictorial representations, in terms of an overall block diagram and detailed block diagrams, are used to describe the important interfaces, both physical and nonphysical, that occur with associated systems.

7.1 BLOCK DIAGRAMS

The overall block diagram of the F-4(FVS) weapons system, including the information flow involved in operation of the aircraft in the Navy and Marine tactical environments, is presented in Figure 7.1. Figures 7.2, 7.3, and 7.4 show detail block diagrams of the system. The F-4(FVS) weapon system is separated into: aircraft subsystem; avionics subsystem; and armament subsystem. The interrelationships of these subsystems and their characteristics are described in detail in Section 8.

The major system associated with the F-4(FVS) is the attack aircraft carrier with its operations involving launching, recovery, servicing, and maintenance of the aircraft. The physical interface noted by this association requires that the F-4(FVS) system be carrier-suitable with respect to weight, size, launching, recovery characteristics, turnaround (reloading) time, and maintenance concept.

Additional systems associated with the F-4(FVS) are the Naval Tactical Data Systems (NTDS), Airborne Tactical Data System (ATDS), and Marine Tactical Data System (MTDS). The shipboard NTDS provides for an integrated task force command and in particular, control of anti-air warfare elements. The airborne early warning function in the fleet is performed by the E-2A aircraft, with the vectored control of interceptors handled by the ATDS on board. Combat air operations in the beachhead area are normally controlled by the MTDS. In all three data systems, pertinent command and control information is exchanged with the F-4(FVS) by the use of digital data link communication.

The capability of the F-4(FVS) to operate in a suitable manner from the aircraft carrier and to be compatible with the tactical data systems permits the aircraft to accomplish a series of missions. These consist of a primary anti-air warfare mission and a secondary air strike role. The air-to-air role includes fleet air defense, beachhead air defense, air superiority, and escort. The air-to-ground role consists of tactical strike (conventional weapons delivery) and strategic strike (nuclear weapons delivery).

Over-All Block Diagram for F-4(FVS) Weapons System

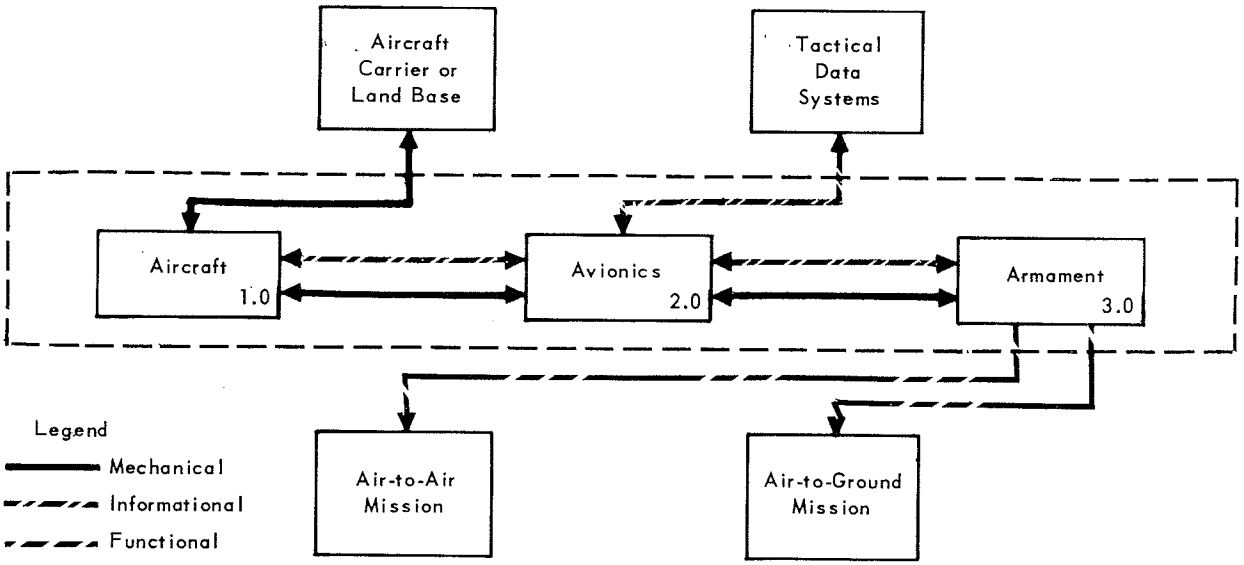


Figure 7.1

Aircraft Detail Block Diagram

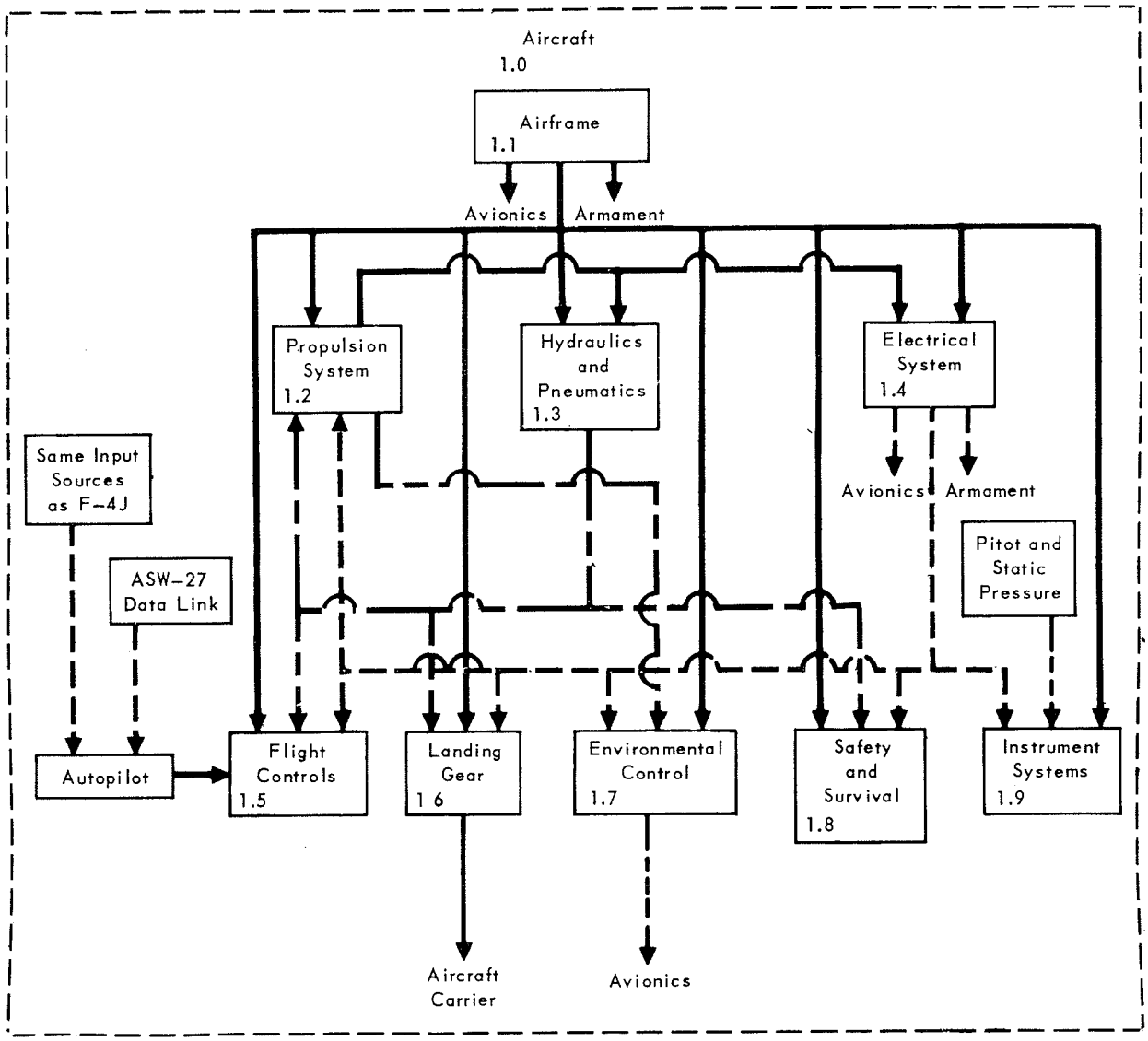


Figure 7.2

Over-All Block Diagram for F-4(FVS) Weapons System

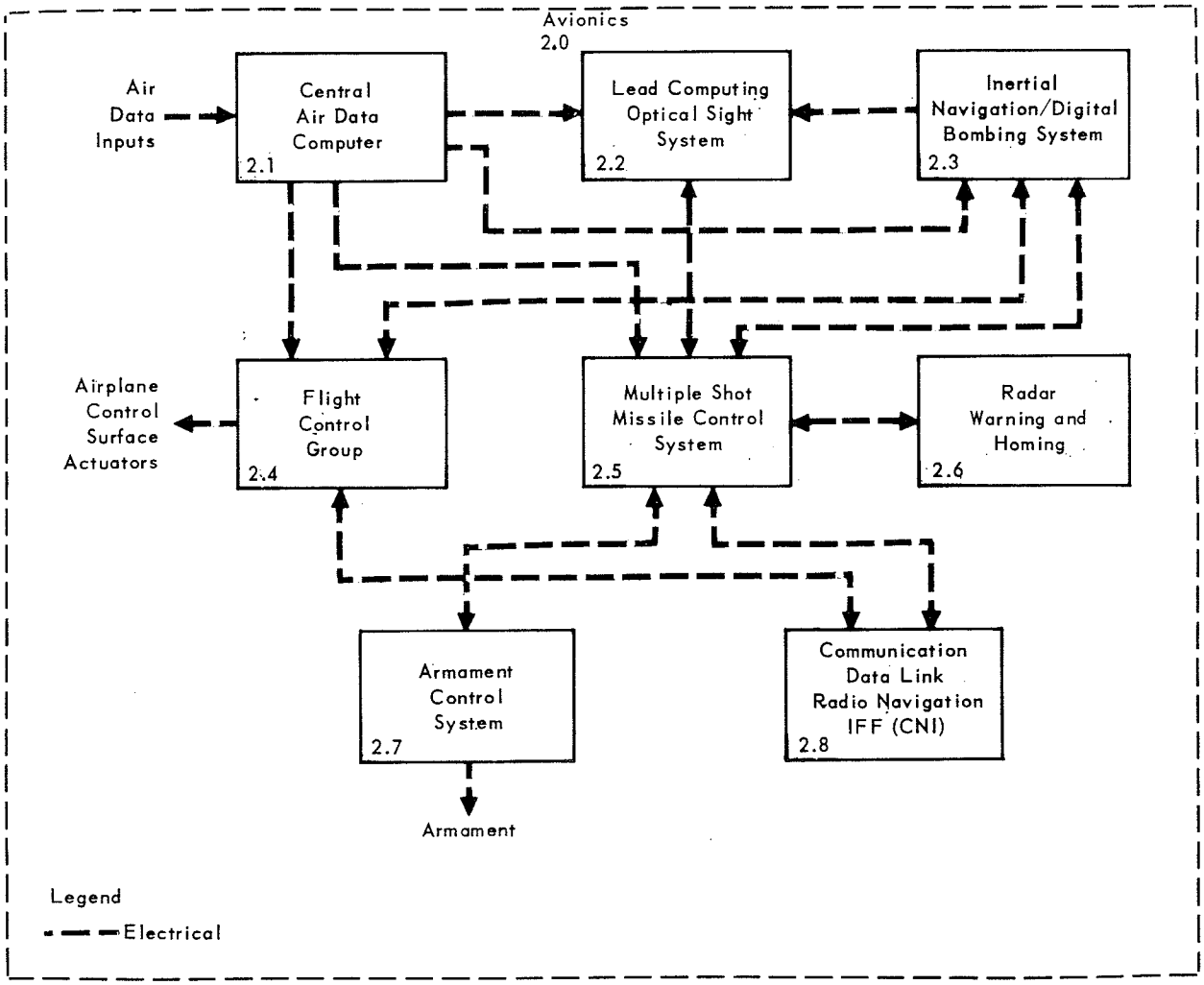


Figure 7.3

Armament Detail Block Diagram

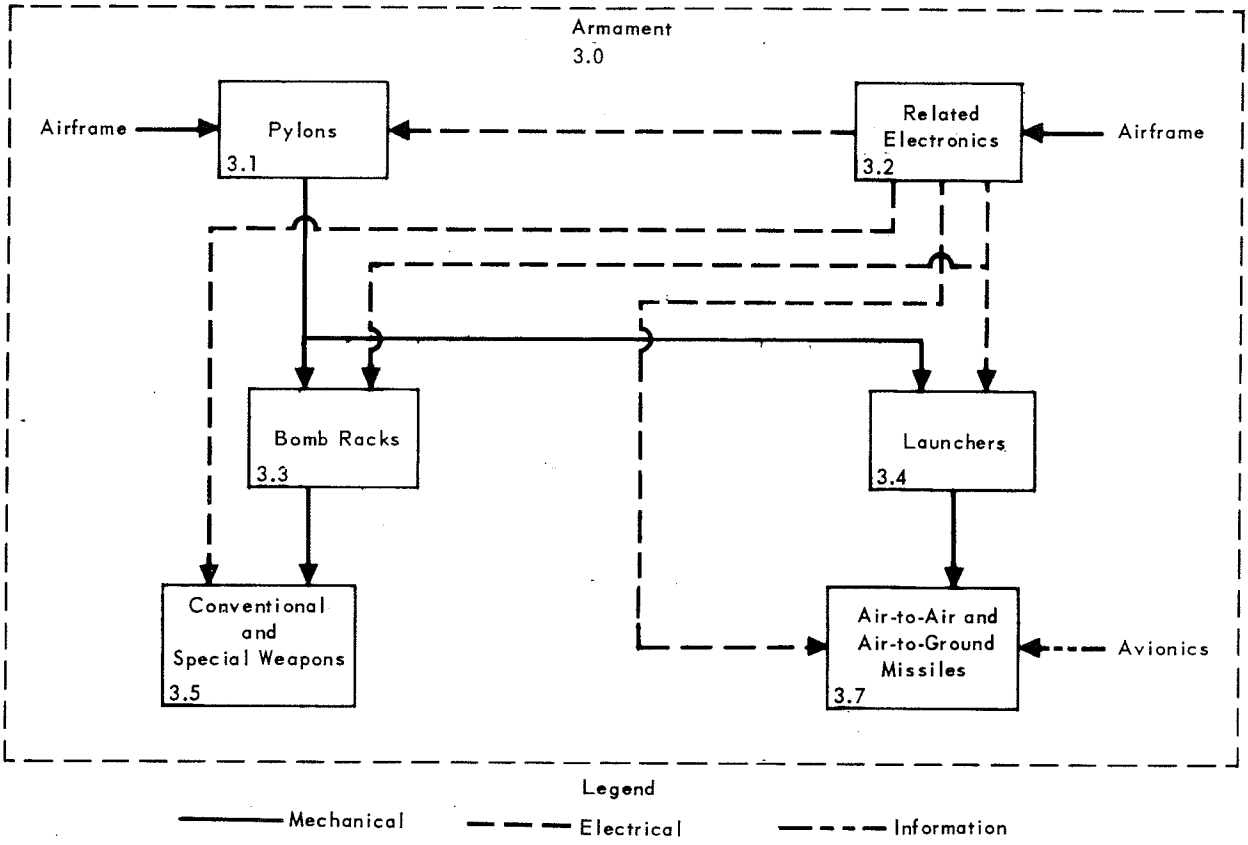


Figure 7.4

SECTION 8

SUBSYSTEM CHARACTERISTICS

8.1 AIRCRAFT

The Model F-4(FVS) aircraft, Figure 8.1, is a modified configuration based on the Model F-4J, and features improved carrier suitability, improved cruise and loiter characteristics, and improved avionics and armament delivery capability. Since the F-4(FVS) is a modification of the F-4J, the same or similar components will be used. For any changes required to meet the improved performance of the F-4(FVS), proven materials, hardware, and design philosophy will be used with no technical risks anticipated.

8.1.1 Airframe

The airplane structure sections are shown by the manufacturing breakdown drawing on Figure 8.2.

The semi-monocoque fuselage structure is formed in three major sections (forward, center, and aft) and consists basically of skin, stringers, longerons, and major bulkheads. Minor frames support equipment and fuel cells, react local pressures, and assist in stiffening the shell.

The primary wing structure consists of a fixed inner wing and a variable sweep outer wing supported by a pivoting joint at 28% span. The inner wing structure is comprised of a continuous "I" beam with a torque box from the pivot fitting to the fuselage. The primary outer wing structure is an integrally stiffened 2 cell box beam. The pivot structure consists of an upper and lower set of lugs each joined by a separate journal.

8.1.2 Propulsion System

The propulsion system consists of two turbojet engines, an air inlet duct system for each engine, and a fuel system. The engine to be used is the General Electric J79-GE-10 augmented (afterburning) turbojet engine producing a nominal sea level static thrust rating of 11,870 pounds at Military Power (non-augmented) and 17,900 pounds at Maximum Power (augmented).

The inlet duct system incorporates variable-control features to optimize performance and to insure engine compatibility over the full range of operational conditions.

The fuel system is designed to supply fuel to the engine at required rates and pressures while maintaining satisfactory airplane balance. This system does not provide fuel metering, which is provided by a subsystem of the engine. The F-4(FVS) internal fuel capacity has been increased by 516 gallons as compared with that of the F-4J.

[redacted]

F-4(FVS)
Three View

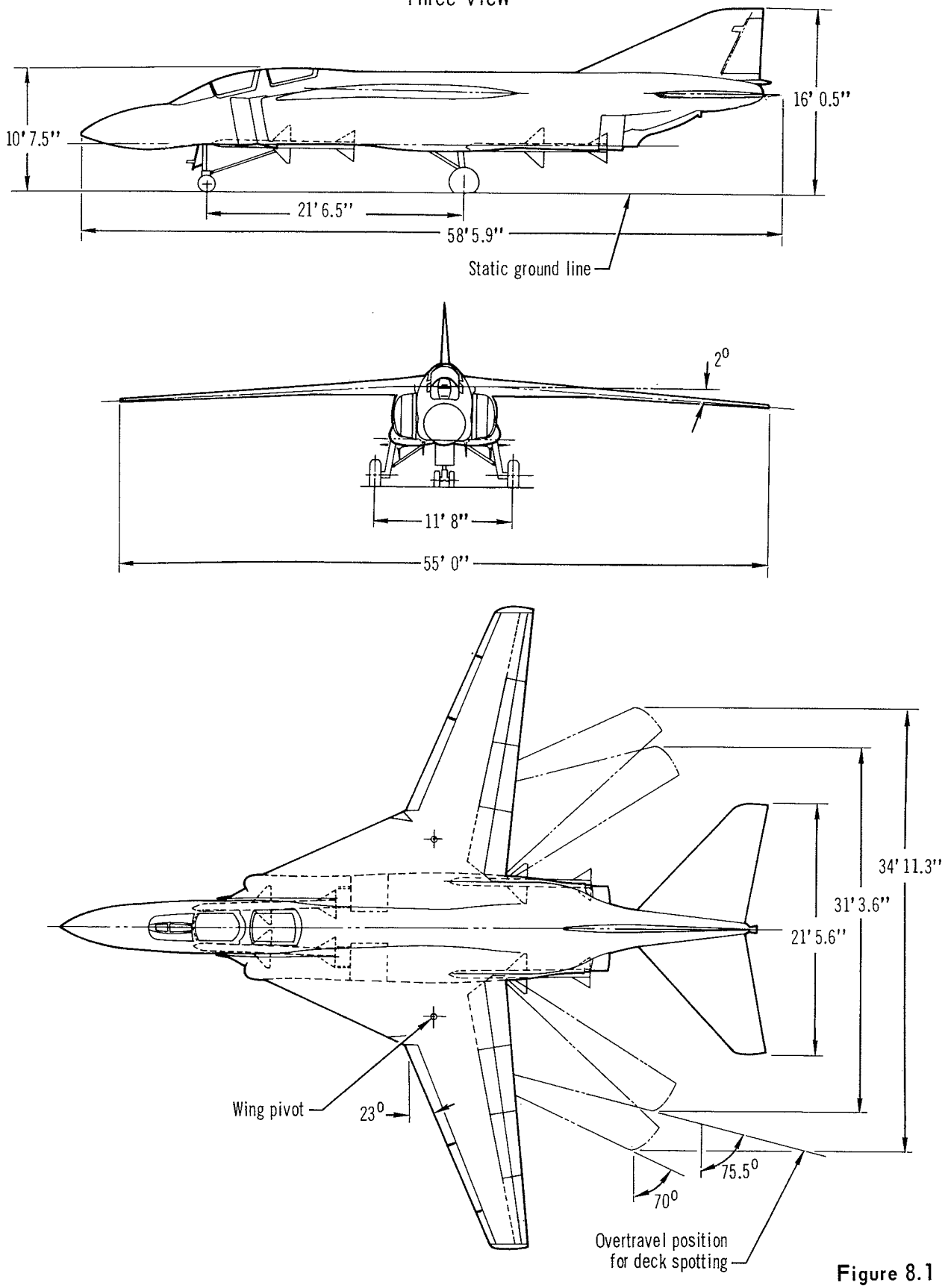
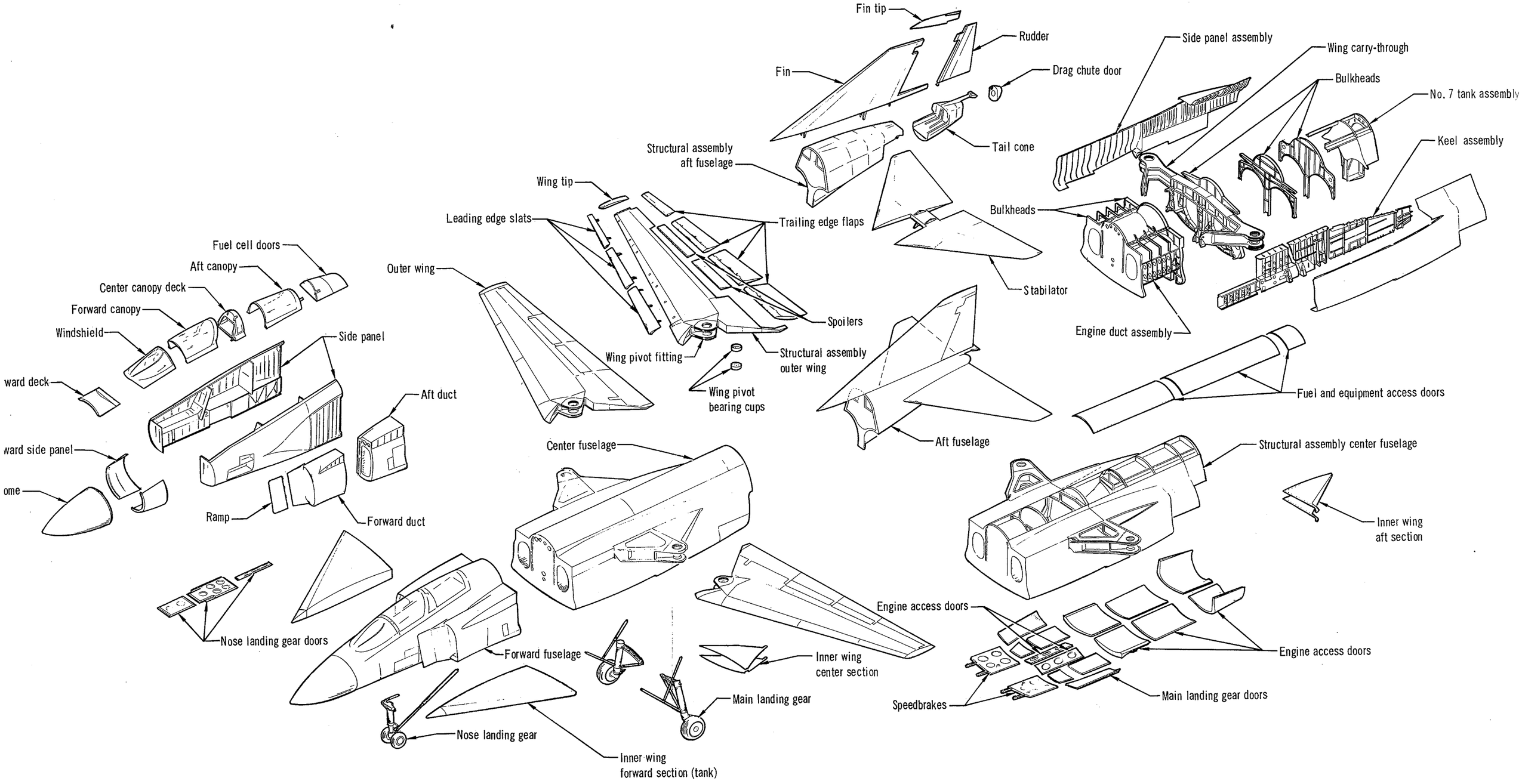


Figure 8.1



F-4 (FVS) Manufacturing Breakdown

Figure 8.2

In addition to providing thrust, the engine supplies power to operate the electrical and hydraulic systems through directly driven accessory pads located at the side of the engine. The engine also supplies pressurized air for pneumatic power which is bled directly from the high pressure compressor and delivered to the environmental control systems. The propulsion system, in turn, utilizes this hydraulic, electric, and pneumatic power for operation of various subsystems and components including inlet control systems, fuel system components, pressurization and vent systems, and various controls associated with the engine proper.

8.1.3 Hydraulics and Pneumatics

The aircraft has three completely independent hydraulic systems, powered by 3000 psi variable delivery engine-driven hydraulic pumps. Two of the systems, Power Control No. 1 and Power Control No. 2, provide power for the wing sweep, ailerons, spoilers, and stabilator. The third system, designated the utility hydraulic system, supplies hydraulic power to the rudder, landing gear, high lift devices, speedbrakes, propulsion system, and all other hydraulically operated devices.

The aircraft incorporates a single, high pressure, 3000 psi, self-sustained pneumatic system to provide air to the normal and emergency systems. Air pressure is maintained by a hydraulic-driven air compressor. The normal actuating systems are the canopies and nose gear extension for catapulting. The emergency actuating systems are the canopies, landing gear, wheel brakes, flaps and slats, cockpit flooding doors, and radar stowage. Pressurization is also supplied to electronic equipment.

8.1.4 Electrical System

The electrical power system consists of a Main Power Supply System, Emergency Power Supply System, and Power Conversion and Distribution System. The Main Power Supply System is the primary source of electrical power, which is developed by two engine-driven alternating current generators. An emergency generator is provided to produce electric power for the essential aircraft systems in the event of a main electrical system failure. DC power is provided by two transformer-rectifiers. The aircraft electrical system provides electric power to avionics and ordnance subsystems and to the aircraft propulsion, flight controls, landing gear, environmental control, safety and survival, and instrument systems.

8.1.5 Flight Controls

Primary and secondary flight controls are provided. The primary flight controls are hydraulically powered. Ailerons, spoilers, stabilator, and rudder are controlled via the mechanical control system by either the pilot or autopilot or both, and electrically operated trim systems. The secondary flight controls consist of electrically controlled, hydraulic powered speed brakes, leading edge slats and double slotted trailing edge flaps. Electric motors are provided for emergency operation of the leading and trailing edge flaps in the event of a hydraulic system failure. Double slotted trailing edge flaps and leading edge slats are additional design features provided to improve the carrier suitability and flying qualities of the aircraft.

8.1.6 Landing Gear

The tricycle landing gear consists of electrically controlled and hydraulically operated main gear which incorporates hydraulically operated wheel brakes; and nose gear which incorporates nose wheel steering and nose gear catapult launch capability. An arresting hook is provided for carrier based operations and a drag chute for land based operations. The nose gear is extendible to provide improved catapult takeoff characteristics. A landing gear with longer stroke provides for the increased landing gross weight. Pneumatic power is provided for emergency operation of the landing gear and wheel brakes.

8.1.7 Environmental Control

This system controls the environment of the cabin and electronic equipment by the use of separate refrigeration systems. The cabin system uses a "bootstrap" air cycle refrigeration package to provide cabin pressurization and conditioning, pressure suit pressurization and conditioning, windshield defogging and defrosting, and windshield rain removal. The equipment system uses a simple air cycle refrigeration package to provide electronic equipment pressurization and conditioning, fuel tank pressurization, anti-g suit pressure, canopy seal pressure, and air flow to the CADC and the high pressure pneumatic source.

Bleed air for both systems is taken from the 17th stage of the two J79-10 engines. A small amount of electrical power is needed by both systems to provide power for control system and warning lights.

8.1.8 Instrument Systems

Flight, navigation, power plant, fuel indicating, position indicating, and miscellaneous instruments and instrument systems are provided in the F-4(FVS).

The pilot's cockpit contains all the instruments and panels essential for flight and normal mission deployment. The radar intercept officer's cockpit contains duplicates of the instruments required for navigation, plus radar warning and homing and inertial navigation indicators and controls, and the radar controls used during all-weather and night interceptor operation. The pitot-static system senses and delivers impact and atmospheric pressures to the instruments and instrument systems requiring these pressures. Electric power required for operation of instruments and instrument systems is provided by the airframe electrical system.

8.1.9 Safety and Survival Subsystem

The safety and survival subsystem includes three sets of equipment which provide life support for the crew during normal flight and escape in emergency situations. All of the equipment in this subsystem is either operational now in the F-4B or is scheduled for early incorporation, and should be available "off-the-shelf" for the F-4(FVS). Human engineering practices, as specified in MIL-H-22174, are complied with in the same manner as the F-4B, including improvements now planned for the F-4B/J.

The oxygen equipment converts liquid oxygen to gaseous and supplies breathing oxygen to the crewmen in pressure suits or in A13A masks, and in the event of cabin pressurization system failure, the oxygen system maintains pressure suit pressurization.

The survival kit (which provides a connection for the suit ventilating air, anti-g pressure, oxygen, and communications) maintains emergency oxygen for breathing during descent from high altitude after ejection or when a failure of the aircraft oxygen system occurs. The kit maintains full pressure suit pressurization at high altitude after ejection or when cockpit pressurization is lost. The kit also provides equipment for survival after ditching or ejection.

The ejection seats provide seating and restraint, and a means of safe efficient escape at practically all altitudes and speeds.

8.2 AVIONICS

The most sophisticated of the F-4(FVS) electronic systems is the AN/AWG-10(MOD) Airborne Weapon Control System (AWCS). As shown by the detail block diagram in Section 7, the AWCS has inputs to and outputs from the majority of the other systems.

Among the inputs to the AWCS are attitude and velocity from the Inertial Navigation Digital Bombing System for air-to-air weapon delivery, for space stabilization of the radar antenna, and for filtering of radar clutter. The Central Air Data Computer supplies altitude and true air speed information so that the AWCS correctly sets the autopilot gain of the AIM-7E/F Sparrow missiles and computes the optimum attack steering commands. The primary inputs to the AWCS from the Communication, Navigation, Identification and the Radar Warning and Homing Set are display signals which are presented on the Pilot's and Radar Intercept Officer's radar indicators. Data link commands to vector the F-4(FVS) to a proper attack position, as well as to direct its subsequent actions, for both air-to-air and air-to-ground weapon delivery are inputs to the AWCS from the Digital Data Link (AN/ASW-27). In addition, symbolic identification of airborne targets displayed on the radar indicators as either friend or foe is made by the air-to-air IFF equipment of the CNI. Homing signals to direct the F-4(FVS) toward threats detected by the Radar Warning and Homing Set are also displayed on the AWCS radar indicators. The AWCS is to have data handling capabilities for up to six missiles in flight simultaneously.

Outputs from the AWCS are sent to the Lead Computing Optical Sight Set (target range for lead computed air-to-air gunnery); to the Inertial Navigation Digital Bombing System (doppler-derived ground speed); to the Data Link (attack status); to the Radar Warning and Homing Set (pulse blanking); and to the Armament Control System (air-to-air and air-to-ground weapon preparation and launch signals).

The CADC output of pressure altitude is supplied the Inertial Navigation System and the Automatic Flight Control System (autopilot), for weapon ballistics computation and altitude hold, respectively.

8.2.1 Airborne Weapon Control System

To obtain a multiple target capability, the AWG-10 analog computer is replaced by a digital computer to provide the required increase in computing capacity. Computations are included for air-to-air missile control, data link, message processing, radar and Track-While-Scan mode. The Radar Intercept Officer is provided with a small range-rate vs. azimuth indicator, a large range vs. azimuth display tube, and computer-generated synthetic displays for complete attack information. A new (terminal illuminate) antenna is added immediately below the AWG-10 antenna to provide guidance at a high data rate for up to two missiles during their terminal flight period.

8.2.2 Central Air Data Computer

The Air Data Computer Set consists of new microminiaturized electronics and the remote transmitters which sense angle-of-attack, air temperature, and pitot and static pressures. Based on these inputs, the computer generates analog signals of mach number, altitude, corrected static pressure, true air speed, total temperature, and impact pressure. These parameters are used by the Airborne Weapon Control System, Automatic Flight Control System, Manual Control System, Inertial Navigation/Digital Bombing System, Variable Inlet Duct Ramp System, and the Bypass Bellmouth System.

8.2.3 Lead Computing Optical Sight System

The AN/ASG-22 (MOD) Lead Computing Optical Sight significantly increases the effectiveness of the F-4(FVS) in both air-to-air and air-to-ground missions. The lead-computed air-to-air gunnery mode allows visual-identification attacks at short ranges. In addition, the drift stabilization of the sight (coupled with a continuous weapon release computation) results in a very accurate visual attack capability against ground targets.

8.2.4 Inertial Navigation/Digital Bombing System

The F-4(FVS) avionics system adds an Inertial Navigation/Digital Bombing System, a precision, self-contained bombing navigation system of high accuracy. It operates virtually independent of external inputs to continuously define the present position, attitude, orientation, and direction of motion of the aircraft. Primary inputs to the inertial system occur at the time of initial alignment. For simple ground-based alignment, base location latitude and longitude are manually inserted. The system is capable of realizing the advantages offered by the "Insertion" alignment method. Air-to-ground continuously computed delivery of conventional and nuclear weapons is provided.

8.2.5 Automatic Flight Control System

The Automatic Flight Control System provides stability augmentation and automatic flight control. It features automatic synchronization which makes Automatic Flight Control System engagement possible at any time without severe transients. It also interfaces with the Data Link system so that pitch, roll, and heading commands received from a ground base or aircraft carrier may be utilized by the Automatic Flight Control System. These commands include automatic carrier landing, target vectoring, and return to aircraft carrier.

8.2.6 Radar Warning and Homing

A Radar Warning and Homing Set has been added which provides detection, audio and visual warning, identification, and steering signals to home on any airborne or ground-based pulse or CW radar within frequencies encompassing a major portion of S-band, as well as C-band and X-band. S-, C-, and X-band azimuth coverage is continuous throughout 360°. S-, C-, and X-band elevation coverage of $\pm$ 35° is provided about the aircraft horizontal.

8.2.7 Heading and Attitude Reference Set

The Heading And Attitude Reference Set provides an all-attitude flight reference and indicating system. It furnishes back-up attitude information to the AFCS, Flight Director Group, Inertial Navigation/Digital Bombing System, and the AWG-10 Airborne Weapon Control System.

8.2.8 Communications, Navigation, Identification Group (CNI)

A miniaturized CNI system with the same basic functions as the present F-4J CNI group are provided in the F-4(FVS). The system consists of individual communications, navigation, and identification equipment with self-contained power supplies, improved performance, reliability, and reduced weight and power requirements. Secure UHF communications and TACAN equipment capabilities have been expanded, and altitude reporting and IFF crypto-computer provisions added to the functions of the air-to-ground IFF system. An air-to-air Mk XII IFF system capable of working in conjunction with the normal airborne air-to-ground IFF and AI radar provides positive identification of friendly aircraft during an air-intercept mission.

The AN/ASW-27 microminiature Data Link provides the normal functions of a two-way time division data link system, single target vector, traffic control, and automatic carrier landing. It also processes multi-target data for the AWG-10 computer and precision course direction for automatic data link bombing. Size, weight, and power requirements of the system have been greatly reduced by microminiaturization, consolidation of couplers and adapters, and the use of the AWG-10 digital computer for the required computations.

8.3 ARMAMENT

The F-4(FVS) armament system is based on minimum system change in order to take advantage of prior F-4 model development work. Limited development work will be required to establish the addition of the MAU-9 A/A pylon capabilities and to insure that the new suspension hardware will meet the F-4(FVS) mission requirements. Suspension and delivery of weapons are provided at nine armament stations, as shown in Figure 8.3.

8.3.1 Pylons

Stations 1 and 9 utilize swivelling pylons, which maintain correct orientation during wing sweep. The pylon with an integral mounted MAU-9 A/A ejector bomb rack will have capability for conventional and special weapons. Necessary electrical connections for weapon arming and release functions are contained in the pylon. These stations will also have Sparrow III and Sidewinder air-to-air missile capabilities with the addition of the appropriate launchers.

Stations 2 and 8 will use fixed position jettisonable pylons on the fixed portion of the wing. Pylons for these stations will be fuel tank pylons with adapters provided to carry MER racks for conventional weapons.

8.3.2 Bomb Racks

Bomb racks are provided at outboard wing stations and at the centerline station for the delivery of both conventional and special weapons, and to carry the required multiple racks (MER's and TER's).

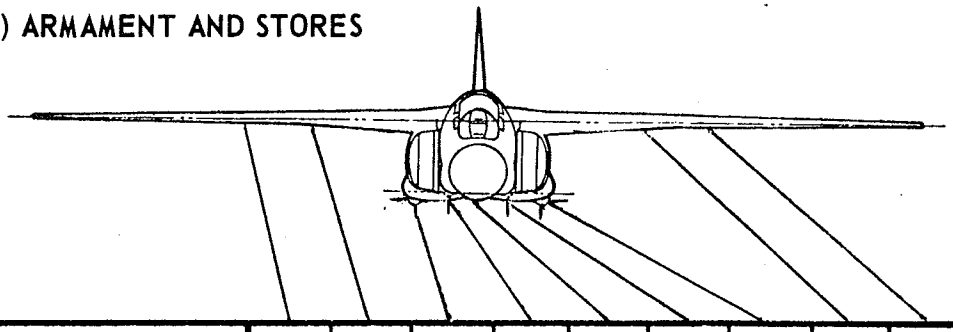
The outboard wing stations employ the MAU-9A/A ejector bomb rack, which is capable of ejecting stores weighing 200 to 4500 pounds. It incorporates both 14 and 30 inch suspension. Store ejection and hook release are accomplished by a dual cartridge-operated gas system. An adapter replaces the fuel tank on the inboard pylon to carry MER's for conventional weapons.

The Aero 27A ejector bomb rack is provided at the centerline station. The rack is mounted submerged into the airplane fuselage. Sway bracing is provided as part of the airplane structure. The Aero 27A has 14 and 30 inch suspension and incorporates a dual cartridge-operated gas ejection and release system.

8.3.3 Multiple Ejector Racks

Multiple carriage of conventional weapons is provided by the Multiple Ejector Rack (MER) which has a six store capability, and the Triple Ejector Rack (TER) which has a three store capability. The MER's are suspended from an adaptor to the tank pylon at the inboard wing stations and from a centerline multiple weapons adapter which is suspended from the Aero 27A bomb rack at the centerline station. The TER's are suspended from the MAU-9A/A bomb racks at the outboard wing stations.

F-4(FVS) ARMAMENT AND STORES



STORE	9	8	7	6	5	4	3	2	1
	BL 152.4	BL 91.2			℄			BL 91.2	BL 152.4
MK4 GUN POD					1				
MK81 LOW DRAG BOMB	3 (6*)	6			6			6	3 (6*)
MK82 LOW DRAG BOMB	3 (6*)	6			6			6	3 (6*)
MK83 LOW DRAG BOMB	1 (3*)	3			3			3	1 (3*)
LAU-3A/A	3	3			3			3	3
LAU 10A	3	3			3			3	3
SIDEWINDER AIM-9B/D	2								2
SPARROW III AIM-7D/E/F/F (MOD.)	1		1	1		1	1		1
MK28 MOD 0					1				
MK28 MOD 1(EX)					1				
MK43 MOD 0&1					1				
MK 57 MOD 0	1				1				1
A/A-37B-3 PRACTICE MULTIPLE BOMB RACK	1				1				1
CP-5 STARTER POD					1				
D704 REFUELING STORE					1				
600 GAL. TANK		1			1			1	

Note: This chart is intended to show physical compatibility for each listed store at that station. It does not imply that the maximum loading shown is possible. Any given combination of weights and stores requires compatibility within weight and balance limits of the airplane. Final compatibilities must be verified through flight tests.

*Alternate loadings using MER instead of TER at stations 1 and 9, resulting in catapult gross weights up to 72,475 pounds with:

(a) Increased wind-over-deck up to 17 knots with C-13, 29 knots with C-7 catapults.

Figure 8.10

The MER and TER racks consist of a supporting beam to which are attached six ejector units in the case of the MER or three ejector units in the case of the TER. The ejector units are single cartridge-operated ejector bomb racks which have 14 inch suspension lugs and sway braces. Each MER and TER contains a stepper switch which sequences the release of the stores from the ejector unit. Electrical provisions for firing of rocket packages and CBU dispensers are provided at each store position. Store arming provisions are also supplied at each ejector unit.

8.3.4 Launchers

Launchers are provided for delivery of air-to-air missiles. Four Aero 7A ejector launchers, used only for delivery of the Sparrow missiles, are semi-submerged in the aircraft at the fuselage missile stations (stations 3, 4, 6, and 7). The launcher consists of the missile attach mechanism, and missile motor fire plugs. The ejection system is a dual cartridge-operated gas system. Ejection force exerted by the pistons is controlled by orifices in the gas system.

Sparrow missile capability is provided at the outboard wing stations by installing launchers on or in place of the MAU-9A/A bomb rack. The pylon contains the necessary electronic components, such as the Klystron tuner. As noted earlier, this launcher contains the missile umbilical attack mechanism and motor fire connection.

Sidewinder missiles are launched from LAU-7A missile launchers which are mounted to the pylon. The LAU-7A launcher consists of a housing which contains a launching rail, umbilical release mechanism, power supply, motor fire detent, cooling gas supply, and the necessary electrical harnesses.

8.3.5 Conventional and Special Weapons

Conventional weapons are single-carried directly from the armament pylon bomb racks or multiple-carried from the MER and TER racks suspended from the pylon and/or centerline bomb racks. General Purpose, Rocket Package, Fire Bomb, Dispenser Munition, and special purpose conventional weapons are carried.

Special weapons are single-carried at the outboard wing stations and the centerline station. Both retarded and free fall type weapons are compatible with these stations.

8.3.6 Air-to-Air Missiles

The Advanced Sparrows (AIM-7F) and (AIM-7F MOD) are semi-active radar guided, supersonic air-to-air, boost-sustained missiles designed to be rail or ejection launched from the F-4 aircraft. The tactical mission of the missile when used as an integral part of the F-4 weapons system is to intercept and destroy enemy aircraft in all-weather conditions. The Advanced Sparrows (AIM-7F) and (AIM-7F MOD) are physically the same as the (AIM-7E) (145 inches long, 8 inches in diameter, 40-inch wing span) except that the Advanced Sparrow weighs approximately 510 pounds.

Design and operation of the Advanced Sparrow are basically similar to the AIM-7E (Sparrow III-6b) with the following additional features:

(a) Solid state design and repackaging.
(b) Pulse doppler (PD) and Continuous Wave (CW) illumination compatibility.
(c) Improved performance of the semi-active seeker, warhead, and motor.
(d) Improved Electronic Counter Countermeasures (ECCM) and fuzing capabilities.
(e) Improved multiple target capability.

SECTION 9

ASSOCIATED SYSTEM CHARACTERISTICS

9.0 GENERAL

Associated systems that interface with the F-4(FVS) are briefly described in this section. The associated systems, indicated by the overall block diagram in Section 7, consist of the various tactical data systems and the aircraft carrier, with its impact on aircraft suitability, logistics, maintenance, and AGE requirements.

9.1 PHYSICALLY ASSOCIATED SYSTEMS

The F-4(FVS) configuration represents a design change from the basic F-4J aircraft that will provide for increased carrier suitability. Shipboard catapult launch and arresting performance will be optimized by use of lower wing sweep angles and high-lift devices, resulting in low takeoff and approach velocities and low wind-over-deck values. The F-4(FVS) will therefore be capable of operating from CVA-19 class carriers equipped with C-11 catapult equipment and MK7, MOD 2-3 (SD) arresting gear. The aircraft will be operable with the MK7-2 barricade, and will be fully compatible with the carrier optical landing system. The provision of an Approach Power Compensator and Automatic Carrier Landing mode will make possible a fully automatic carrier landing approach for the aircraft down to approach minimums.

In the wings swept aft configuration, the F-4(FVS) will readily spot on and off CVA-19 deck edge elevators at hangar and flight deck levels with a minimum of 12 inches clearance in the horizontal plane. Nose gear tow and wheel tread width will be compatible with C-11 and improved catapults. The wheel brake system will be capable of adequate braking for deck handling without engine operation or external power package.

9.2 FUNCTIONALLY ASSOCIATED SYSTEMS

The Tactical Data Systems will utilize time division data link for exchange of command and control information with the F4(FVS). The control terminal subsystems will transmit data for direct display on the pilot's indicators. The terminal equipment used for the ATDS and MTDS consists of the AN/ASW-14 control set. The NTDS shipboard control center uses the AN/SSW-1 terminal data link set. The data link to be installed in the F-4(FVS) is the AN/ASW-27, which is a two-way, multi-target, microminiature set that will replace the AN/ASW-21 presently operational in the F-4G. The AN/ASW-27 system provides fully automatic flight control functions for automatic flight control functions for automatic carrier landings, wave-off and transmission control, return to base, target designation, and vectoring control. Additional functions include multi-target data processing for the multi-shot AWG-10 computer and Precision Course Direction for automatic data link bombing under control of the Marine AN/TPQ-10 system. The AN/ASW-27 will be fully compatible with the present control systems, as well as the new generation of control centers such as the Tactical Automatic Control System (TACS), NATO Air Defense Ground Environment (NADGE), and Japanese Air Defense Ground environment (BADGE).

SECTION 10

RELIABILITY AND MAINTAINABILITY PLAN

10.1 Reliability Assurance

10.1.1 Technical Requirements

10.1.1.1 Reliability (Design Goal) Requirements

The probability of successfully completing a basic Combat Air Patrol mission of 2.88 hour duration shall be 0.91 exclusive of the GFAE defined in Appendix 1 (MCL) of the F-4(FVS) Detail Specification SD-513-2.

10.1.1.2 Reliability Qualification Tests

Reliability qualification testing of new avionics equipments, both GFAE and CFE, shall be to MIL-STD-781A, Reliability Tests Exponential Distribution, Test Level "E", Test Plan III or V. Test Plan III is required for specified MTBF's up to 2000 hours and Test Plan V for specified MTBF's of 2000 hours or more. However, should any of CFE fail to meet the accept criteria as specified, this shall not abridge the acceptability of the Integrated Aircraft Weapon System if weapon system demonstration requirements are met.

10.1.1.3 Environmental Conditions

Environmental criteria for the F-4 electronic equipment have been established and documented by McDonnell Aircraft Corporation in MAC Report 8738. Additional environmental studies will be required to determine the effects, if any, of changes to the F-4(FVS) airframe and flight characteristics. For non-electronic equipment the environmental criteria shall be in accordance with applicable government specifications and are set forth in each equipment Specification Control Drawing (SCD).

10.1.2 Reliability Program Plan

10.1.2.1 Program Objective

A Reliability Plan shall be required from the Aircraft Contractor and each principal GFAE supplier developing new equipments. These plans shall be in accordance with paragraph 4.1 of MIL-STD-785, Requirements for Reliability Program, and shall assure adequate reliability consideration throughout all aspects of the design, development and production phases as necessary to meet the specified reliability requirements. The extent to which the various elements of MIL-STD-785 apply to each equipment shall be individually determined such that an effective and economical program is provided. The primary program objective is to assure retention of the achieved reliability in those common F-4 equipments while improving those equipments being materially changed or added. The suppliers of GFAE and the Airframe Contractor shall conduct similar type programs to assure attainment of allocated numerical requirements.

10.1.2.2 Applicable Documents

The Contractor shall use the following list of reliability documents as a guide in formulating the reliability program and shall determine the extent to which these apply to each equipment procurement.

MIL-STD-785	Requirements for Reliability Program
MIL-STD-721	Definition of Terms for Reliability Engineering
MIL-STD-756A	Reliability Prediction
MIL-HDBK-217A	Reliability Stress and Failure Rate Data for Electronic Equipment
MIL-STD-757	Reliability Evaluation from Demonstration Data
MIL-STD-781A	Reliability Tests Exponential Distribution

10.1.2.3 Major Reliability Program Elements

10.1.2.3.1 Predictions

Predictions shall be required of all suppliers of new equipment with periodic updating of the prediction analysis to reflect design effort and relate development progress to the established requirement. Copies of all predictions on GFAE equipments shall be provided to the Aircraft Contractor for incorporating in the Mission Success Probability Model. MIL-HDBK-217A shall be used as a guide in making predictions for electronic equipments. Other appropriate failure rates information, such as laboratory tests, field tests, etc., may be used when properly identified.

10.1.2.3.2 Mission Success Probability Model

A Mission Success Probability Model shall be required of the aircraft contractor and principal GFAE major subsystem contractors. These models shall be prepared in accordance with MIL-STD-756 "Reliability Predictions" and MIL-STD-757 "Reliability Evaluation from Demonstration Data". These models shall reflect the results of the most recent subsystems predictions and shall be updated at periodic intervals throughout the development program.

10.1.2.3.3 Malfunction and Failure Reporting, Analysis, and Corrective Action

The Aircraft Contractor and each principal GFAE supplier shall establish an effective monitoring program starting with the manufacturing of the first preproduction article. Primary emphasis shall be placed on analyses of all malfunctions and failures early in the program for application of effective corrective action to improve equipment performance and reliability where deficient. Malfunction and failure reporting procedures shall be established that are compatible with the SNMMMS (Standard Navy Maintenance and Material Management System) so that the magnetic tapes that are periodically available from NATSF can be utilized. Procedures and criteria shall be established to provide a periodic "critical items list" as a standard machine output. This process shall be expanded during production to include a Unified Electronic Data Processing procedure (UEDP) that will provide malfunction and failure summaries for supplier and contractor laboratory testing, aircraft flight testing and Navy operational experience.

10.1.2.4 Specification Review and Approval

Quantitative reliability, service life, elapsed time meter, environmental design and reliability test requirements for each new electronic or functional equipment shall be included in the procurement specification. Where reliability testing to MIL-STD-781A is required, the specified MTBF along with the minimum acceptable shall be provided. To assure that proper emphasis is given to reliability considerations, all GFAE procurement specifications shall be reviewed and receive the approval of the reliability engineering section.

10.2 MAINTAINABILITY ASSURANCE

10.2.1 Maintainability Assurance Plan

Maintainability assurance has been implemented during the FVS study phase and will be continued during the Design, Development and Operational Phases. The activities of these phases will interlock to provide a continuous, coordinated maintainability assurance program. Within each phase, the maintainability assurance program for the F-4(FVS) will be a continuation of the maintainability programs conducted for previous F-4 models except as modified by Addendum Y dated 10 August 1966 to Specification WR-30, "Integrated Maintenance Management for Aeronautical Weapons, Weapon Systems, Related Equipment' dated 1 May 1963. The events of the maintainability plan are as outlined in Figure 10.1. Revisions to Figure 10-5 of the TDP guide are shown in heavy outline for added functions and shaded blocks for deleted functions. These revisions are based on previous F-4 experience.

10.2.1.1 F-4(FVS) Study Phase - The major events accomplished have included the following:

(a) Establishment of the desired maintenance philosophy.

(b) Establishment of Preliminary Maintainability Requirements and Objectives.

(c) Preliminary design review to insure compatibility of the equipment designed with the desired maintenance philosophy and with anticipated maintenance task requirements.

(d) Review of available F-4 and other current aircraft maintenance data to identify any existing maintenance problem areas as candidates for special maintainability design effort. These areas have been investigated and will be eliminated or minimized wherever practical.

(e) Preparation of Addendum Y to WR-30 from which an Integrated Maintenance Management Plan for the F-4(FVS) Weapon System will be prepared.

(f) Preparation of Maintainability and Reliability Demonstration Plan.

[redacted]

Events in a Maintainability Plan

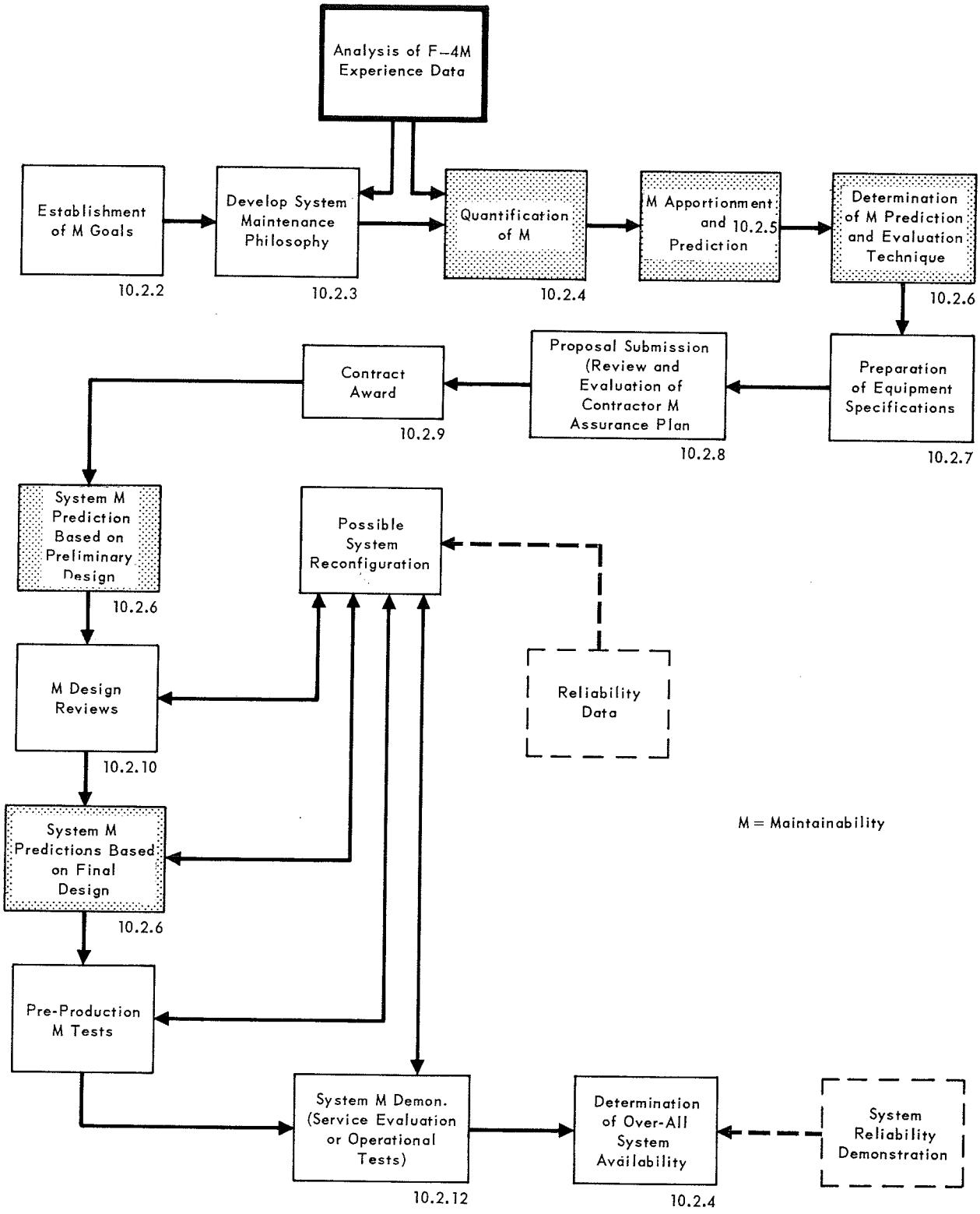


Figure 10.1

10.2.1.2 Design and Development Phase - The Naval Air Systems Command will implement a joint maintainability assurance program with the contractor after an award of a development contract. This will be a continuation and expansion of the maintainability effort begun during the study phase. Emphasis will be placed on achievement of optimum maintainability compatible with other tradeoff requirements for redesigned subsystems incorporated in the weapon system. This will include examination of the interface of the subsystems, as defined in Section 8, and of the weapon system with physically and functionally associated systems, as defined in Section 9 of this TDP. The major events of the Design and Development Phase will include:

(a) Preparation of preliminary Maintenance Engineering Analysis for new or redesigned subsystems. The preliminary maintenance philosophy for each subsystem will be refined and expanded to a depth sufficient to provide a sound basis for decisions affecting personnel, training, support equipment, technical data, spares, and facilities requirements.

(b) Maintainability Design Reviews and tradeoff studies will be accomplished by the contractor as required. The equipment design will be examined for compatibility with the maintenance philosophies and maintainability characteristics established for each subsystem and for the weapon system.

(c) Preparation of formal Maintenance Engineering Analysis. The contractor will prepare and submit MEARs in accordance with Addendum Y to Specification WR-30.

(d) Navy review and approval of Maintenance Engineering Analysis.

10.2.1.3 Operational Phase - The contractor will collect and analyze maintenance data as specified in Addendum Y to WR-30. This data will be periodically reviewed to evaluate equipment maintainability characteristics. Where appropriate, action such as the submission of Engineering Change Proposals will be taken to provide improvement.

10.2.2 Quantitative Maintainability Requirements and Objectives

Appropriate quantitative maintainability requirements and objectives have been established. The total direct MMH/FH goal has been established as 19.6 for Organizational and Intermediate levels of maintenance. This includes 2.7 MMH/FH for GFAE engines and 4.2 for the remainder of GFAE. These goals are established for the F-4(FVS) aircraft. These figures were derived from F-4B systems which are common to the F-4(FVS), and comparative analysis with like or similar systems for new or redesigned systems. Apportionment has been made of maintainability requirements between CFE and GFE systems.

10.2.3 Maintenance Philosophy

The overall maintenance philosophy for the F-4(FVS) Weapon System is a composite of the subsystem maintenance philosophy described below. These basic maintenance philosophies will provide guidelines for all subsequent support planning.

10.2.3.1 Airframe and Propulsion Systems and Components

(a) Planned maintenance levels. The maintenance level (Organizational, Intermediate, or Depot) at which each task is to be performed will be as specified in BUWEPSINST 4700.2, "The Naval Aircraft Maintenance Program." The tasks to be performed are basically the same type as required for previous F-4 models. Unusual or unfamiliar tasks will not be required.

(b) Support equipment requirements. Maximum use will be made of existing Standard and Special F/RF-4 support equipment. The plan to determine the requirements for new or modified support equipment resulting from aircraft configuration changes are defined in Section 11 of this plan.

(c) Technical data requirements. Inspection Work Cards and Maintenance Manuals will confirm to applicable technical data specifications. Logic-tree troubleshooting charts will be provided where these would be a significant maintenance aid.

(d) Spares and logistics requirements. Requirements for spare parts and assemblies to be provided at appropriate maintenance levels will be determined from Navy-approved MEARs.

(e) Special skills requirements. No new or special skills will be required for Organizational or Intermediate level maintenance of the F-4(FVS) airframe and propulsion systems. At Depot level, the special skills required are common to previous F-4 models.

(f) Facilities requirements. Maintenance facilities for the F-4(FVS) airframe and propulsion systems will be equivalent to those required for previous F-4 models, except for additional space requirements described in Section 11 of this plan.

10.2.3.2 Avionics

(a) Planned maintenance levels. The maintenance level at which each task is to be performed will be as specified in BUWEPSINST 4700.2. The basic maintenance philosophy is fault isolation through scheduled maintenance vice non-scheduled maintenance. Repair of repairables will be made at the lowest practical level of maintenance. WRA's which are found defective at Organizational level will be verified and repaired at Intermediate level or returned to Depot level or otherwise disposed of as determined by the Maintenance Engineering Analysis. All new avionics design will be compatible with VAST. Existing avionics may be adapted to VAST whenever a trade-off study indicates a favorable solution.

(b) Self-contained maintenance aids. Provisions for self-test will be incorporated wherever practical in the design of new subsystems and in the aircraft interface. Emphasis will be placed on preflight and inflight "go-no-go" confidence checks.

(A)

(c) Support equipment requirements. Maximum use will be made of existing support equipment for subsystems which are common with previous F-4 models. Requirements for Intermediate and Depot support equipment for all new subsystems and where practical for existing subsystems, will be significantly reduced through compatibility with VAST. Requirements for new support equipment are defined in Section 11.

(d) Technical data requirements. Maintenance manuals containing checkout instructions, troubleshooting logic-trees, and simplified functional-loop schematics (including systems integration) will be required at Organizational level. For Intermediate and Depot levels, existing maintenance manuals will be revised as necessary for existing and/or modified subsystems and support equipment. New maintenance manuals will be required at Intermediate and Depot levels for new subsystems and support equipment.

(e) Spares and logistics requirements. Requirements for spare parts and/or assemblies to be provided at the appropriate maintenance levels will be determined from Navy approved Maintenance Engineering Analysis. Economic repair by subassembly replacement at Intermediate level will be a design goal for redesigned subsystems.

(f) Special skills requirements. Special skills may be required at Intermediate and Depot levels for the repair of assemblies containing microelectronic integrated or thin film circuits and precision electromechanical subassemblies (see Section 13). The special skills required in this area for the F-4(FVS) will be the same as those required for other aircraft using this type equipment.

10.2.4 Qualification of Maintainability

Requirements of this paragraph dealing with MTBF-MTTR trade-offs to preserve a specified availability value are not applicable since F-4(FVS) Reliability and Maintainability requirements are expressed as probability of mission success and MMH/FH, respectively.

10.2.5 Maintainability Apportionment

Apportionment of maintainability allocations to lower order elements of the system will be accomplished by the contractor to provide a means of measurement and control of the overall aircraft MMH/FH throughout design and development. The overall aircraft MMH/FH will be guaranteed as specified in MAC Report E-791.

10.2.6 Determination of Maintainability Prediction and Evaluation Technique

Determination of a maintainability prediction and evaluation technique will not be required since much of the experience data from previous F-4 programs is applicable to the F-4(FVS). Cost of a formal prediction and evaluation program as defined in MIL-M-23313A (SHIPS) or MIL-S-23603 is therefore not considered justified.

(A)

10.2.7 Preparation of Equipment Specifications

Maintainability plans and procedures for the overall weapon system will be contained in the Maintainability Program Plan which will be based on requirements set forth in Addendum Y to WR-30. Maintainability and Reliability requirements and demonstration plans and procedures are defined in MAC Report E-791. Equipment specifications prepared by the contractor for equipment to be supplied by sub-contractors/vendors will contain appropriate maintainability guidelines and requirements to assure compatibility with the overall weapon system maintenance philosophy, maintainability requirements, and the operational and support plans.

10.2.8 Proposal Submission and Review

The maintainability program submitted by the contractor has been reviewed jointly by the Project Manager and the Project Engineer to determine responsiveness to specifications.

10.2.9 Contract Award

The requirement to follow the maintainability plan will be included in contractual documentation.

10.2.10 System Maintainability Predictions and Design Reviews

Maintainability review will be accomplished by the contractor on a continuous basis throughout the design and development phase as an integral part of the maintainability program. Reviews will provide the means for implementing maintainability design control to assure meeting specified human factors criteria for the equipment or system and expeditious handling of changes. Formal maintainability predictions will not be required as explained in paragraph 10.2.6. The degree of maintainability achievement will be evaluated by the contractor and results will be recorded in the predicted time and resource requirements in the MEARs. Selected MEARs will be reviewed by the IMMT.

10.2.11 Scheduled Maintenance Considerations

Scheduled maintenance requirements will be given equal consideration with unscheduled requirements throughout the maintainability program. Analysis will be made of each scheduled task with particular emphasis being placed on incorporation of design features to reduce time and manpower requirements or to eliminate the need for the task. Emphasis will be placed on scheduled requirements such as the following:

(a) Turnaround time requirements.
(b) Provisions for concurrent servicing of various subsystems.
(c) Reaction time requirements.
(d) Scheduled inspection requirements and intervals.

10.2.12 System Maintainability Demonstration

A combined reliability and maintainability demonstration of the achievement of the specified requirements will be conducted. McDonnell will submit the reliability and maintainability requirements together with the plan for demonstration. Data gathered during this demonstration will be used to determine the overall system availability.

SECTION 11

OPERABILITY AND SUPPORTABILITY PLAN

11.0 General

Specific response to the Operational and Support objectives of the F-4(FVS) will follow the concepts used on current F-4 aircraft. The F-4(FVS) incorporates state-of-the-art advances in certain electronic systems as well as the introduction of additional electronic systems that are new. The experience gained on similar subsystems previously employed on other models of the F-4 aircraft and under special development projects, has provided a background for the Operability and Supportability plan that will be used for the F-4(FVS). Additional refinements of the F-4 aircraft to improve performance and armament will require minor changes in facilities, personnel quantities/skill levels, and support equipment.

The interfaces between the man and machine are shown in Figure 11.1 and are expressed to assure "operator"/"maintenance man" - machine interface to provide careful consideration for:

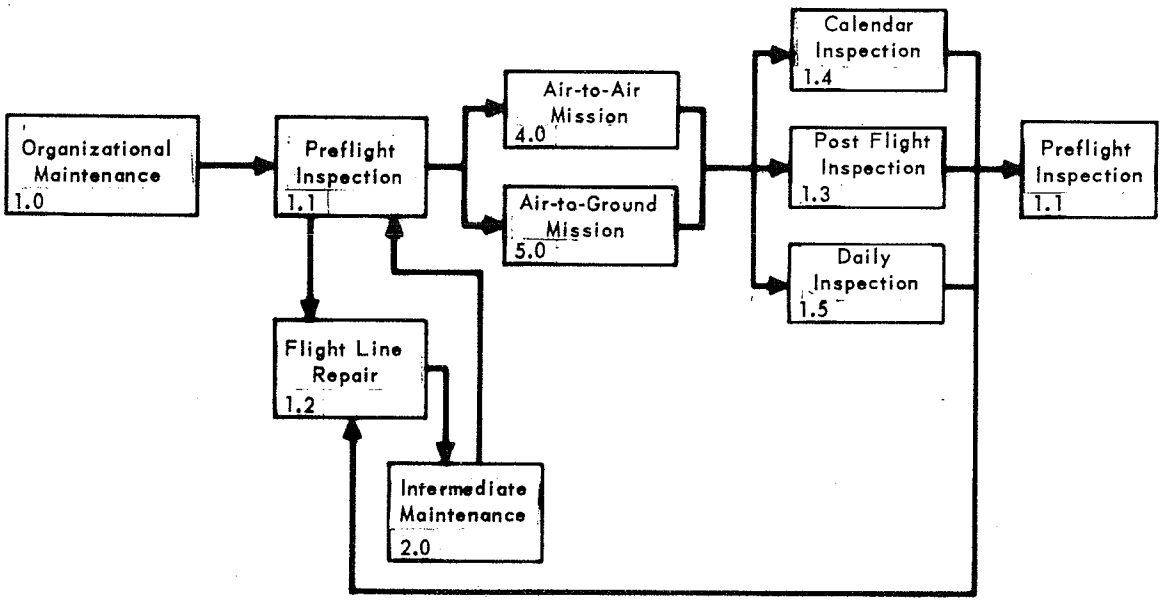
(a) capable personnel planned for weapon system operations.

(b) complete logistics support.

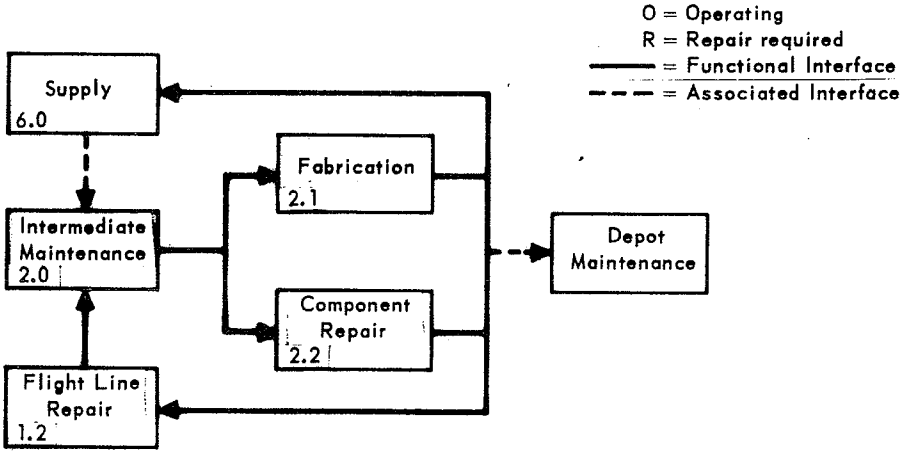
(c) testing the acceptability, feasibility, and suitability of the planned support program.

(d) suitable safety requirements.

Man-Machine Interface Functions



(a) Organizational Maintenance



(b) Intermediate Maintenance

Figure 11.1

11.1 Operability Assurance (Human Factors)

Operability of the F-4(FVS) system by Navy personnel will be considered throughout system design development and test phases. The human factors effort for the F-4(FVS) will focus on optimizing system operability. This effort will be limited to those operational and support equipment ground facilities, training programs and equipment, and operator tasks characteristic of the F-4(FVS) system which are new or different from the corresponding elements of the F-4J aircraft system.

11.1.1 Man-Machine Interface (Human Factors)

To insure that the F-4(FVS) system man-machine interface is optimized, the human factors program will include analyses of new or different functions within the F-4(FVS) system assigned to man and to machine. Included in these analyses will be the following elements:

1. Personnel Interface Points: Personnel Interface Points will be shown in relation to the overall F-4(FVS) Operational Sequence Flow Diagram.

2. Human Capability Considerations: In determining the equipment and task characteristics of the appropriate F-4(FVS) man-machine interaction points the capabilities and limitations of air and ground crew personnel will be considered in detail.

3. Human Engineering: Standard human engineering principles and procedures will be employed on a continuing basis, in the design of all new or different equipment and in the development of all new or different operator tasks incorporated within the F-4(FVS) system final design.

4. Man-Machine Performance Measurement: The acceptability and effectiveness of the man-machine interface will be monitored during the design phase of system development and will be measured as required during component, subsystem and system ground and flight testing, thus documenting and describing the man-machine performance capabilities of the F-4(FVS).

On the basis of preliminary human factors systems study, it is expected that the main emphasis of the man-machine interface studies will be on optimizing the modifications in the F-4(FVS) rear cockpit required for installing the Automatic Missile Control System, on optimizing the front cockpit changes needed to permit installation of a wing sweep control and on optimizing the support and training equipment design implications of these two significant differences between the F-4(FVS) and F-4J systems.

11.1.2 Operation Manuals

General technical manual requirements, including flight operating and airframe maintenance data, for support of the weapon system during service evaluation tests and the production phases of the weapon system program will be developed. Selection of manuals from detail recommendations against known general requirements will be accomplished during a joint services/contractor manual selection conference.

The contractor will make maximum utilization of data from existing F-4 technical publications in preparing publications to support the F-4(FVS). New basic publications will be supplied for support of the F-4(FVS) airframe systems and for F-4(FVS) peculiar support equipment and CFAE.

Additional recommendations will be provided by the contractor upon completion of provisioning actions or as determined by maintenance engineering analysis resulting from ECP actions. Preparation of technical publications will be in accordance with applicable technical manual specifications and as authorized by the Technical Manual Contract Requirement (TMCR). Manual development will be programmed to meet milestones established by the F-4(FVS) programming plan.

Adequacy and accuracy of the technical content of the publications for the F-4(FVS) test program will be monitored in accordance with a contractor prepared Publications Validation Plan. Verification to prove the adequacy of formal technical manuals for operation and maintenance of the F-4(FVS) in the operational environment will be accomplished under Navy jurisdiction. Verification of specialized manuals such as component pilot repair (CPR) or overhaul manuals will be made by the prime depot level activity. Periodic up-dating of manuals will be accomplished by the contractor to insert corrections, omissions, and newly developed material in accordance with contractual provisions.

11.1.3 Operator Training

Training requirements for F-4(FVS) aircrews will be determined as a part of the human factors program planned for this system and described briefly in paragraph 11.1.1. The principal parts of the aircrew training requirements study will involve a description of the tasks of the pilot and radar intercept officer in accomplishing their mission with the F-4(FVS) aircraft. These data will be compared with similar descriptions of the aircrew tasks in the F-4J. Such differences in aircrew tasks as are discovered in this comparison will serve as the basis for generating a new training program to develop in the pilot and radar intercept officer the skills required to perform their new or different F-4(FVS) tasks.

A preliminary study of the F-4(FVS) aircrew tasks suggests that a minimum modification in F-4J training equipment will be required to accommodate the F-4(FVS) system and that additions to the classroom training course to the technical publications and to the familiarization flight training syllabus will satisfy the needs for new F-4(FVS) operator training.

11.2 SUPPORTABILITY ASSURANCE

11.2.1 General

To assure complete and economical support of the F-4(FVS) Weapon System when introduced into the operational inventory, support program planning was initiated by the contractor prior to contract go-ahead and will be continued through all subsequent phases. Subsequent support program planning and development activity will be a coordinated Navy/contractor effort, time phased to the design, development, test, and operational programs for the weapon system. The F-4(FVS) Integrated Maintenance Management Plan, prepared in accordance with the requirements of WR-30 as applied to the F-4(FVS) by Addendum "Y", will provide the management guidelines for the planning, development, and delivery of support data and resources. The maintainability program, to insure consideration of optimum maintenance characteristics in the aircraft and its equipment, and the related maintenance analysis to identify and document support resource requirements, are described in Section 10. All support program activity will be planned to utilize, to the greatest possible extent, applicable existing information, data, and resources developed for current F-4 programs.

11.2.2 Initial Requirements

Figure a shows, by general category and type, the logistics/maintenance data which will be available during various phases of the program, its application in support program development, and resulting decision capability during the various phases. The contractor has developed support milestone schedules, properly time-phased to the master program schedule at the start of the design/development effort.

11.2.3 Assignment of Responsibilities

Considering the high degree of commonality and the similarity of the FVS support requirements with current F-4 aircraft, the established Integrated Maintenance Management Team will be chartered to manage the F-4(FVS) IMMP. Supportability planning will be a joint Navy/contractor responsibility under the cognizance of the IMMT. Initial support planning will be updated in each program phase as additional data extends the decision capability (Figure 11.2 Support Program Development vs Decision Data Availability).

Support Program Development vs Decision Data Availability

Program Phases	Maintenance/Logistics Data Available	Application	Decision Capability
Contract Definition Study Pre-Contract Study Period	F–4J SOR requirements. F/RF–4B maintenance data from Navy Data Collection System. F/RF–4B, F–4J MEAR's for proposed common systems, equipment. Contractor experience data (Field Service reports – F/RF–4B IMMT actions).	Contractor estimates gross requirements for personnel, facilities, training – identifies system, subsystem maintainability targets – identifies potential problem areas – prepares proposed IMMP, including Maintainability Assurance Plan.	Navy/contractor agreement on maintenance concept – IMMP review, revision, approval.
Design, Development, and Test	Maintainability Assurance Plan. Approved IMMP. Established maintenance concept. Gross requirements for personnel, training, etc. estimated during study effort. Common system/equipment MEAR's. Current maintenance data from Navy maintenance data collection system.	Accomplish maintainability design reviews. Prepare preliminary maintenance analysis. Establish vendor requirements. Prepare formal maintenance analysis (MEAR's) new systems. Develop plans for and start preparation of: Spares and AGE documentation. Technical publications Facilities requirements Training Test program support Contract technical services	Finalize contract requirements. IMMT guidance meetings. Navy approval of MEAR's. Navy approval of support resource plans. Maintainability verification. Technical manual verification. MEI.
Operational	Up-dated data collection. ECP requirements.	Prepare new or up-date MEAR's.	IMMT guidance. Change support plans actions if required.

Figure 11.2

11.2.4 Time-Phased Support Actions and Predictions

Time-phasing of major support program elements with relation to system development program events is shown in Figure 11.3. Figure 11.4 is a logistics PERT chart of major support events.

11.2.5 Information Flow

Since the F-4(FVS) is an extension of the current F-4 aircraft, the latter will serve as a baseline for those logistic parameters normally stated in the SOR. Predictions/measurement of logistic elements, and support planning, information flow, and detailed responsibilities are specific requirements of the IMMP prepared in accordance with WR-30 Addendum Y. This addendum also establishes requirements for maintenance analysis and other related data and support documentation. Management of the logistic support program is vested in the IMMT composed of PDA, using agency, and contractor representatives. This team provides the guidance and direction for procurement of support resources to be compatible with the Program Master Plan (PMP). As the PMP changes, the logistic support program plans are revised accordingly by the IMMT.

11.2.6 Facility Requirements

11.2.6.1 General

Introduction of the F-4(FVS) Weapon System into the operational inventory will not require extensive modifications to the existing F-4B/J maintenance facilities. Additional facilities required for maintenance of new avionics systems are minimized by use of the VAST concept for avionics maintenance. Airframe and powerplant facility requirements remain the same except for an increase in the size of dock space to accommodate the increased wing span.

11.2.6.2 Repair and Maintenance - Organizational Maintenance Facilities

The only anticipated increase in organizational maintenance facilities is a larger block dimension for parking the aircraft and an increase in the size of the hangar maintenance dock.

Parking Area Block Dimension

F-4B/J	-	45' X 45' =	2025 sq. ft.
F-4(FVS)	-	50' X 50' =	2500 sq. ft.

Hangar Maintenance Dock

F-4B/J	-	55' X 55' =	3025 sq. ft.
F-4(FVS)	-	60' X 60' =	3600 sq. ft.

11.2.6.3 Repair and Maintenance - Intermediate Maintenance Facilities

a. Airframe and Powerplant. Preliminary analysis indicates that existing F-4B/J Airframe and Powerplant maintenance facilities will provide adequate support for the F-4(FVS).

(A)

F-4(FVS) Logistics Support Checkpoint Schedule

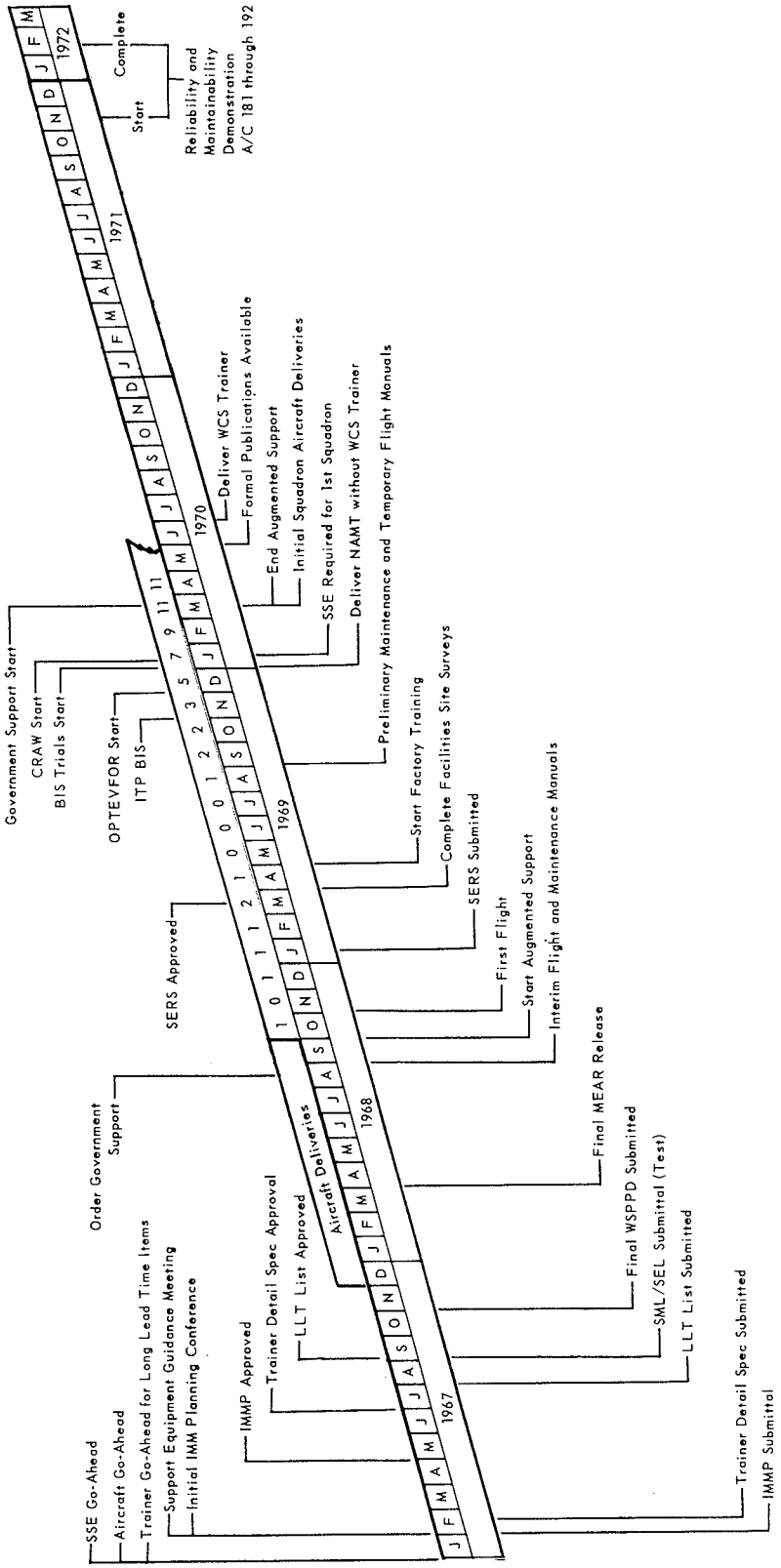


Figure 11.3

[redacted]

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SUPPLY SUPPORT
GOVERNMENT SUPPORT
SUPPLY SUPPORT
AUGMENTED SUPPORT
HUMAN FACTORS
HUMAN FACTORS
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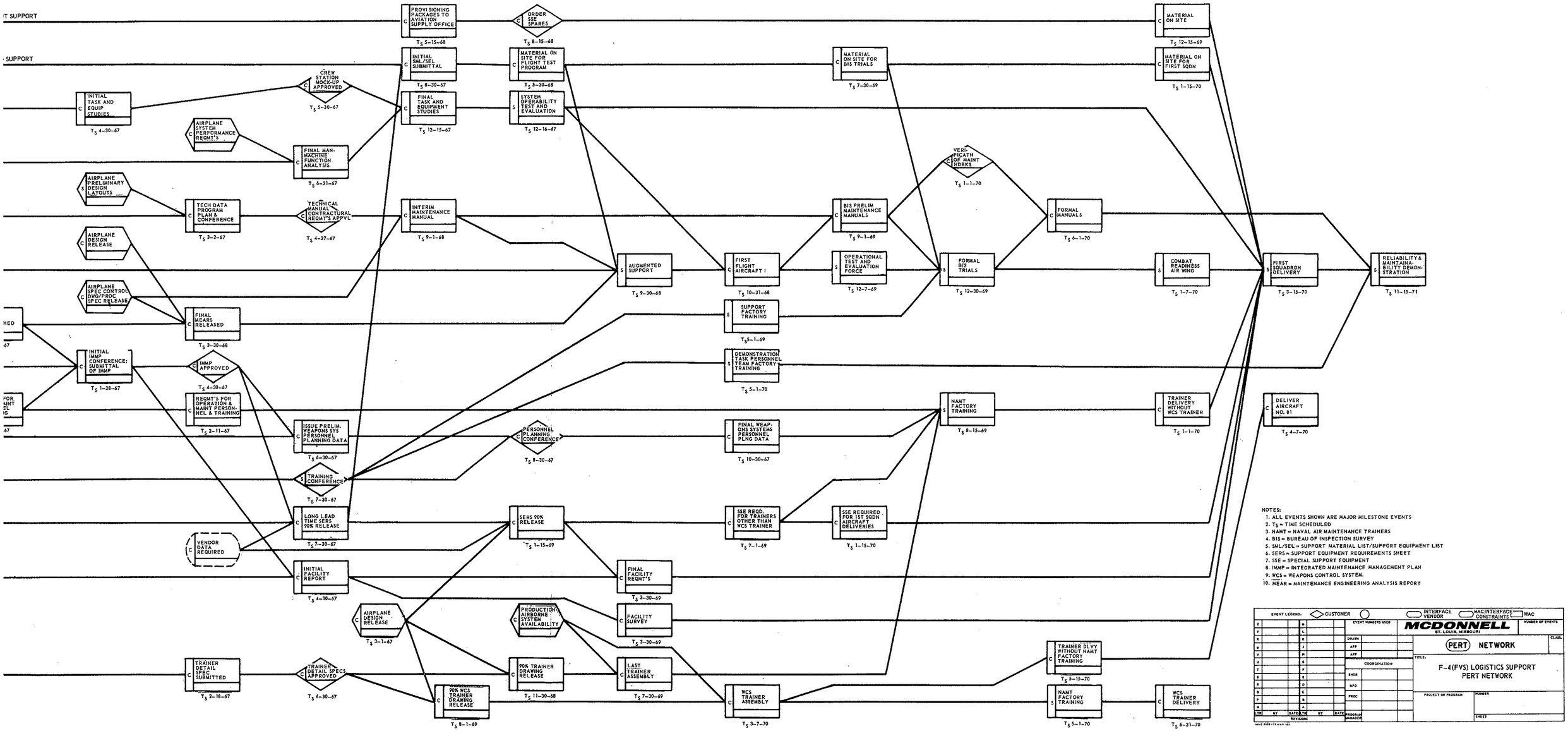
NOTES:
1. ALL EVENTS SHOWN ARE MAJOR MILE
2. T_S = TIME SCHEDULED
3. NAMT = NAVAL AIR MAINTENANCE TR
4. BIS = BUREAU OF INSPECTION SURVE
5. SML/SEL = SUPPORT MATERIAL LIST
6. SERS = SUPPORT EQUIPMENT REQUIR
7. SSE = SPECIAL SUPPORT EQUIPMENT
8. IMMP = INTEGRATED MAINTENANCE
9. WCS = WEAPONS CONTROL SYSTEM.
10. MEAR = MAINTENANCE ENGINEERING

EVENT LEGEND: CUSTOMER

Figure 11.4

[redacted]



NOTES:
1. ALL EVENTS SHOWN ARE MAJOR MILESTONE EVENTS
2. T_S = TIME SCHEDULED
3. NAMT = NAVAL AIR MAINTENANCE TRAINERS
4. BIS = BUREAU OF INSPECTION SURVEY
5. SML/SEL = SUPPORT MATERIAL LIST/SUPPORT EQUIPMENT LIST
6. SERS = SUPPORT EQUIPMENT REQUIREMENTS SHEET
7. SSE = SPECIAL SUPPORT EQUIPMENT
8. IMMP = INTEGRATED MAINTENANCE MANAGEMENT PLAN
9. WCS = WEAPONS CONTROL SYSTEM.
10. MEAR = MAINTENANCE ENGINEERING ANALYSIS REPORT

EVENT LEGEND: CUSTOMER | INTERFACE VENDOR | MACINTERFACE CONSTRAINTS | MAC

EVENT NUMBERS USED | NUMBER OF EVENTS

MCDONNELL
ST. LOUIS, MISSOURI

CLASS.

PERT NETWORK

TITLE:
F-4(FVS) LOGISTICS SUPPORT
PERT NETWORK

DRAWN | APP | APP | COORDINATION | ENGR | MFG | PROC | PROGRAM MANAGER

PROJECT OR PROGRAM | NUMBER | SHEET

REVISIONS

Figure 11.4

[redacted]

b. Avionics. The addition of new avionics systems will require modifications to the existing F-4B/J avionics shop. Utilization of the Versatile Avionics Shop Test (VAST) concept for the new and modified systems will minimize the modifications. Specific space and utility requirements cannot be defined until VAST Facility Requirements are known and the amount of VAST utilization for all FVS Avionics systems has been established. It is reasonable to assume that avionics shop space will be less than that required for F-4B/J support.

11.2.6.4 Development, Evaluation and Checkout

Existing F-4B/J development, evaluation, and test facilities are considered adequate to support the F-4 FVS program.

11.2.6.5 Assembly, Installation and Checkout

Existing contractor production facilities are considered adequate for F-4(FVS) production requirements.

11.2.6.6 Distribution and Storage

Similarity of the F-4(FVS) with the F-4J and continued utilization of policies and procedures of WR-30 as applicable to the F-4(FVS) for selection, requisition, and distribution of spares indicates no new distribution or storage facilities will be required.

11.2.6.7 Training Facilities

Refer to Section 13 Paragraph 13.3(9) for definition of F-4(FVS) Training Facilities.

11.2.6.8 Facility Requirements Documentation

The contractor will conduct an analysis of the FVS weapon system facility requirements and provide documentation in accordance with WR-30 as amended.

11.2.7 Spares and Repair Parts

The similarity of the F-4J/F-4(FVS) Weapon Systems and the intended operational utilization of the F-4(FVS) dictates the continued utilization of WR-30 policies and procedures as amended, for the selection, acquisition, storage, and distribution of spares and repair parts to support the test and development program and the operational deployment of the weapon system.

Augmented support will be specified for support of the test and development program, and the Fleet introductory phase to provide a responsiveness to design changes and to insure an orderly transition to full Navy support.

Initial provisioning will be limited to items identified as peculiar to the F-4(FVS) weapon system. Common F-4 support will be obtained by increasing the quantity of current procurement. The Aviation Supply Officer (ASO) will be responsible for the selection, acquisition, storage, and distribution of spares andrepair parts.

Trainer spares and repair parts will be provisioned in accordance with WR-32. Initial provisioning will be limited to items peculiar to the F-4(FVS) weapon system. Common F-4 support will be obtained by increasing the quantity of current procurement. The Commander, Naval Air Technical Training will be responsible for this action.

11.2.8 Packaging and Handling Equipment

Packaging and handling equipment requirements will be based on the air eligibility of all spares and repair parts, support equipment, and repairable evacuation required in support of the F-4(FVS) Weapon System. Standard packaging and handling specifications, such as MIL-S-3712, MIL-S-726, and MIL-S-7926 will apply. In addition, techniques developed by other military departments and industry will be reviewed and adopted as appropriate. The Material Inspection Service (MIS) will be responsible for this action.

11.2.9 Support Equipment

Using the F-4J as the base aircraft for the development of the F-4(FVS), a comparison between the two aircraft has been conducted and major differences that influence test equipment, special tools and calibration equipment have been determined. The results of this comparison have been based on reliability and maintainability analyses, mission requirements, human factor analyses, technical considerations and personnel training goals implemented under an "Integrated Logistics Management" concept.

The framework of Spec. WR-30, as amended, "Integrated Maintenance Management" requires the preparation of a support plan and establishes procedures applicable to the documentation of support resources. The utilization of PERT reporting techniques will monitor the progress of time phased milestones to assure timely development, test, and acquisition of support requirements.

Material Inspection Service (MIS) will be responsible for the distribution of Special Support Equipment (SSE) and General and Standard Support Equipment in accordance with instructions defined in Spec. WR-30, as amended. The functions of the "Integrated Logistics Management Team" as defined in Spec. WR-30, as amended, will assure performance of evaluation, and prompt decisions essential to orderly and timely progress of the program.

VAST (Versatile Avionics Shop Tester) will be utilized to the maximum extent possible to accomplish checkout and test of the electronic WRA's (Weapon Replacement Assembly) at the Intermediate maintenance level.

To achieve optimum effectiveness of the VAST system, Spec MIL-S-23603 will be implemented in the design of airborne systems to assure that all electronics of new avionic systems will have both electrical and physical compatibility with VAST with minimum test equipment or interface adapters.

Existing avionic systems will be analyzed to determine if adaptation to the VAST system is logistically economical.

Present F-4J and military inventory test and checkout equipment will be used where practicable to support avionic system having electromechanical or electromagnetic functions which cannot profitably be adapted to VAST.

Response to the operational requirements will be predicated on the individual system reliability (MTBF) predictions, technical considerations, including MTTR, human factor analyses and MMH/FH requirements established by maintenance engineering will be evaluated to determine support requirements.

The feasibility and extent of support required will be determined through trade-off and cost effectiveness studies incorporating specific criteria supplied by the individual logistic disciplines.

The documentation of the support items recommended will reflect the logistic parameters as included in the applicable exhibits of Spec. WR-30, as amended.

The RDT&E phase of the program will be covered under Augmented Support Procedures wherein minimum quantities of support items and maximum use of the contractor's resources is most practical.

The formal procedures of the Government Support Program, as described in Spec. WR-30, as amended, for the determination of required quantities and areas of utilization and types of material will be operable during the life cycle of the weapon system.

Military inventory support equipment used at Organizational and Intermediate maintenance levels will be utilized to the maximum extent possible. Existing support equipment will be used with minimum modifications to accommodate airborne system and interface changes. The following systems are considered modified from the F-4J and will affect support requirements:

(a) The addition of a new nose landing gear, incorporating nose gear catapult tow and holdback provisions, is installed in the forward fuselage. Similar F-4J Organizational and Intermediate support equipment that reflects the mechanical differences will be required for support of this system.

(b) Handling and servicing equipment used at the Organizational and Intermediate maintenance levels to support the F-4(FVS) wing, stabilizer, swivel pylon and main landing gear, will be similar to the support equipment required for similar F-4J subsystems, except for modifications generated by configuration changes.

(c) Rigging tools, fixtures and gauges required to adjust control systems of the leading edge slats, double slotted trail edge flaps, and trailing edge spoilers will be new but similar to existing F-4J Organizational and Intermediate support equipment.

(d) An increase in the total cooling requirements for the F-4(FVS) is the result of an increase in the electronics and avionics equipment. Experience indicates that operation of the present ground cooling units under extreme environments could result in inadequate cooling for the F-4(FVS) aircraft. New specification for a ground cooling unit will be generated to satisfy the additional cooling requirements at the Organizational and Intermediate levels of maintenance.

Versatile Avionic Shop Tester (VAST) will be utilized at the Intermediate maintenance level to satisfy avionic system test requirements. If the avionic system design initiates the requisite for Organizational test and checkout equipment, hardware similar to that presently used on the F-4J will be recommended. Systems that may qualify under this category are the Automatic Flight Control System, Digital Inertial Navigational/Bombing System, Radar Warning and Homing Receiver, Lead Computer Optical Sight Set, Backup Attitude Reference, Air Data Computer, CNI, Data Link, Flight Director Group, Direct Radar Scope Recorder, and Airborne Weapons Control System AN/AWG-10 (AWCS).

11.2.10 Operational Logistic Factors

Procedures and systems used for provisioning initial and replenishment support materiel for the F-4B/J Weapon Systems will be revised, and problem areas identified for special action to preclude their recurrence during the acquisition and operational support of the F-4(FVS) Weapon System. Special emphasis will be placed on an analysis of problems and lessons learned as a result of the Vietnam conflict. This will be a joint responsibility of the CNO, Naval Air Systems Command, the MIS, the ASO, and the contractor.

11.2.11 Contractor Technical Services (CTS)

Technical representation will be provided by the prime contractor on airframe, airborne systems, and special support equipment to serve as liaison to expedite any problems with suppliers equipment. Representatives are assigned in four categories: Airframe Systems, Electronics, Support Equipment, and Supply.

The representatives will advise the activities in the solution of technical difficulties and serve as liaison between the contractor and Navy and provide an interface association between the numerous CFE and GFE items. The supply and support equipment representatives will be assigned to assist in the initial operational phase with the aircraft system and electronic representatives assignment duration is dependent upon the rate of proficiency of the operational and maintenance effort.

11.2.12 Maintenance Personnel and Training

The Personnel and Training requirements as set forth in Section 13 has been correlated not only with the Supportability Plan but with the development of the aircraft, systems, and related equipment. Close and continuing Navy/Contractor coordinated effort must be maintained in order to reflect required changes in the training program. New equipment, such as the Versatile Avionic Shop Tester (VAST), under development for or in use by the Navy requires that Personnel and Training Requirements be continuously updated.

The development of a training program for F-4(FVS) maintenance personnel will employ the same technique described in paragraph 11.1.3 above with respect to the training of operator personnel. A comparison of the task requirements for F-4(FVS) maintenance personnel and similar task requirements for the F-4J system will describe the scope of training needed. The resulting requirements for training will be analyzed to determine the most effective means for satisfying them. Data generated by the human factors program will be utilized again to aid in defining the necessary training program.

A preliminary human factors system study has revealed that certain aspects of the F-4(FVS) AMCS may necessitate development of a limited amount of new training materials.

See Section 13 of this plan for definition and requirements of the Personnel - Training Plan.

11.2.13 Integrated Logistic Support

11.2.13.1 The overall integrated logistic support management approach and the manner in which logistic information will be generated will be governed by Addendum Y to WR-30. The Inventory Control Point (ICP) for the F-4(FVS) will provide to the contractor an Item Support Plan Policy Statement (ISPPS) as directed by the IMMT. The ISPPS will define the documentation and the service requirements which will be negotiated between the contractor and the supply activity.

11.2.14 TDP Sectional Interface

During the design development period, support resource planning will be based on the maintainability allocations and maintenance philosophy developed by the maintainability program. As support requirements are analyzed during preparation of maintenance analysis, predicted maintenance requirements for each system will be compared with maintainability allocations for that system. Where required, improvement of maintainability of systems/equipment will be made to eliminate problem areas. During the test and evaluation period, adequacy of the planned support resources will be verified, analysis updated, and design improvement changes submitted to eliminate deficiencies.

11.2.15 Relationship to Procurement Documents

Addendum Y to WR-30 defines the requirements of Integrated Maintenance Management as specifically applicable to the F-4(FVS) to provide operability and supportability assurance. This addendum will be incorporated into contractual documentation. Monitoring of contractor compliance with the intent of the Operability and Supportability Plan will be the responsibility of the IMMT.

SECTION 12

TEST AND EVALUATION PLAN

12.0 GENERAL

A Service Evaluation Test (SET) plan has been established whereby production F-4(FVS) aircraft and electronic systems performance will be verified and tactical deployment techniques will be developed. Technical evaluation conducted by the Board of Inspection and Survey (BIS), and operational suitability testing conducted by the Operational Test and Evaluation Force (OPTEVFOR) will judge conformance to applicable specifications and operational suitability. A tactical squadron will demonstrate weapon system reliability and maintainability. The weapons system will be deemed acceptable when aircraft performance satisfies the mission requirements of the design and when no flight safety discrepancies remain unresolved.

12.1 OBJECTIVES OF SERVICE EVALUATION TEST

The Service Evaluation Test Program is established to insure by ground and flight testing that the weapons system delivered to the Fleet adheres to the following criteria:

(a) Free of basic flight defects within the established flight envelope.
(b) Safely operable to the limits and under the conditions specified.
(c) Equipped to satisfactorily complete the assigned mission.
(d) Supportable and maintainable in performance of the assigned mission.

The objectives of the test program will be accomplished in two parts:

(a) Technical Evaluation (BIS Trials) - conducted to evaluate system performance with respect to specifications and contract guarantees and to certify that the weapons system is ready for operational evaluation.

(b) Operational Evaluation (OPTEV) - conducted to determine the operational suitability, combat potential, and utilization of the weapons system.

12.2 SCOPE AND LIMITATIONS

12.2.1 Board of Inspection and Survey

Testing to be conducted during BIS trials falls into two general areas:

(a) Testing to verify that systems common to other F-4 aircraft are not adversely affected by incorporation of the F-4(FVS) electronic and aerodynamic changes.

(b) Testing to evaluate those systems not common to other F-4 models for contract and specification compliance. Emphasis will be placed on technical evaluation of major airframe and system revisions.

The aircraft used in the BIS trials will be structurally configured as described in Section 8 of this report. Each aircraft requiring items of electronic equipment will have production components installed. Therefore, no simulation of interface signals is required. Data generated by the BIS flight test program will be representative of the production configuration.

12.2.2 Operational Test and Evaluation

The planned production equipment will be installed in all aircraft prior to delivery to OPTEVFOR. Maintainability, reliability, and supportability data acquired will be representative of the production item and offensive and defensive tactics developed will be applicable to the weapons system in the final production configuration.

12.3 TEST LOCATIONS AND SPECIAL SUPPORT REQUIREMENTS

The Naval Air Test Center (NATC), Patuxent River, Maryland, will be the test site for aircraft and engine performance, flying qualities, carrier suitability, and electrical and electronic evaluation, while armament testing will be conducted at the Naval Missile Center, Point Mugu, California. Operational testing and evaluation will be conducted at a location selected by and under the cognizance of COMOPTEVFOR.

The contractor will provide engineers, technicians, and mechanics as required in support of the Service Evaluation Test. Specific support requirements will be negotiated with the Contractor through the principal development activity.

Peculiar CFE and GFE items similar to those listed in the F-4 Support Material List will be required and, in addition, items of special test equipment to support the new or modified equipment in the F-4(FV) will be identified at a later date.

12.4 BIS TRIALS PLAN

12.4.1 Initial Phase

The objective of the initial trials phase (ITP) will be to discover and report, within sixty days after receipt of the BIS aircraft at each activity conducting trials, such major defects as can be found in the limited time available. During the ITP, a basis for the complete trials program will be formulated. Attention will be concentrated on those characteristics of weapons system performance which are marginal or unsatisfactory and which will require further investigation. Areas which are obviously satisfactory will be identified in order that no unnecessary effort be expended during the formal BIS trials. Evaluation during this phase will be primarily qualitative, and trials will not normally be delayed for instrumentation installation or calibration. However, pre-trial contractor data, when properly documented, will be considered by the Board in order to expedite completion of the trials and to reduce flight and manhour expenditure.

The ITP Program will also include functional evaluation of appropriate Aerospace Ground Support Equipment.

Initial trials, conducted by the appropriate test activity, will include the following inspections and tests.

(a) Armament - Deleterious effects on the airframe, engines, or aircraft equipment resulting from launching, jettisoning, or dropping the armament will be determined.

(b) Electrical and Electronic - The ITP will include an inspection of the aircraft electrical and electronic systems to determine conformance of equipment installation and wiring to specifications and directives pertaining to equipment accessability, wire chafing, entrance of foreign matter, and other items which would adversely affect safely of flight or operational suitability.

(c) Carrier Suitability - The aircraft will be inspected to determine critical clearances and suitability for use with carrier handling equipment. Takeoff, landing, and waveoff characteristics will be determined.

(d) Flying Qualities and Performance - Tests to supplement the Navy Preliminary Evaluation and the Contractor Demonstration will be conducted to discover and report major deficiencies in stability and control characteristics.

(e) Guided Missiles - Emphasis during this phase will be placed on compatibility of the modified Sparrow missile to the missile control system.

(f) Service Suitability - Immediately upon receipt of the first aircraft for Service Suitability Trials, it will be given a thorough acceptance inspection to determine at the earliest possible time any major defects affecting the design mission and Fleet utilization. The ITP will include flight tests to determine operational adequacy.

12.4.2 Formal Phases

Formal BIS Trials will be conducted by the appropriate test activity and will include the test phases described below.

12.4.2.1 Armament Trials - These trials will be conducted in three phases to determine the operability and suitability of specified armament equipment throughout the flight envelope.

(a) Bomb Phase - Bombing accuracy and reliability against discrete and non-discrete radar targets will be verified. Flight characteristics at bomb release will be determined.

(b) Armament Control System Phase - Functional adequacy, reliability, and accuracy of the system will be evaluated.

(c) AFCS Phase - Evaluation of AFCS equipment associated with the Armament Control System will be performed.

12.4.2.2 Electrical and Electronics Trials - The electrical and electronic systems will be evaluated in the following phases.

(a) Electrical Systems Phase - Electrical components not common to other F-4 models will be assessed to determine the degree to which the electrical system meets the operational mission criteria of the weapons system.

(b) Electronic System Phase - All electronic systems installed in the aircraft, except those common to other models of the F-4, will be evaluated, using contract guarantees, equipment specifications, recognized good engineering practice, and aircraft characteristics as guides, for their operational performance and compatibility. Primary emphasis will be placed on the multi-shot capability of the missile control system. Ground testing will be conducted to identify and eliminate possible electromagnetic interference utilizing the shielded hangar facility at NATC. Contractor systems engineers will assist in conducting and interpreting the results of this testing.

12.4.2.3 Carrier Suitability Trials - These trials will be conducted in two phases.

(a) Shore-based Phase - Launching and arresting equipment and the structural integrity of the aircraft and aircraft equipment will be evaluated. Dynamic and aerodynamic handling characteristics during launch, climbout approach, and arrestment will be determined.

(b) Carrier Qualification Phase - Suitability for carrier operations under conditions approximating those expected in service use will be verified. Maximums and minimums, with respect to aircraft configuration and weather factors for launch and recovery, will be determined.

12.4.2.4 Flying Qualities and Performance Trials - These trials will be conducted in two phases.

(a) Performance Phase - Airspeed and altitude position errors will be determined and tests will be conducted as necessary to determine actual performance of the aircraft in various loading configurations.

(b) Flying Qualities Phase - Flying qualities in various configurations will be evaluated, and compared to applicable specifications. This testing will include, longitudinal and lateral stability, control effectiveness in high and low speed flight, trim effectiveness, inertia coupling, and effectiveness of the emergency control system. In addition, the test aircraft utilized by the contractor for spin demonstration will, at the completion of the demonstration, be delivered to the Naval Air Test Center for additional spin recovery evaluation. Special instructions for these tests, including the aircraft delivery configuration requirements will be issued by NAVAIRSYSCOM.

(A)

12.4.2.5 Guided Missile Trials - These trials will be conducted in two phases.

(a) Preliminary Phase - Flights necessary to determine compliance with aircraft contract guarantees and specifications in regard to guided missile operations, carrying, launching, guidance, and jettison will be conducted. Analytical studies necessary to describe systems performance will be performed.

(b) Final Phase - Tactics for successful employment of the multi-shot capability will be developed in a test program consisting of simulated and live missile firings. Kill probability statistics will be accumulated. Data obtained during the phase will be made available to OPTEVFOR and will form a base from which the OPTEV Program will be formulated.

12.4.2.6 Service Suitability Trials - The following trial phases will be conducted to determine defects affecting the design mission and fleet utilization.

(a) Maintenance Phase - Qualitative evaluation of maintenance requirements with regard to component reliability, unusual problems, special tools, and AGE will be conducted. Systems operation logs will be compiled, and maintenance task analysis will be conducted.

(b) Operational Safety and Reliability Phase - Evaluation of the weapon system will be conducted in a simulated operational environment to determine qualitatively any serious defects in service reliability and safety.

(c) All-Weather Operations Phase - Operational capabilities of the aircraft will be determined during simulated combat missions under conditions of darkness, low visibility, precipitation, turbulence, and icing.

(d) Tactical Operations Phase - The aircraft will be subjected to the type of usage it would receive during service operations, and any defect affecting the tactical suitability of the weapons system will be reported. Fuel specifics, loading configuration data, performance capabilities, etc. derived from this program will be submitted to OPTEVFOR and will be the basis for proceeding with the OPTEV Program.

The schedule for BIS testing is presented in Figure 12.1

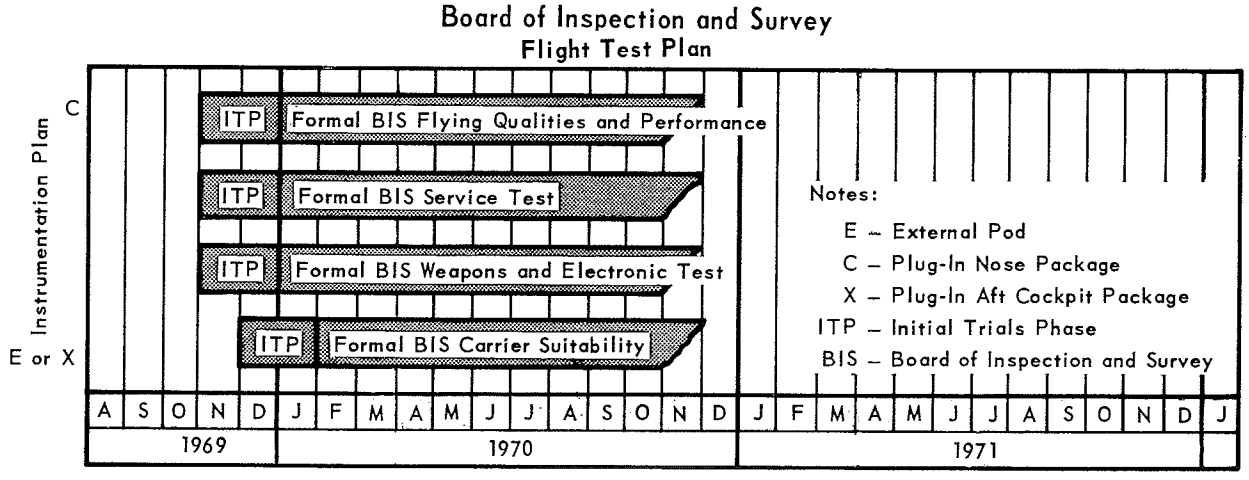


Figure 12.1

12.5 OPTEVFOR TEST PLANS

12.5.1 Operational Tests

Offensive and defensive techniques will be developed whereby the maximum combat potential of the aircraft may be realized. The tactical deployment of the weapons system will be extensively investigated in the following areas:

(a) Aircraft Performance - Acceleration, time to climb, supersonic ceiling, maximum level flight speed, and maneuverability will be determined throughout the operating envelope. Performance characteristics will be determined with sufficient accuracy to allow the development of the best possible aircraft utilization techniques.

(b) Missile Control - Utilization of the AN/AWG-10 multi-shot Missile Control System capability against a variety of raid configurations will be a major subject for investigation. Tactics will be developed to insure coverage of the largest number of targets consistent with the system limiting conditions such as antenna look angle during various stages of the attack, the number of missiles simultaneously in the terminal guidance phase, and ECM environment. Intercepts will be made with and without data link information in an effort to develop offensive tactics under all expected combat conditions.

(c) Weapons Delivery - Tactics will be developed to exploit the capability of the release computer in LABS, lay-down, and offset bombing modes. Bomb delivery techniques, taking full advantage of aircraft performance and the digital computer capabilities, will be worked out for delivery of special weapons. Procedures for utilization of the Lead Computing Optical Sight System will be developed for air-to-air and air-to-ground operation.

12.5.2 Serviceability Tests

Ground and flight tests will be performed in a simulated operational environment to evaluate the general service suitability of the weapons system. The following areas will be investigated.

(a) Systems Safety and Reliability - Tests will be performed to detect design, construction, or functional deficiencies in the weapons system that would affect operational safety and reliability. During flight tests, all systems and components will be operated to the maximum extent consistent with expected Fleet use in order to establish a broad data base.

(b) Maintainability - Maintenance suitability information will be obtained by keeping records of all maintenance action required on aircraft in the OPTEV Program. Supply support will be evaluated by compiling a list of parts replaced, showing availability of these parts and the periods during which the aircraft was AOCP or ANFE. Maintenance and supply data will be used to forecast expected in-commission rates and turnaround times for use in developing optimum tactics for utilization of the weapons system.

(c) Publications - Adequacy of operational and maintenance publications will be determined. Accuracy of the Flight Handbook, including performance curves, specifics charts, and descriptive material will be verified. Applicable technical publications, including check lists, pre-flight and post-flight sheets, maintenance manuals, and contractor bulletins will be analyzed for accuracy and to insure that all applicable topics are included in the publication.

(d) Aerospace Ground Support Equipment - The functional suitability and reliability of the AGE equipment provided will be evaluated to determine the extent to which the equipment complements the design mission of the weapons system.

12.5.3 OPTEV Program

Five production aircraft will be used for the OPTEV Program. Delivery of these aircraft will be accomplished in August and September, 1969.

12.6 Reliability and Maintainability Demonstration

In demonstrating the weapon system reliability and maintainability, one hundred flights will be flown to a basic Combat Air Patrol mission profile of 2.88 hours duration while simulating air-to-air combat with four AIM-7F missiles. Maintainability data will be gathered over a total flight time period of 1000 hours or 3 months, whichever occurs first. Scheduled for third quarter 1970, the demonstration shall be a joint Navy/Contractor program conducted with squadron aircraft. The rules and procedures for conducting this demonstration will be prepared by the Contractor and coordinated with the Navy prior to start of the program.

12.7 REPORT REQUIREMENTS

BIS Yellow Sheet Reports will be prepared by the cognizant BIS trial activity in order to rapidly identify deficiencies discovered during BIS trials. A separate yellow sheet will be prepared for each deficiency in design, material, or workmanship that results in malfunctions or unsatisfactory performance of the aircraft, structure, or equipment.

Maintenance, operation, and configuration logs to include aircraft, systems, and armament will be kept by each BIS and OPTEV test activity. Logs will be submitted with the final test activity report.

Each phase of the BIS trials as defined in Section 5 of this plan is a reportable increment of the overall program. Each test activity will prepare phase reports at the earliest practical time for submission to the Board of Inspection and Survey. Phase reports may be consolidated by the test activities if such action will expedite the reporting function. The final report for each major category of BIS trials will summarize the conclusions of the test activity.

The Board of Inspection and Survey will recommend to the CNO, at the conclusion of the ITP, the suitability of the aircraft for delivery to the Fleet. Interim reports will be submitted as required to recommend changes for early incorporation into the production aircraft. A final report, summarizing the test results and major conclusions of the test activities,

will be prepared at the conclusion of the test activities. This report will contain definite recommendations as to conditions for final acceptance of the weapons system.

COMOPTEVFOR will report on the suitability of the weapons system for fleet use and submit recommendations. An F-4(FVS) Weapons System Tactical Handbook will be prepared to present information regarding the tactical employment of the aircraft in its various combat missions.

SECTION 13

PERSONNEL AND TRAINING PLAN

13.0 General

Estimates of squadron maintenance and operator personnel, factory personnel training, and training equipment are based on the differences between the F-4(FVS) and F-4B/J systems requirements. Training planners have related the F-4(FVS) personnel and training requirements to available Navy resources in order to derive the additional information required to complete this section.

13.1 Responsibilities

The Chief of Naval Personnel (CNP) has determined the feasibility of supporting equipment and system development within the scope of the Navy's current and future personnel potential. The Chief of Naval Personnel will provide the personnel to man and maintain the F-4(FVS). This section has the concurrence of the Chief of Naval Personnel and is considered valid and effective.

13.2 Procedure

The specific items included in this section have been developed utilizing all of the F-4 information available and the estimates included will be refined on each subsequent review and resubmission.

13.3 Contents

(1) Training and Personnel Summary

To develop an adequate program of training for operators and maintenance personnel for the F-4 (FVS) system a number of studies will be necessary. Some of the studies have been mentioned in the preceding paragraphs while several have not been noted previously. The training and personnel studies required and planned for the F-4(FVS) system development are listed below:

1. Operator training requirements study.
2. Maintenance personnel training requirements study.
3. Operator training program mechanization trade-off studies.
4. Maintenance personnel training program mechanization trade-off studies.
5. F-4(FVS) training program criteria development study.
6. F-4(FVS) system manpower requirements study.

System personnel assignment plan development study (including a plan for new F-4(FVS) personnel and a plan for personnel transitioning from earlier F-4 systems to the F-4(FVS) system).

(2) Operations and Maintenance Personnel Requirements

A Weapon System Personnel Planning Data (WSPPD) Report will be prepared for the F-4(FVS) aircraft. This report will further develop and/or verify the following list of preliminary squadron maintenance and operator personnel estimates for a twelve-aircraft squadron.

TITLE	RATING/MOS/NOBC	NUMBER
Fighter Pilot	7307 8528	14
Airborne Radar Intercept Officer	7352 8507	14
Master Chief Aircraft Maintenanceman	AFCM 6412	1
Master Chief Avionics Technician	AVCM 6691	1
Aviation Machinist Mate	ADJ 6412	36
Aviation Electrician's Mate	AE 6615	39
Aviation Structural Mechanic (Hydraulic)	AMH 6442	24
Aviation Structural Mechanic (Structures)	AMS 6441	24
Aviation Structural Mechanic (Safety Equipment)	AME 6443	14
Aviation Electronics Technician	AT 6611	4
Aviation Electronics Technician (Radio and Radio Navigation Equipment)	ATN 6611	6
Aviation Electronic Technician (Radar and Radar Navigation Equipment)	ATR 6611	6
Aviation Fire Control Technician	AQ 6613	7
Aviation Fire Control Technician F (Fire Control)	AQF 6613	17
Aircrew Survival Equipmentman	PR 7113	10
Aviation Storekeeper	AK 3071	2
Aviation Maintenance Administrationman	AZ 6491	6

- Operations and Maintenance Personnel Requirements (Cont.)

TITLE	RATING/MOS/NOBC	NUMBER
Aviation Ordnanceman	AO 6511	25
Airman	AN 6400	6
	TOTAL	256

As the Maintenance Engineering Analysis Record (MEAR) Program, as outlined in Section 2, progresses the maintenance effort established by each MEAR will be analyzed and interpreted in terms of manpower. Separate maintenance analyses will be accomplished for the maintenance functions not covered by MEAR's (i.e. Inspections, Servicing, Aircraft Handling) and all analyses will be treated with factors in such a manner that all "Productive Direct" and "Productive Indirect" labor efforts will be identified to provide the total maintenance effort required to support the F-4(FVS) aircraft. The departure point for preparing the WSPPD will be the Personnel Planning Conference required by WR-6 and all Personnel Planning Milestones will be established on this base.

(3) Training Requirements

As previously stated in Section 11, para. 11.2.12, the training requirements have been correlated not only with the Supportability Plan but with the development of the aircraft, systems, and related equipment. An analysis of the training requirements as related to the F-4B/J and new equipment, such as the Versatile Avionic Shop Tester (VAST), under development for or in use by the Navy has been made and the following F-4(FVS) training requirements are recommended.

(4) Operator Training

The initial cadre of aircrews will be drawn from existing F-4B/J squadrons. These aircrews will complete an abbreviated formal transition following the Replacement Carrier Air Wing Syllabus in the F-4(FVS). Subsequent crews will progress through the full RCVW syllabus similar in scope and length to the existing F-4B/J program.

(5) Operator Training Equipment

Existing F-4J Cockpit Orientation Trainers, F-4J Radar Operator Part Task Trainers and F-4B Mission Simulators with optimized updating and supplementary technical data will be utilized.

(6) Maintenance Training

Based upon the course prerequisite of previous F-4B/J experience and upon an analysis of the systems and related support equipment of the F-4(FVS), the following courses are listed as the minimum requirements.

1. Squadron Personnel - Pilots 40 Hours

   A general orientation course to explain the function and operation of the aircraft systems. To provide knowledge of pre-flight checks, emergency procedures, etc.

2. Squadron Personnel - RIO - 40 Hours

   A general orientation course to explain function and operation of the aircraft systems with emphasis on the missile control system.

3. Squadron Personnel - Crew Chief - 60 Hours

   This course will provide instruction in aircraft maintenance and servicing procedures, daily, pre-flight and post-flight inspections, normal and emergency ground operation, safety and aircrew assistance.

4. Squadron Personnel - AD - 160 hours

   Power plant and aircraft fuel system maintenance and servicing are the major subjects of this course. In addition, the subjects are engine b uild-up, engine installation and removal and engine operation.

5. Squadron Personnel - AM - 240 Hours

   Course content for this rate covers the ejection seat, survival equipment, aircraft structures, hydraulics system maintenance, the landing and arresting gear, the air induction system and wing sweep system mechanical and hydraulic considerations.

6. Squadron Personnel - AE - 500 Hours

   Subjects for this course are the Electrical Power Generating and Distribution System, the Air Data Computer and Autopilot, the Attitude Reference, the Data Link, the Flight Director Group and the Approach Power Compensator. In addition, the course will include the new wiring considerations, the air induction electrical and certain instruments such as the Liquid Oxygen Gauging System.

7. Squadron Personnel - AO - 160 Hours

   This is an Armament, Missile and Weapons Control System Course covering the various configurations of racks and launchers, the Airborne Weapon Control System, the Fuze Function Control Set, the Loft Bomb Computer tie-in and the Special Wing Station.

8. Squadron Personnel - AT - 360 Hours

   A course in Communication, Navigation and Identification to the organizational level, plus Data Link and Inertial Navigation.

9. Squadron Personnel - AQ - 864 Hours

An Airborne Weapons Control System course including the Lead Computing Gunsight, the Scope Camera System and the Weapons Release Computer. One section of the course will provide training on the Radar Warning and Homing Set.

10. NAMT Instructor - AT - 560 Hours

This course will update personnel in UHF, Tacan, IFF, SIF, Aux. Receiver, Navigation Computer, Data Link, ADF, Digital Data Radio Set, etc. Included will be functional analysis of inertial navigation computer and platform and the interface with crypto computer and speech coder.

Data Link and Inertial Navigation will consume the larger blocks of training.

The use of VAST will be given in connection with all the various areas. Trainer peculiar information will be in lecture form.

11. NAMT Instructor - AM - 160 Hours

Updating will be provided on the seat and survival equipment plus any changes to the basic hydraulic system. The new structure, landing gear and flight controls are the major subjects.

New trainers are to be provided, therefore, their use and maintenance will be a part of this course.

12. NAMT Instructor - AE - 286 Hours

Ten subjects will be reviewed for this rate. They will include the Power Generating and Electrical systems, remote compass transmitter, wire bundles and Approach Power Compensator. Other subjects are the Flight Director Group, Data Link, Attitude Reference, Autopilot and Central Air Data Computer. Some of the latter systems are new, solid state or miniaturized.

13. NAMT Instructor - AD - 40 Hours

These students will learn the aircraft fuel system, the power plant installation and removal and its mounting and cooling provisions.

14. NAMT Instructor - AQ - 380 Hours

As in the other rates, the training subjects are not new with one exception. The new subject is the Radar Warning and Homing Set. Minor update will be given on the ECM Pod, the Fuze Function Control and the Scope Camera. Much longer courses are for the AWCS, Lead Computing Gunsight, Weapons Release Computer and Data Link. Trainer information will be provided.

15. NAMT Instructor - AO - 80 Hours

This course will provide an understanding of the function and operation of the armament release system and the Missile and Weapon Control systems as they apply specifically to this aircraft. Discussions will cover the ECM dispenser, the fuze function control, the bomb release computer and the special station on the outer panel.

(7) Maintenance Training Equipment

The maintenance training units required for the F-4(FVS) have been separated into three categories according to the impact of the change on the existing F-4 NAMTRADETS.

(a) New training units required to provide a new organizational and intermediate training capability:

Training Unit - Maintenance, Inertial Navigation/Digital Bombing System
Training Unit - Maintenance, Countermeasures Systems
Note: This unit will move to category (b) below, upon implementation of F-4B ECP 707.

Organizational and intermediate ground support equipment, graphic aids, and trainer handbooks will be required with these trainers.

(b) Supplementary training units required to update an existing training capability at the F-4 NAMTRADETS to accommodate the F-4(FVS) training requirements:

Training Unit - Maintenance, Communications, Navigation and Identification
Training Unit - Maintenance, Central Air Data Computer
Training Unit - Maintenance, Weapons Control System
Training Unit - Maintenance, Landing Gear System
Training Unit - Maintenance, Armament System
Training Unit - Maintenance, Flight Controls Systems
Training Unit - Maintenance, Heading and Attitude Reference System
Training Unit - Maintenance, Data Link System "Two Way" (F-4J "One Way" Data Link Trainers are currently on order for F-4 NAMTRADETS.)

Organizational and intermediate ground support equipment peculiar to the F-4(FVS) systems will be required with these supplementary units. Graphic aids and trainer handbooks will also be required.

A supplementary Facilities Report documenting additional classroom requirements for trainers listed in subparagraphs (a) and (b) above, will be required.

(c) Existing trainers now in use which may be utilized without modification:

Training Unit - Maintenance, F-4J 30 KVA Electrical System
Training Unit - Maintenance, F-4B Ejection Seat and Canopy Systems
Training Unit - Maintenance, F-4B/J Jet Engine (ECP 501R3 is currently being incorporated to add J-79-10 engines to these trainers.)
Training Unit - Maintenance, F-4B Approach Power Compensator System
Training Unit - Maintenance, F-4B Fuel System
Training Unit - Maintenance, F-4B Hydraulic System
Training Unit - Maintenance, F-4B Landing and Arresting Gear (The arresting gear and parabrake portions of these trainers may be utilized.)
Miscellaneous Training Equipment - Air Conditioning Equipment Group, Compact Wire Bundle Repair, AN/APN-141 Radar Altimeter Set

Graphic Aids depicting the minor features unique to the F-4(FVS) will be required. No additional ground support equipment is anticipated for these trainers.

(8) Equipment and Test Equipment Requirements

One complete set of peculiar Organizational/Intermediate Ground Support Equipment, other than VAST will be required at each training site. Versatile Avionics Shop Tester (VAST) installations will be used for intermediate level support for electronic portions of new avionic systems installed in the F-4(FVS). No other support equipment will be required at intermediate level for electronic checkout of these systems. Since each shipboard VAST installation will serve all aircraft on board, training for utilization of VAST for aircraft intermediate support will be a general technical training requirement separate from the introduction of the F-4(FVS). To avoid duplication of NASC training plans for introduction of VAST into Navy inventory; VAST, training, installations, and auxiliary equipment required to adapt the weapons replaceable assemblies to the VAST will not be planned for the F-4 NAMTRADETS at this time.

(9) Training Facilities Requirements

Present training facilities at Miramar and Oceana are deemed adequate to meet the needs of F-4(FVS) training. No new installations are planned nor recommended.

Existing F-4B/J training units of Naval Air Maintenance Training Detachments 1013 (Miramar) and 1014 (Oceana) require additional classroom space. Preliminary analysis indicates approximately 7200 square feet of additional classrooms will be required to support the F-4(FVS) training units. Existing 400 cycle AC and

- Training Facilities Requirements (Cont.)

28 VDC power, and hydraulic/pneumatic utilities should be sufficient, however, it is anticipated that additional 1 20 VAC 3 Phase 4 Wire 60 Cycle Power will be required.

(10) Contract Engineering Service Requirements

The weapon system concept of design, manufacture, and support has served to emphasize the need for complete correlation of industry and service activities. The contractor is aware of the support required to maintain weapon system availability in the Operational Commands and proposes to furnish the necessary technical personnel to support the F-4(FVS) weapon system and its integration into the using command. Much can be gained by the contractor's furnishing representatives who have been trained in their specialty areas during the design and manufacturing phases of the aircraft. An existing world-wide field service organization currently offering staff assistance to the operating commands utilizing F-4 models of aircraft has demonstrated the value of this type support. It is considered that the introduction of the F-4(FVS) Weapons System can be readily accommodated by this existing organization with a minimum of orientation. The use of the established Field Service organization for field activity reporting will facilitate coordination with suppliers as well as the various engineering and support functions of the contractor.

13.4 Summary of Input Requirements

The personnel and training analysis is a developing process which provides successively more accurate and comprehensive data. Certain inputs are necessary to such an analysis. F-4(FVS) inputs include the following:

1. Detailed system and mission description.
2. Specific sub-system descriptions and specifications.
3. The operating and maintenance concept.
4. The echelons of maintenance and support.
5. The sub-system function allocated to man.
6. The similarity of human functions to those in existing systems in the F-4B/J.

SECTION 14

PRODUCTION DELIVERY AND INSTALLATION PLAN

Figure 14.1 presents the production delivery schedule for a 300 aircraft contract.

CONFIDENTIAL *(when filled in)*

WEAPON SYSTEM PLANNING DATA, NAVWEPS FORM 13010/1A-1 (9-63)

MODEL	POWER PLANT (Model and quantity)	ADMINISTRATIVE LEAD TIME	DEVELOPMENT LEAD TIME	DATE
F-4(FVS)	J79-GE-10 (2)			

PROCUREMENTS

FISCAL YEAR	NO.	STATUS OF BUDGET OR CONTRACT
1967 & PRIOR	7	
1968	40	
1969	132	
1970	121	

TOTAL ACCEPTANCES PRIOR TO: (DATE) 1 July 1968 (NUMBER) 0 AIRCRAFT

PRODUCTION SCHEDULE

CY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1968										1	0	1
1969	1	1	2	1								
1969								1	2	2	3	5
1970	7	9	11	11	11	11	11	11	11	11	11	11
1971	11	11	11	11	11	11	11	11	11	11	11	11
1972	11	11										

AIRCRAFT INVENTORY AND OPERATING NUMBERS *(at end of period)*

TIME PERIOD																		
TOTAL INVENTORY (PROGRAM & NON-PROG.)																		
LOGISTIC SUPPORT																		
TOTAL OPERATING (PROGRAM & NON-PROG.)																		
NON-PROGRAM - TEST																		
PROGRAM OPERATING																		
NAVAIRLANT																		
NAVAIRPAC																		
NATRA																		
NAVESTRA																		
NAPS																		
NSTAE																		

REMARKS

First seven (7) aircraft to Contractor Flight Testing

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Figure 14.1

Rev. No. MAC Report E790
Date: 10 August 1966