

SEQUENTIAL COPY

NO. 030

# FLIGHT HANDBOOK SUPPLEMENT

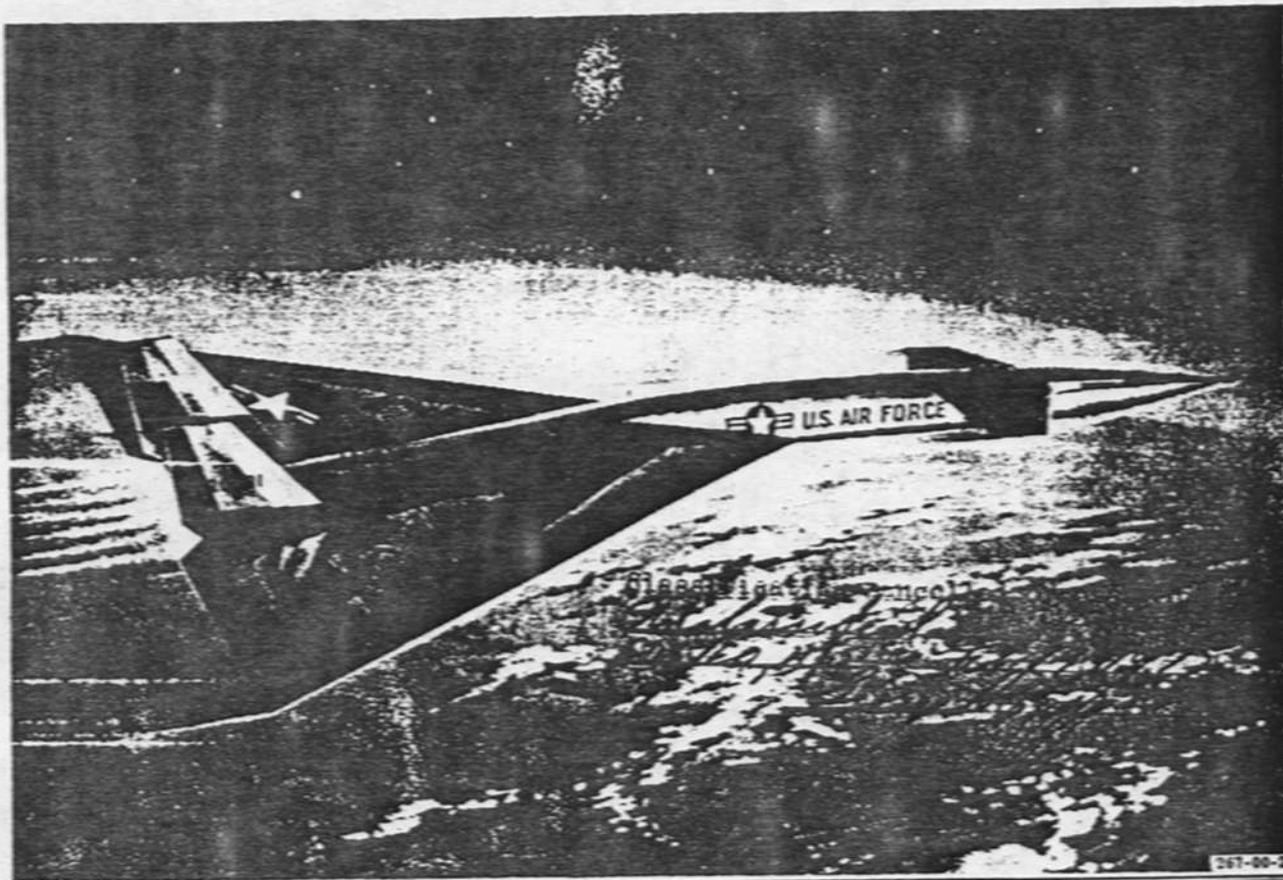
(TITLE UNCLASSIFIED)

USAF SERIES

## **XB-70A**

AIRCRAFT

CONTRACT AF33(600)-42058  
CONTRACT AF33(657)-15871



# CHANGE NOTICE

**LATEST CHANGED PAGES SUPERSEDE  
THE SAME PAGES OF PREVIOUS DATE**

Insert changed pages into basic  
publication. Destroy superseded pages.

Commanders are responsible for bringing this publication to the attention of all personnel cleared for operation of subject aircraft.

PUBLISHED UNDER AUTHORITY OF THE  
SECRETARY OF THE AIR FORCE

THIS PUBLICATION SUPPLEMENTS FHB-XB-70  
(FORMERLY T. O. 1B-70(X)A-1)

IN ADDITION TO SECURITY REQUIREMENTS WHICH MUST BE MET, THIS DOCUMENT IS SUBJECT TO SPECIAL EXPORT CONTROLS AND EACH TRANSMITTAL TO FOREIGN GOVERNMENTS OR FOREIGN NATIONALS MAY BE MADE ONLY WITH PRIOR APPROVAL OF THE AERONAUTICAL SYSTEMS (ASZV) WRIGHT-PATTERSON AIR FORCE BASE, OHIO.

NOTICE: This material contains information affecting the national defense within the meaning of the Espionage Laws, Title 18, U.S.C., Sections 793 and 794, and the transmission or revelation of its contents in any manner to an unauthorized person is prohibited by law.

Radio transmission, in the clear, of pertinent emergency operating instructions contained herein is authorized under emergency conditions.

70-1-00-24E

**30 SEPTEMBER 1964**  
CHANGED 15 FEBRUARY 1967

DOWNGRADED AT 1 YEAR INTERVALS;

DE [REDACTED]  
DOD DIR 5200.10

Reproduction for nonmilitary use of the information or illustrations contained in this publication is not permitted without specific approval of the issuing service. The policy for use of Classified Publications is established for the Air Force in AFR 205-1.

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

## LIST OF EFFECTIVE PAGES

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page.

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 118, CONSISTING OF THE FOLLOWING:

Page No.	Issue
*Title . . . . .	.15 Feb 67
*A . . . . .	.15 Feb 67
1 thru 11 . . . . .	.25 Mar 66
1-1 thru 1-12 Deleted . . . . .	.25 Mar 66
2-1 thru 2-5 . . . . .	Original
2-6 Blank . . . . .	Original
3-1 . . . . .	Original
3-2 . . . . .	.25 Jun 65
3-3 thru 3-4 . . . . .	Original
5-1 . . . . .	.25 Mar 66
*5-2 thru 5-3 . . . . .	.15 Feb 67
5-4 thru 5-5 . . . . .	.25 Mar 66
5-6 Blank . . . . .	.25 Mar 66
5-7 thru 5-8 Deleted . . . . .	.25 Mar 66
6-1 thru 6-8 Deleted . . . . .	.25 Mar 66
A-1 . . . . .	.25 Mar 66
A-2 Blank . . . . .	Original
A1-1 thru A1-2 Deleted . . . . .	.25 Mar 66
A2-1 thru A2-26 Deleted . . . . .	.25 Mar 66
A3-1 thru A3-10 Deleted . . . . .	.25 Mar 66
A4-1 thru A4-15 . . . . .	Original
A4-16 Blank . . . . .	Original
A5-1 thru A5-19 . . . . .	Original
A5-20 Blank . . . . .	Original
A6-1 thru A6-11 . . . . .	Original
A6-12 . . . . .	.25 Jun 65
A6-13 thru A6-15 . . . . .	Original
A6-16 . . . . .	.25 Jun 65
A6-17 thru A6-24 . . . . .	Original
A6-25 thru A6-34 . . . . .	.25 Jun 65
A6-35 . . . . .	Original
A6-36 Blank . . . . .	Original
A7-1 thru A7-5 . . . . .	Original
A7-6 Blank . . . . .	Original
A8-1 thru A8-8 . . . . .	Original
A9-1 thru A9-8 . . . . .	Original
A10-1 thru A10-24 Deleted . . . . .	.25 Mar 66
All-1 thru All-2 . . . . .	.25 Mar 66
All-3 thru All-6 Deleted . . . . .	.25 Mar 66

\*The asterisk indicates pages changed, added, or deleted by the current change.

SECTION II

NORMAL PROCEDURES

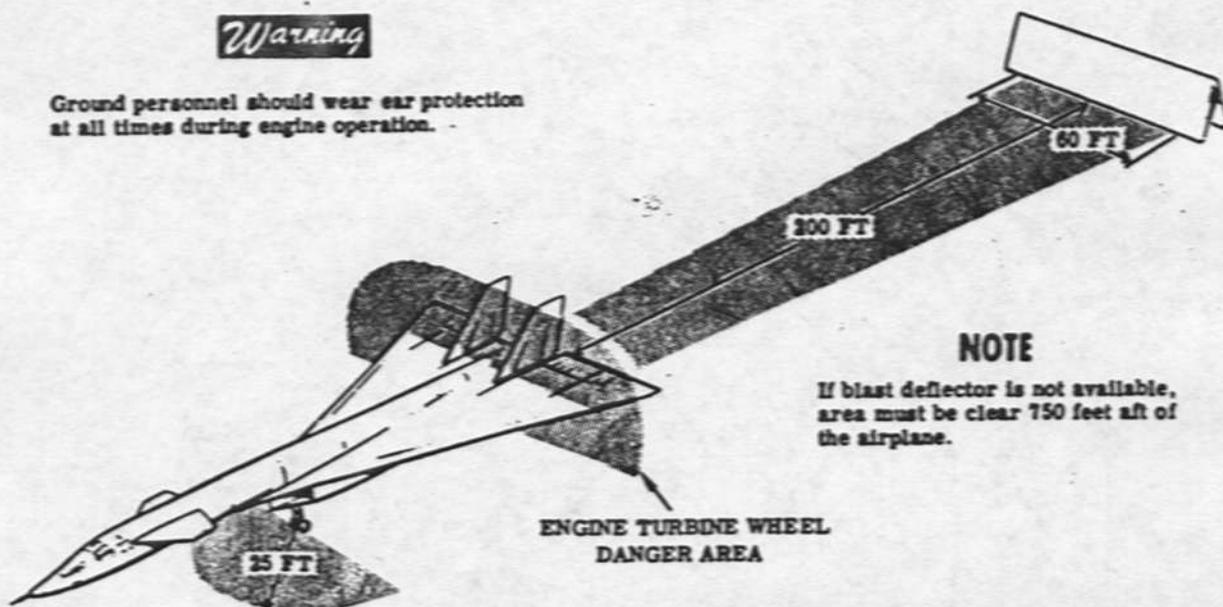
All Section II information is in the unclassified Flight Manual, T.O. 1B-70(X)A-1, except the following:

**DANGER AREAS**

ENGINE JET WAKE VELOCITIES AND TEMPERATURES

**Warning**

Ground personnel should wear ear protection at all times during engine operation.



**NOTE**

If blast deflector is not available, area must be clear 750 feet aft of the airplane.

		DISTANCE FROM NOZZLE - FEET				
		0	40	80	120	160
IDLE	VELOCITY (MPH)	275	75	35	15	10
	TEMPERATURE	550° F 388° C	220° F 104° C	150° F 68° C	120° F 49° C	100° F 38° C
MILITARY	VELOCITY (MPH)	1735	425	305	95	40
	TEMPERATURE	1600° F 871° C	450° F 232° C	300° F 149° C	200° F 93° C	140° F 60° C
MAXIMUM	VELOCITY (MPH)	2375	750	375	220	110
	TEMPERATURE	3310° F 1821° C	1070° F 576° C	670° F 354° C	400° F 204° C	260° F 127° C

8-70-1-12-11A

Figure 2-3 (Sheet 1 of 5)

SOUND PRESSURE LEVELS  
 (2000 - FT RADIUS)  
 6 ENGINES - IDLE THRUST

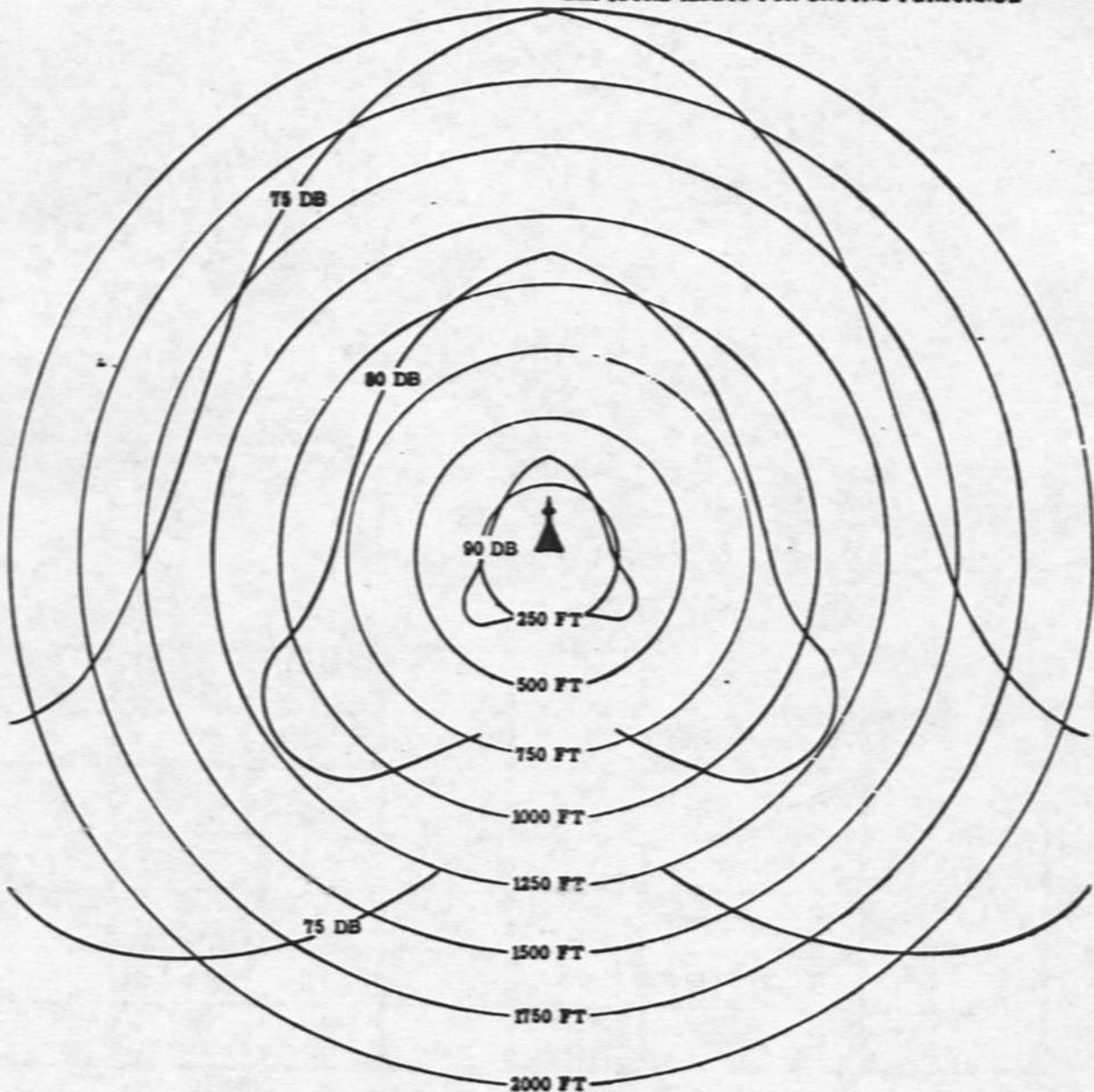
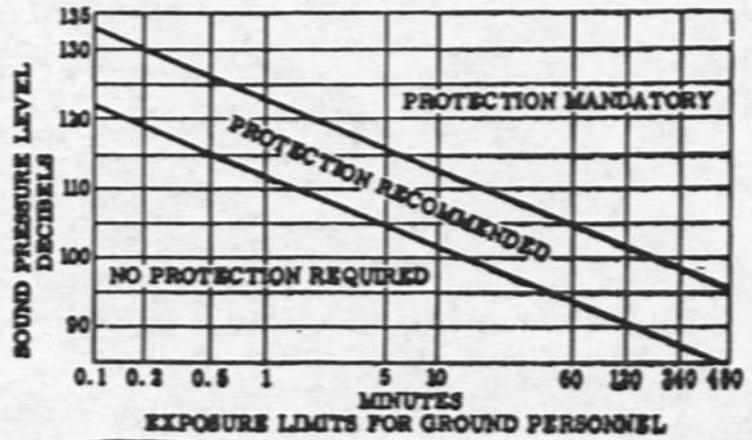
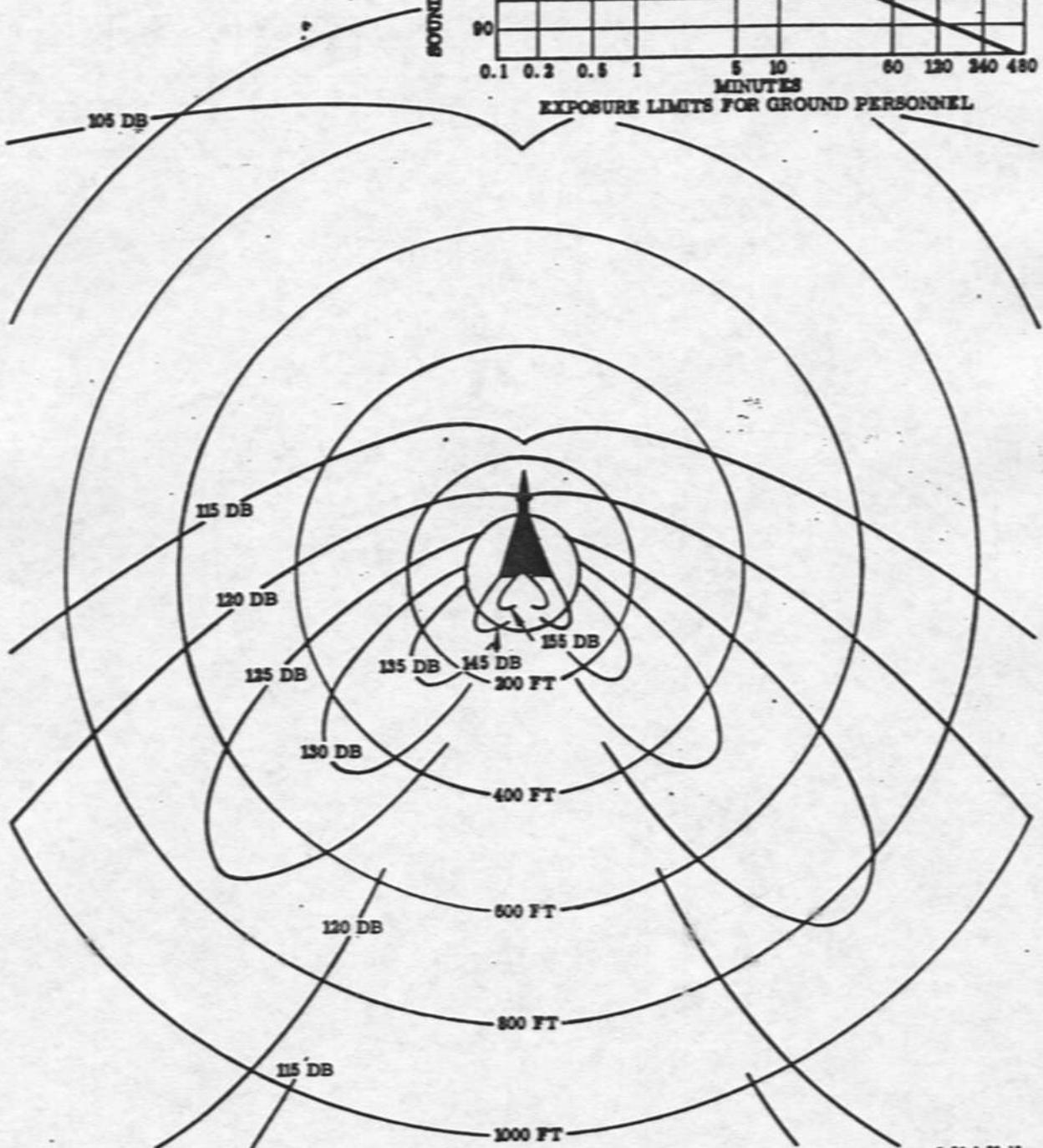
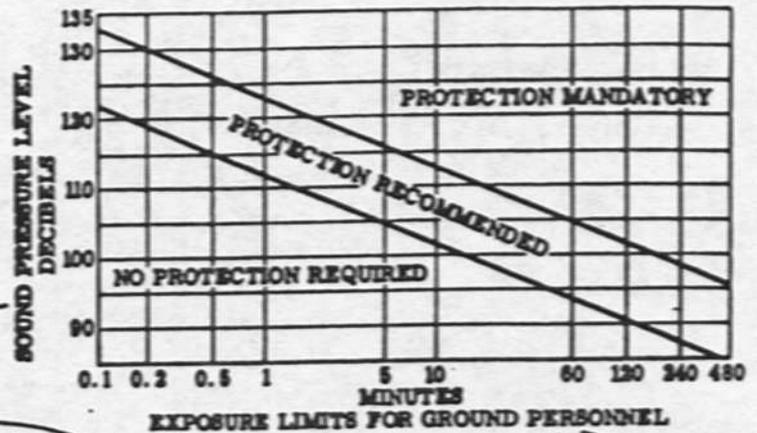


Figure 2-3 (Sheet 2 of 5)

SOUND PRESSURE LEVELS  
(1000 - FT RADIUS)  
6 ENGINES - MILITARY THRUST



8-70-1-13-13

Figure 2-3 (Sheet 3 of 5)

SOUND PRESSURE LEVELS  
(500 - FT RADIUS)  
6 ENGINES - MAXIMUM THRUST

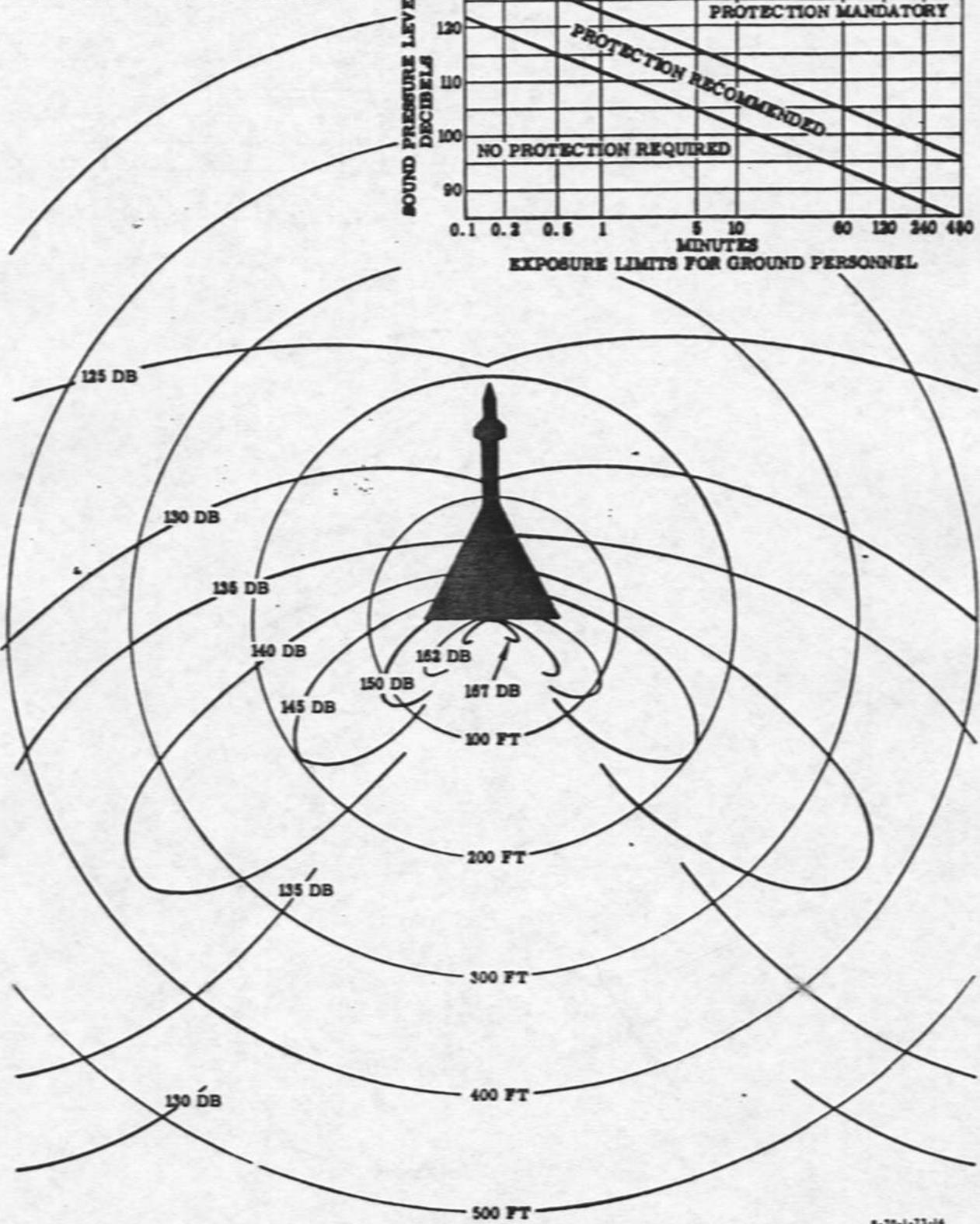
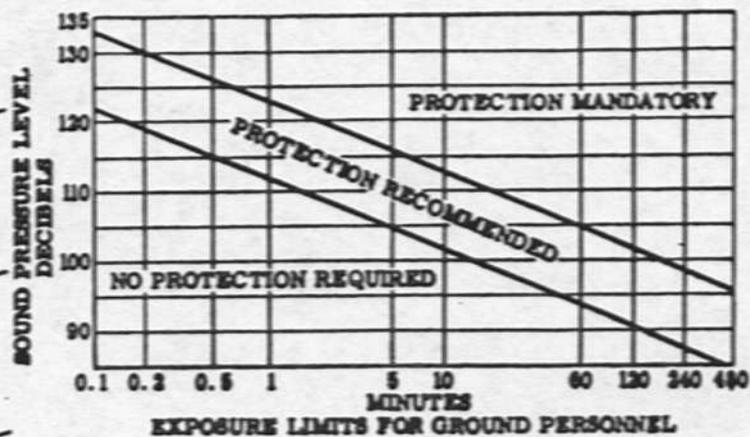
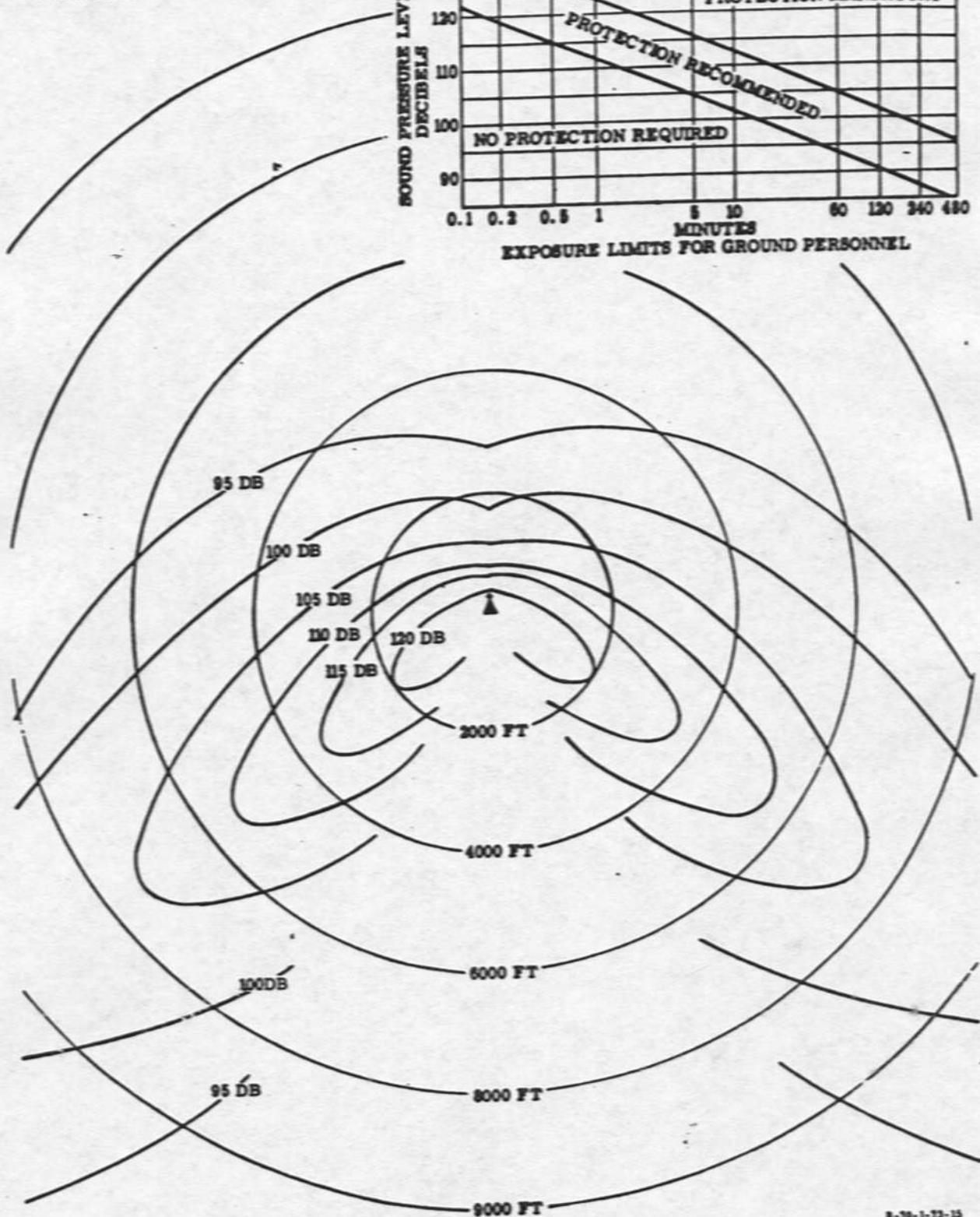
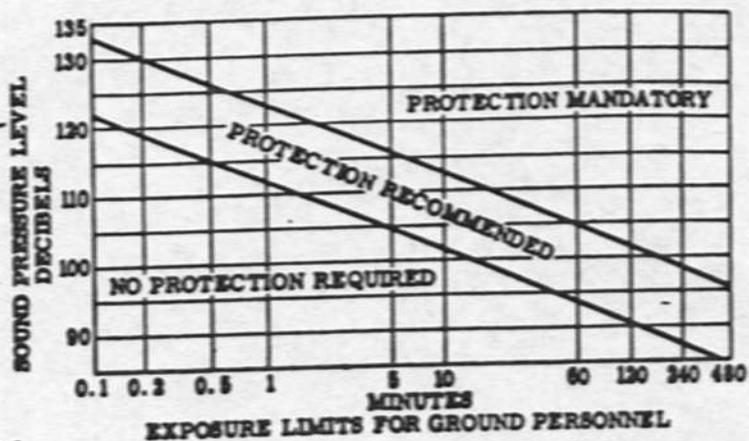


Figure 2-3 (Sheet 4 of 5)

SOUND PRESSURE LEVELS  
(9000 - FT RADIUS)  
6 ENGINES - MAXIMUM THRUST



2-70-1-73-15

Figure 2-3 (Sheet 5 of 5)

SECTION III  
EMERGENCY PROCEDURES

All information on emergency procedures is in the unclassified Flight Manual, T.O. 1B-70(X)A-1, except the following:

MAXIMUM GLIDE.

Normal descent speeds provide the maximum distance during an idle thrust descent, therefore, these speeds also should be used for obtaining the maximum glide potential. The descent speed schedules are given in Part 9 of Appendix I. Whether five or six engines are operating, there is very little difference in the glide capability. If engine shutdown occurs at an airspeed which is below the recommended descent speed, reduce altitude at a constant Mach number to obtain the desired speed. If engine shutdown occurs when the airspeed is above the recommended descent speed, attempt to maintain altitude until the recommended speed is reached, then descend.

In subsonic flight, the maximum glide ratio is about 11 to 1 for a gear-up, no-wind condition. This gives a glide distance of about 18 nautical miles for each 10,000 feet of altitude. (See figure 3-4.) For the maximum glide distance at a gross weight of 375,000 pounds, the best glide speed is 340 knots CAS. The best glide speed varies with gross weight and the following rule of thumb can be used to determine this speed for other gross weights. At gross weights higher than 375,000 pounds, increase the 340-knot glide speed by 5 knots for each 10,000 pounds above 375,000; at gross weights less than 375,000 pounds, decrease the 340-knot glide speed by 5 knots for each 10,000 pounds below 375,000. For example,

the best glide speed for a gross weight of 425,000 pounds is 365 knots CAS and the best glide speed for 325,000 pounds is 315 knots CAS.

When the landing gear is down, the increased drag reduces the maximum glide distance. If it is desired to extend the glide with the gear down in the vicinity of the base, the best gear-down glide speed is obtained by reducing the airspeed 60 knots IAS below the comparable gear-up glide speed. For example, at a gross weight of 300,000 pounds, the gear-up glide speed is 300 knots CAS, and the gear-down glide speed is 240 knots CAS. However, at heavy weights, use maximum gear-down speed as the gear-down glide speed.

EMERGENCY DESCENT OF AIRPLANE.

Because the normal descent speed of 340 knots CAS provides maximum air distance with minimum fuel consumption, it also can be used for emergency descent conditions if the known emergency does not require an immediate and relatively rapid descent. For maximum glide potential, this speed may be adjusted in the subsonic speed range. (Refer to "Maximum Glide" in this section.)

# RECOMMENDED LEVEL FLIGHT LOITER- 3 ENGINES OUT

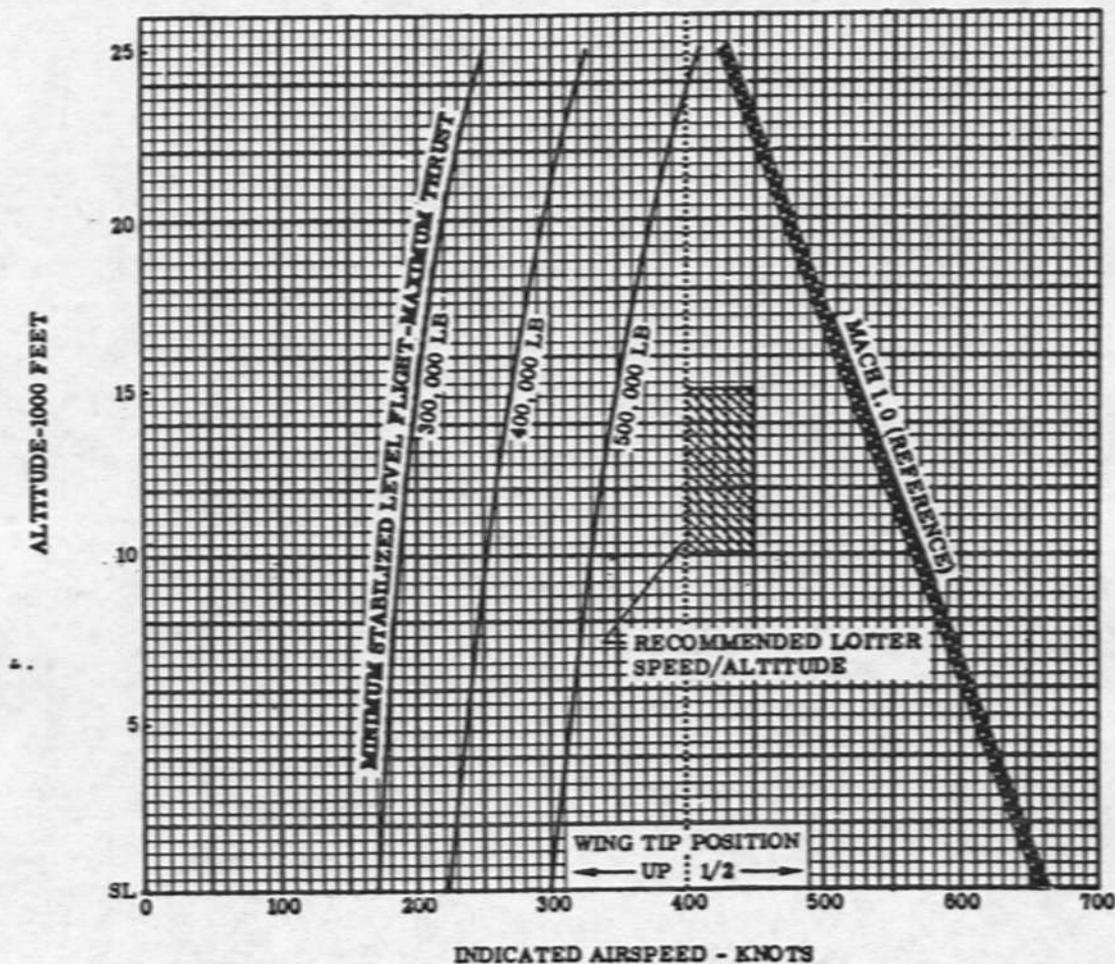


Figure 3-1

# MAXIMUM GLIDE DISTANCES

APPLICABLE FOR GROSS WEIGHT OF 375,000 POUNDS

6 ENGINES AT IDLE THRUST  
OR  
5 ENGINES AT IDLE THRUST AND 1 WINDMILLING

## RECOMMENDED GLIDE SPEED

GEAR UP	GEAR DOWN
<b>340</b>	<b>275</b>
KNOTS CAS	KNOTS CAS

## NOTE

- Glide distance with gear up is approximately 18 nautical miles per 10,000 feet descent.
- Glide distance with gear down is approximately one-half glide distance of clean airplane.
- Distances shown are for a wings-level glide from altitude to touchdown.
- For glide speeds at other gross weights, refer to "Maximum Glide" in this section.

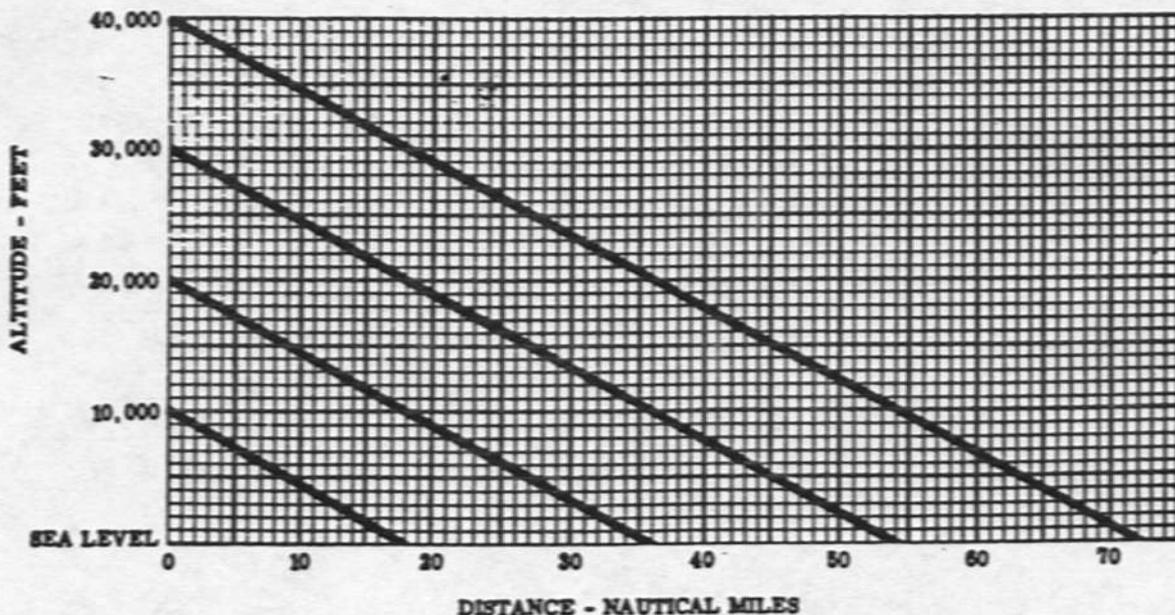


Figure 3-4

Rapid descents should be made at 450 knots IAS with all throttles at IDLE. Turning maneuvers may be used up to the maximum allowable load factor to aid speed and/or altitude decrease. During pressurization system emergencies with the emergency ram air scoop open, a 400-knot (minimum) descent allows the scoop to maintain the cabin altitude at or below 40,000 feet. The 450-knot speed is a sufficiently low airspeed to prevent exceeding the flight limits inadvertently during the descent. Also, this speed is low enough to prevent turbulent air from subjecting the airplane to high stress levels after the structure has been heated by supersonic flight. The choice of the descent procedure used depends on the particular emergency. To provide sufficient bleed air for the environmental systems, if the refrigeration switch is ON, advance the throttles of any two of the four inboard engines to obtain 87% rpm. If the throttles cannot be advanced, the refrigeration switch must be at OFF.

## NOTE

If landing cannot be made immediately, cruise at Mach 0.9 - 0.95 between 25,000 and 35,000 feet.

## CAUTION

Supersonic speeds must be monitored carefully during dives from a high altitude, and only relatively small nose-down attitudes may be used, because speed increases rapidly and the Mach number limit can be exceeded. (Familiarization flights at or near limit airspeed should include maneuvers that demonstrate this characteristic.)

## NOTE

Refer to the unclassified Flight Manual, T.O. 1B-70(X)A-1, for Section IV, Auxiliary Equipment.

SECTION V

OPERATING LIMITATIONS

All information on operating limitations is in the unclassified Flight Manual, T.O. 1B-70(X)A-1, except the following:

color divisions, and the exhaust temperature is in a higher temperature direction for the related temperature, the maximum continuous steady-state operating time is reduced to 10 minutes.

EXHAUST TEMPERATURE LIMITS.

The exhaust temperature limits are shown in figure 5-1.

GROUND START EXHAUST TEMPERATURE LIMITS.

NOTE

- The amount and duration of any engine overtemperature must be entered in the Form 781 (or equivalent).
- Because a changed combustor is used on some engines, different exhaust temperature limits apply, and, as a result, the engines are identified as "nominal EGT" or "derated EGT" engines. (Rated performance is met or exceeded by either nominal EGT or derated EGT engines.)

The exhaust temperature limits for ground starts are shown in figure 5-1. If the exhaust temperature climbs steadily past 680°C during a start, the throttle should be retarded to OFF. An accumulation of 10 start attempts during which the exhaust temperature exceeds 680°C requires engine removal for inspection. If the single occurrence maximum ground start exhaust temperature limit of 760°C is exceeded, the engine must be removed for inspection of the "hot section." Normal maximum exhaust temperature peak during ground starts should not exceed 500°C to 670°C in the first 10 seconds after engine light-off. (Conditions contributing to high exhaust temperature peaks during ground starts include: high ambient temperature, low light-off rpm, the start of the third engine in either inlet, and a normally high-temperature starting engine.)

The exhaust temperature limits are a function of the prevailing inlet total temperature. To provide a direct visual indication of this relationship, the exhaust temperature gage and the total temperature gage are marked with corresponding alternating green and yellow divisions. (See figure 5-1.) The proper temperature limit relationship for maximum continuous steady-state operation exists when the exhaust temperature gage pointer and the total temperature gage pointer are at the same relative position within the corresponding color division on the respective gages. For engines operating with normal control tolerance, the exhaust temperatures are expected to be about one color division width lower than the maximum continuous steady-state operating limit.) If the exhaust temperature and the total temperature are at opposite ends of the corresponding color division, and the exhaust temperature is at the high end, maximum continuous steady-state operation for this condition is reduced to one hour. If the pointer differential increases to one and one-half

(Deleted)

## INSTRUMENT MARKINGS

## NOTE

Refer to unclassified Flight Manual, T. O. 1B-70(X)A-1, for total temperature gage markings.



EXHAUST TEMPERATURE GAGE

## NOTE

ENGINE LIMITATIONS ARE BASED ON JP-5 OR JP-6 FUEL

DERATED EGT ENGINES

- 200°C TO 890°C CONTINUOUS STEADY STATE
- ▲ 680°C MAXIMUM GROUND START

## NOTE

- If exhaust temperature climbs steadily past 680° C during ground starts, retard throttle to OFF immediately.
- Single occurrence ground start exhaust temperature limit is 760° C.

- ▲ 836°C MAXIMUM CONTINUOUS STEADY STATE (MILITARY THRU MAXIMUM THRUST) FOR TOTAL TEMPERATURE OF 313°F AND ABOVE
- ▲ 890°C MAXIMUM CONTINUOUS STEADY STATE (MILITARY THRU MAXIMUM THRUST) FOR TOTAL TEMPERATURE OF 211°F AND BELOW
- ■ 836°C TO 890°C MAXIMUM CONTINUOUS STEADY STATE (MILITARY THRU MAXIMUM THRUST) FOR TOTAL TEMPERATURE BETWEEN 211°F AND 313°F (See table below for proper exhaust temperature-total temperature relationship.)
- ▲ 890°C TO 1150°C MAXIMUM TIME-LIMITED TRANSIENTS (See table below.)
- ▲ 1150°C MAXIMUM INSTANTANEOUS TRANSIENT

EXHAUST TEMPERATURE LIMITS (°C) VS TOTAL TEMPERATURE (°F)

TOTAL TEMP °F	TOTAL TEMP GAGE * EXHAUST TEMP GAGE	EXHAUST TEMPERATURE °C										
		MAXIMUM STEADY-STATE LIMITS †				MAXIMUM TRANSIENT LIMITS ‡ (APPLICABLE DURING AIR STARTS, A/B LIGHTS, STALLS, THROTTLE BURSTS, OR THROTTLE CHOPS.)						
		CONT	3 HR	1 HR	10 MIN	60 SEC	25 SEC	20 SEC	15 SEC	10 SEC	5 SEC	INSTANT
0 TO 211	■	890	898	904	912	912	912	950	1000	1050	1100	1150
211	■	890	898	904	912	912	912					
230	■	880	889	894	902	902	909					
258	■	868	875	880	888	888	908					
286	■	852	860	866	873	873	903					
313	■	836	845	850	858	858	900					
313 AND ABOVE	■	836	845	850	858	858	900	950	1000	1050	1100	1150

\* Total temperature gage markings from 157°F to 211°F not applicable to derated EGT engines.

† Before reaching temperature-time limits, retard throttle to maintain maximum continuous steady-state limit.

‡ If transient limits are exceeded, immediately retard throttle or shutdown engine to clear the overtemperature. Another transient operation maybe attempted, however if overtemperature persists, shut down engine.

NOMINAL EGT ENGINES



EXHAUST TEMPERATURE GAGE

## NOTE

The amount and duration of any engine overtemperature must be recorded in the Form 781 (or equivalent).

200°C TO 918°C CONTINUOUS STEADY STATE

680°C MAXIMUM GROUND START

## NOTE

- If exhaust temperature climbs steadily past 680° C during ground starts, retard throttle to OFF immediately.
- Single occurrence ground start exhaust temperature limit is 760° C.

836°C MAXIMUM CONTINUOUS STEADY STATE (MILITARY THRU MAXIMUM THRUST) FOR TOTAL TEMPERATURE OF 313°F AND ABOVE

918°C MAXIMUM CONTINUOUS STEADY STATE (MILITARY THRU MAXIMUM THRUST) FOR TOTAL TEMPERATURE OF 157°F AND BELOW

836°C TO 918°C MAXIMUM CONTINUOUS STEADY STATE (MILITARY THRU MAXIMUM THRUST) FOR TOTAL TEMPERATURE BETWEEN 157°F AND 313°F (See table below for proper exhaust temperature - total temperature relationship.)

918°C TO 1150°C MAXIMUM TIME-LIMITED TRANSIENTS (See table below.)

1150°C MAXIMUM INSTANTANEOUS TRANSIENT

EXHAUST TEMPERATURE LIMITS (°C) VS TOTAL TEMPERATURE (°F)

TOTAL TEMP °F	TOTAL TEMP GAGE EXHAUST TEMP GAGE	EXHAUST TEMPERATURE °C										
		MAXIMUM STEADY-STATE LIMITS §				MAXIMUM TRANSIENT LIMITS ¶ (APPLICABLE DURING AIR STARTS, A/B LIGHTS, STALLS, THROTTLE BURSTS, OR THROTTLE CHOPS.)						
		CONT	3 HR	1 HR	10 MIN	60 SEC	25 SEC	20 SEC	15 SEC	10 SEC	5 SEC	INSTANT
0 TO 157		918	926	932	940	940	940	950	1000	1050	1100	1150
157		918	926	932	940	940	940					
176		908	916	922	930	930	936					
203		894	903	908	916	916	929					
230		880	889	894	902	902	922					
258		866	875	880	888	888	915					
286		852	860	866	873	873	908					
313		836	845	850	858	858	900					
313		836	845	850	858	858	900	950	1000	1050	1100	1150
AND ABOVE												

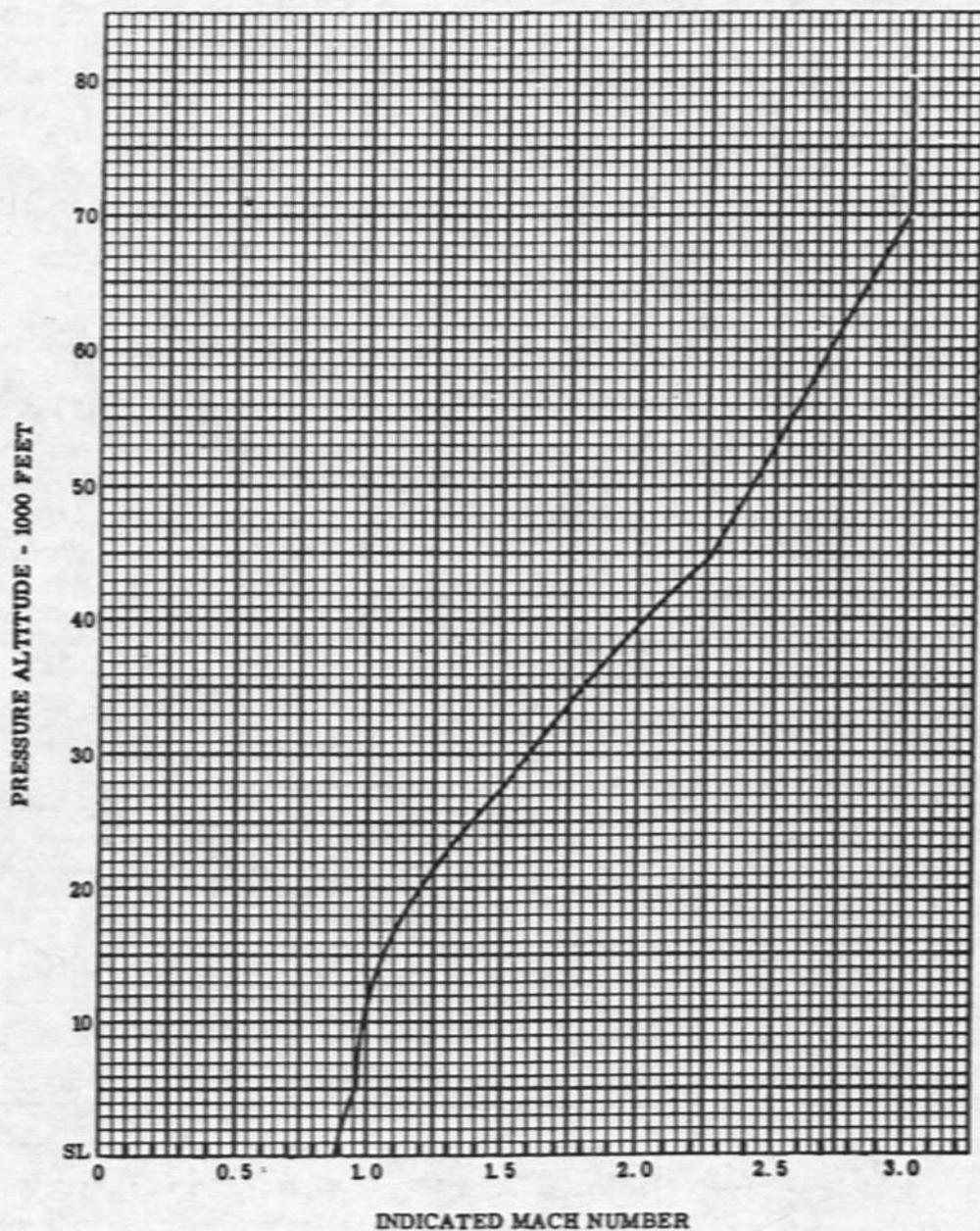
§ Before reaching temperature-time limits, retard throttle to maintain maximum continuous steady-state limit.

¶ If transient limits are exceeded, immediately retard throttle or shutdown engine to clear the overtemperature. Another transient operation maybe attempted, however if overtemperature persists, shut down engine.

70-1-51-48

Figure 5-1 (Sheet 2 of 2)

# MAXIMUM ALLOWABLE AIRSPEED



**Warning**

Do not exceed 630 degrees F total temperature

Figure 5-6

AIRSPPEED LIMITATIONS.

It should be noted that the limit airspeeds are attainable in level flight, and under most conditions, at less than maximum engine thrust. Therefore, approach to these limits should be made with caution. During operation at or near these limits, avoid maneuvers that tend to rapidly increase speed, such as accelerations, dives, abrupt thrust increases, etc.

All airspeed limitations are given in the unclassified Flight Manual T.O. 1B-70(X)A-1 except the following:

MAXIMUM ALLOWABLE AIRSPEED.

The maximum allowable airspeed is expressed as a Mach number limit and/or as a total temperature limit, whichever applies. (See figure 5-6.)

MAXIMUM ALLOWABLE MACH NUMBER.

The maximum allowable Mach number is shown in figure 5-6.

NOTE

Mach number limit displayed by the maximum allowable Mach marker on the airspeed/Mach/safe-speed indicator is temperature corrected.

MAXIMUM ALLOWABLE TOTAL TEMPERATURE.

The maximum allowable total temperature is 630°F. However, transient operation is permitted for a 30-second temperature rise from 630°F to 675°F followed by a one minute steady-state temperature at 675°F, then a 30-second decrease in temperature to 630°F.

CAUTION

Do not exceed the maximum allowable total temperature because high temperature can damage the airplane structure and components.

ACCELERATION LIMITATIONS.

The limit load factors for all gross weights are as follows:

Symmetrical (straight pull-outs).....	1.6 G
Symmetrical (straight push-downs).....	0.4 G
Asymmetrical (rolling pull-outs).....	0.7 G to 1.33 G
With gear and/or flaps down.....	1.6 G

CAUTION

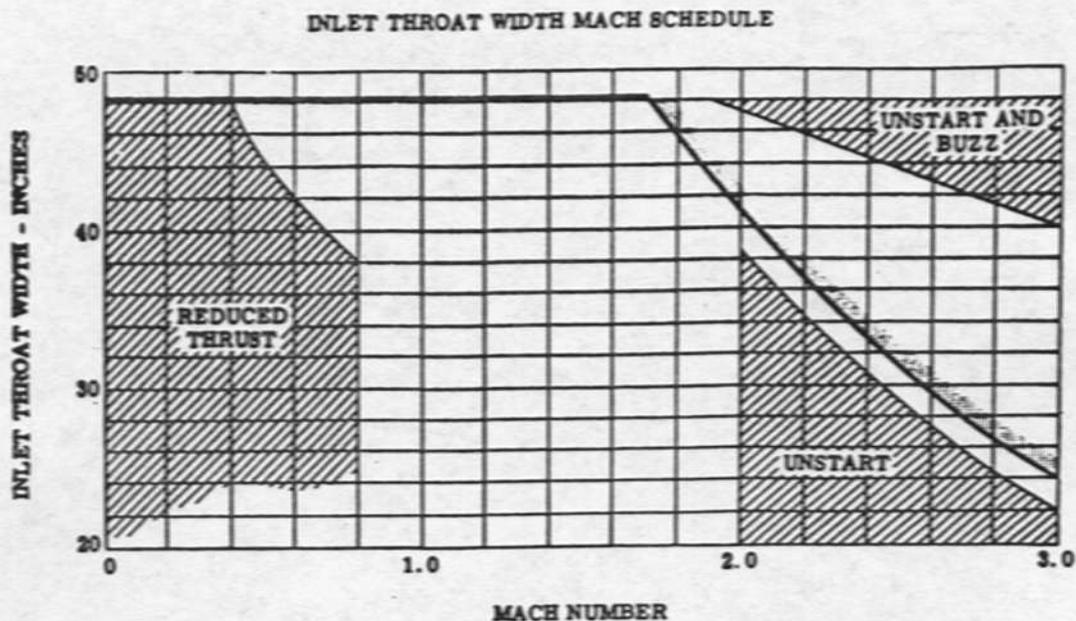
Negative-G flight is prohibited.

NOTE

Refer to the unclassified Flight Manual, T.O. 1B-70(X)A-1, for Section VI, Flight Characteristics, and Section VII, Systems Operation.

(Pages 5-7/5-8 and 6-1 through 6-8 deleted)

# OPERATING LIMITATIONS



### NOTE

- Inlet started above Mach 2.0.
- Manual operation band denoted by
- Caution area denoted by

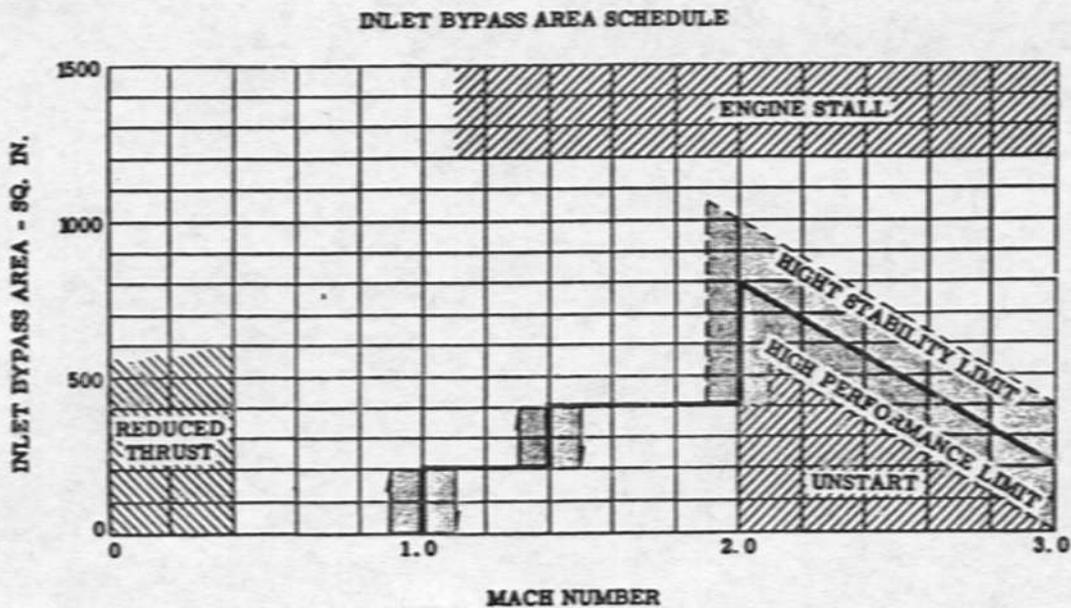


Figure 5-7 (Sheet 2 of 2)

8-70-1-81-218

APPENDIX I  
PERFORMANCE DATA

TABLE OF CONTENTS		PAGE
PART		
1	INTRODUCTION.....	*
2	TAKE-OFF.....	*
3	CLIMBOUT AFTER TAKE-OFF.....	*
4	ENROUTE CLIMB.....	A4-1
5	LEVEL FLIGHT ACCELERATION.....	A5-1
6	RANGE.....	A6-1
7	ENDURANCE.....	A7-1
8	LEVEL FLIGHT DECELERATION.....	A8-1
9	DESCENT.....	A9-1
10	APPROACH AND LANDING.....	*
11	MISCELLANEOUS CHARTS.....	All-1

\*Refer to unclassified Flight Manual,  
T.O. 1B-70(X)A-1, for this information.

(Pages A1-1 through A3-10 and A10-1 through A10-14 deleted)

PART 4

ENROUTE CLIMB

Underlined page numbers denote charts.

TABLE OF CONTENTS	PAGE	PAGE
Description.....	<u>A4-1</u>	Inlet Pressure Recovery Correction Factors - Supersonic Climb..... <u>A4-13</u>
Use of Charts.....	<u>A4-1</u>	Temperature Correction Factors - Subsonic Climb..... <u>A4-14</u>
Subsonic Climb - Military Thrust....	<u>A4-10</u>	Temperature Correction Factors - Supersonic Climb..... <u>A4-15</u>
Subsonic Climb - Maximum Thrust....	<u>A4-11</u>	
Supersonic Climb - Maximum Thrust..	<u>A4-12</u>	

DESCRIPTION.

Climb charts for both subsonic and supersonic recommended speed schedules are presented. The subsonic charts initiate at sea level and are shown for both Military and Maximum Thrust operation. The supersonic chart is shown for Maximum Thrust operation only and initiates at 25,000 feet altitude. Time and distance are plotted against gross weight with guide lines to show the reduction in gross weight due to the fuel used during climb. Cruise ceiling and best cruise altitude are superimposed on the graphs. The recommended climb speed schedule is tabulated on each chart. These charts are based on an ARDC Standard Day and with the inlet pressure recovery at the design level.

horizontal distance traveled during the climb. The difference between initial and final values for gross weight gives the fuel used during climb. Since time and distance are zero at sea level (25,000 feet for supersonic climb), the time required and distance traveled may be read directly opposite the final altitude for climbs starting at this point. Fuel used, however, must still be determined by the difference in gross weights.

SUBSONIC CLIMB CORRECTION FACTORS.

The time, distance, and fuel used, as read from the subsonic climb charts, must be corrected for both the inlet pressure recovery reduction and then for the temperature effects.

USE OF CHARTS.

All data is computed from the time the best climb speed is attained. To obtain the climb data desired, enter the proper climb chart at the gross weight and altitude corresponding to the start of climb. Note the time and distance at this point. From this initial point, trace a line parallel to the guide lines to intersect the desired altitude at the end of climb. Note the time, distance, and gross weight at this intersection. The difference between the initial and final values for time and distance gives, respectively, the time required to climb and the

NOTE

- To correct chart values (Military Thrust) for each 1 percent reduction in inlet pressure recovery, increase time and distance by 4 percent and increase fuel used by 2.5 percent.
- To correct values (Maximum Thrust) for each 1 percent reduction in inlet pressure recovery,

increase time and distance by 2.5 percent and increase fuel used by 1.3 percent.

- To correct chart values for temperature, refer to figure A4-8 and the following discussion.

To correct time and distance for temperature, enter the proper chart (Maximum Thrust or Military Thrust) on the subsonic climb temperature correction factors chart at the given temperature. Move up vertically to the line representing time. From this point, move left horizontally and read the multiplying factor. Multiply the time that has been corrected for inlet pressure recovery reduction by this factor. This is the time required to climb to the final altitude. Using the same chart and the same method, move up vertically to the line representing distance and obtain the multiplying factor. Then multiply the distance that has been corrected for inlet pressure recovery reduction by this factor. This is the distance required to climb to the final altitude.

To correct fuel required for temperature, enter the proper chart (Maximum Thrust or Military Thrust) on the subsonic climb temperature correction factors chart at the given temperature. Move up vertically to the line representing fuel. From this point, move left horizontally and read the multiplying factor. Multiply the fuel that has been corrected for inlet pressure recovery reduction by this factor. This is the fuel required to climb to the final altitude. Subtracting this fuel weight from the initial gross weight gives the final gross weight at the final altitude. To find the rate of climb, divide the altitude difference by the time required to climb.

#### SUPERSONIC CLIMB CORRECTION FACTORS.

For supersonic climb, the time, distance, and fuel used as read from the charts must be corrected for both the inlet pressure recovery reduction and then for the temperature effects.

#### NOTE

- To correct chart values for inlet pressure recovery reduction,

refer to figures A4-6 and A4-7 and the following discussion.

- To correct chart values for temperature, refer to figure A4-9 and the following discussion.

Initially find time and distance from figure A4-6 by entering the chart at the gross weight at the start of the climb. Move up vertically to the altitude at the start of the climb. From this point, move horizontally to the left and read the distance and time. To correct the time and distance chart values for inlet pressure recovery reduction, enter figure A4-7 at the determined average percent reduction in inlet pressure recovery obtained during the climb and move up vertically to the altitude line for the altitude at the start of the climb on the time and distance portion of the chart. From this point, move left horizontally and read the time and distance correction multiplying factor. Multiply the time and distance obtained from figure A4-6 by these factors and record the results. Return to figure A4-6 and enter the chart again at the altitude and gross weight at the start of the climb. Move up parallel to the guide lines to the altitude at the end of the climb. Then move horizontally to the left and read the distance and time. To correct these values for inlet pressure recovery reduction, again enter figure A4-7 at the average percent reduction in inlet pressure recovery obtained during the climb and move up vertically to the altitude line for the altitude at the end of the climb on the time and distance portion of the chart. From this point, move left horizontally and read the time and distance correction multiplying factor. Multiply the new time and distance obtained from figure A4-6 by these new factors. Subtract the two time and distance values to get the time and distance required to climb to the final altitude with the given reduced inlet pressure recovery.

To correct fuel used for inlet pressure recovery reduction, first trace a line parallel to the guide lines from the initial gross weight and altitude point on figure A4-6 down to the gross weight scale.

Subtract the initial gross weight from the gross weight read at this intersection. Then, enter figure A4-7 at the given reduction in inlet pressure recovery. Determine the fuel correction multiplying factor for the altitude at start of climb in the same manner as for the time and distance correction multiplying factor. Multiply the gross weight difference by this factor and record the result. Return to figure A4-6 and from the intersection with the final altitude of the line previously traced parallel to the guide lines (for time & distance determinations), project a line down vertically to the gross weight scale. Subtract this gross weight from the gross weight obtained by the intersection of the traced line with the gross weight scale. Again, enter figure A4-7 as before and determine the fuel correction multiplying factor at the final altitude. Multiply the gross weight difference just determined by this factor. From this value subtract the value determined from the previous multiplication. The difference is the fuel used during climb for the airplane operating with the given reduced inlet pressure recovery.

During part of a supersonic climb, the reduction in inlet pressure recovery from the design level may be much greater than during another part. For example, at Mach 2.0, the inlet is deliberately started by significantly increasing the bypass area which is accompanied by a greater reduction in inlet pressure recovery. It is best to first determine the time, distance, and fuel for a supersonic climb to Mach 2.0 and 40,000 feet for the applicable pressure recovery reduction in the manner just described. Then, in the same manner, determine the time, distance, and fuel from Mach 2.0 and 40,000 feet to the end Mach number and altitude using an average reduction in pressure recovery for this range. Add the two increments of time, distance, and fuel to obtain the total time, distance, and

fuel for the supersonic climb to the final altitude uncorrected for temperature.

To correct fuel required for temperature, enter the supersonic climb temperature correction factors chart at the proper temperature. Move up vertically to the line representing the final altitude on the fuel portion of the chart. From this point, move left horizontally and read the multiplying factor. Multiply the fuel that has been corrected for inlet pressure recovery reduction by this factor. This is the fuel required to climb to the final altitude. Subtracting this fuel weight from the initial gross weight gives the final gross weight at the final altitude. To find the rate of climb, divide the altitude difference by the time required to climb.

To correct time and distance for temperature, enter the supersonic climb temperature correction factors chart at the proper temperature. Move up vertically to the line representing the final altitude on the time and distance portion of the chart. From this point, move left horizontally and read the multiplying factor. Multiply the time and distance that has been corrected for inlet pressure recovery reduction by this factor. This is the time and distance required to climb to the final altitude.

#### SAMPLE PROBLEM - SUBSONIC CLIMB.

##### GIVEN:

1. Initial gross weight..360,000 pounds
2. Initial altitude.....20,000 feet
3. Final altitude.....35,000 feet
4. Climb.....Subsonic
5. Thrust setting.....Military Thrust

# SUBSONIC CLIMB

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MILITARY THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

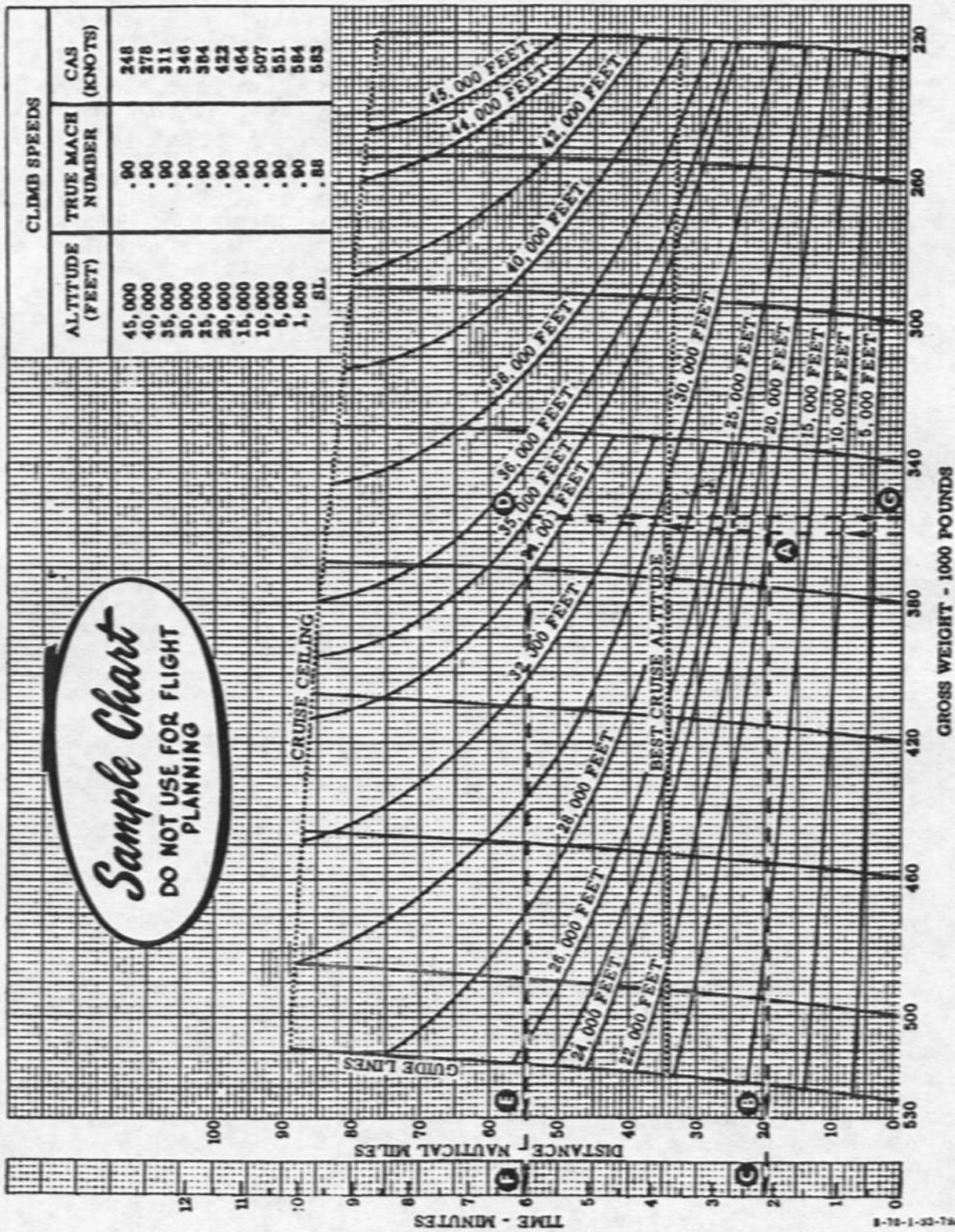


Figure A4-1

FIND:

1. Distance traveled during climb, and time required to climb to 35,000 feet
2. Final gross weight, fuel, and rate of climb required to climb to 35,000 feet

SOLUTION - DISTANCE TRAVELED AND TIME REQUIRED.

Enter figure A4-1 at the gross weight of 360,000 pounds and move up vertically to 20,000 feet (point A). Note the distance as 19.6 nautical miles (point B) and the time as 2.1 minutes (point C) on the scales to the left side of the chart. Then move up from point A, parallel to the guide lines, to intersect the line representing 35,000 feet (point D). Note the distance reading of 54.1 nautical miles (point E) and the time reading of 6 minutes (point F). Subtracting 19.6 nautical miles from 54.1 nautical miles gives 34.5 nautical miles, the horizontal distance traveled during the climb, uncorrected for inlet pressure recovery reduction and temperature. Subtracting 2.1 minutes from 6 minutes gives 3.9 minutes, the time required to climb to 35,000 feet, uncorrected for inlet pressure recovery reduction and temperature.

SOLUTION - FINAL GROSS WEIGHT, FUEL REQUIRED, AND RATE OF CLIMB.

Move down vertically from point D to the base of the chart and read 355,500 pounds (point G), the final gross weight. Subtracting 355,500 pounds from 360,000 pounds gives 4500 pounds, the amount of fuel used during the climb, uncorrected for inlet pressure recovery reduction and temperature.

Rate of climb is determined by dividing the difference between initial and final altitude by the time required to climb. Therefore, rate of climb uncorrected for inlet pressure recovery reduction and temperature is:

$$\frac{35,000 - 20,000}{3.9} = \frac{15,000}{3.9} = 3850 \text{ fpm}$$

SAMPLE PROBLEM - SUPERSONIC CLIMB.

GIVEN:

1. Initial gross weight.....410,000 pounds
2. Initial altitude...25,000 feet
3. Final altitude.....Mach 3.0 cruise
4. Climb.....Supersonic
5. Thrust setting.....Maximum Thrust
6. Inlet pressure recovery reduction.....3 percent to Mach 2.0 and 40,000 feet.  
6 percent to 12 percent (9 percent average) from Mach 2.0 and 40,000 feet to Mach 3.0 cruise altitude.
7. Outside air temperature.....Average 10°F higher than ARDC standard.

FIND:

1. Distance, time, and fuel required to climb from 25,000 feet to Mach 3.0 cruise altitude, corrected for inlet pressure recovery reduction and temperature effects.
2. Final gross weight and average rate of climb to Mach 3.0 cruise altitude, corrected for inlet pressure recovery reduction and temperature effects.

SOLUTION - DISTANCE, TIME, AND FUEL REQUIRED.

Enter figure A4-2 at the gross weight of 410,000 pounds at 25,000 feet (point A). Since the supersonic climb chart begins at 25,000 feet, calculation of

# SUPERSONIC CLIMB

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

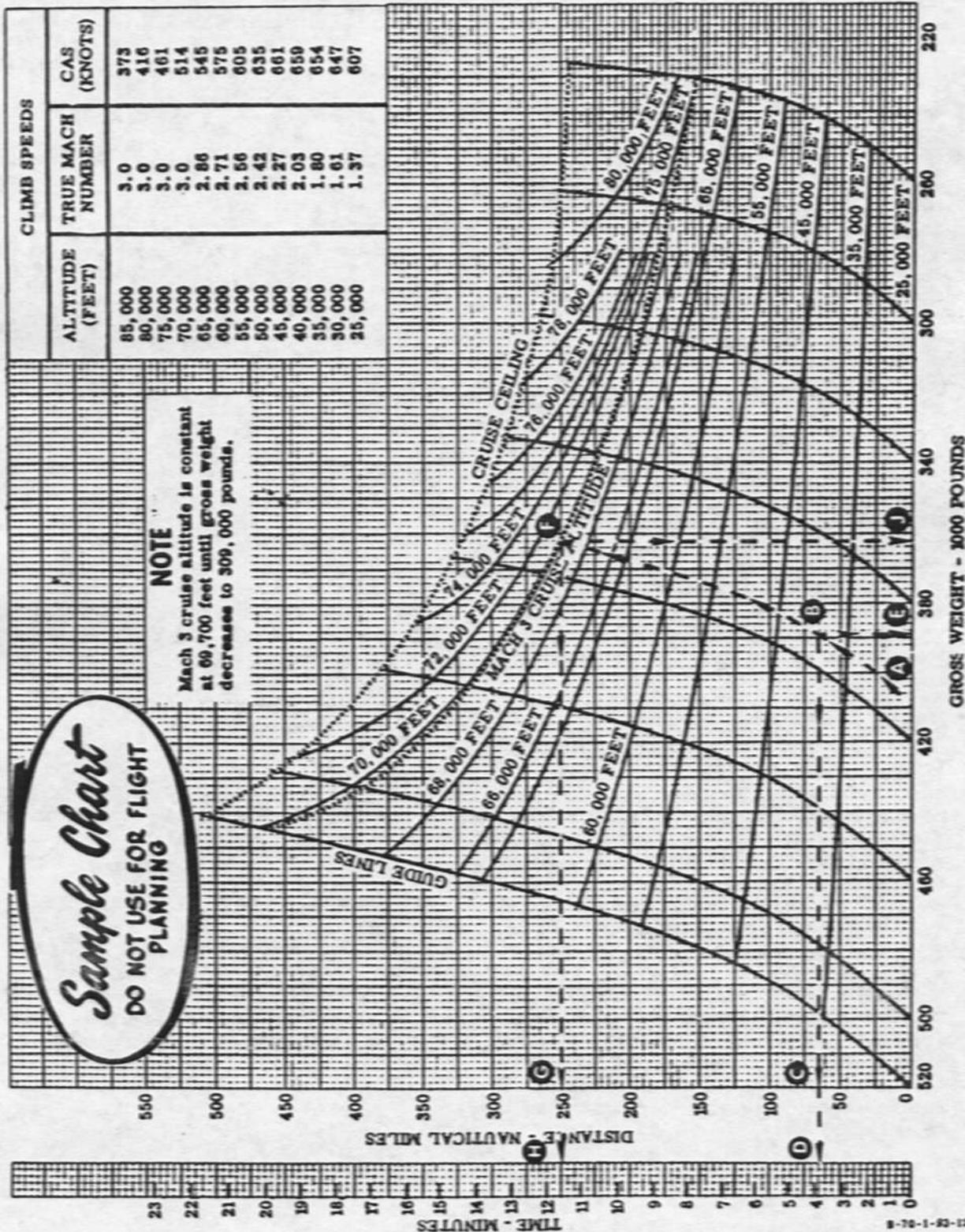


Figure A4-2

distance, time and fuel increments begins from zero. From point A follow the guide lines up to 40,000 feet (point B). Move left horizontally and note the distance as 65 nautical miles (point C) and the time as 3.9 minutes (point D).

Enter figure A4-3 at the 3 percent reduction in inlet pressure recovery (point A). Move up from point A on the time and distance chart and intersect the line marked 40,000 feet (point B). Move horizontally to the left and note the correction factor as 1.20 (point C).

Multiplying the previously determined distance (65 nautical miles) and time (3.9 minutes) by this factor gives 78 nautical miles and 4.68 minutes, the distance and time required to climb from 25,000 feet to 40,000 feet with an inlet pressure recovery reduction of 3 percent.

Return to figure A4-2, and from point B move downward vertically to the gross weight scale and read a gross weight of 389,000 pounds (point E). Subtracting 389,000 pounds from 410,000 pounds gives 21,000 pounds, the fuel used if the airplane operates at the design level of inlet recovery.

Again, enter figure A4-3 at the inlet recovery reduction of 3 percent (point D) and move up on the fuel chart to intersect the line marked 40,000 feet (point E). Move horizontally to the left and note the correction factor as 1.183 (point F). Multiplying 21,000 pounds by 1.183 gives 24,850 pounds, which is the fuel required to climb from 25,000 feet to 40,000 feet with an inlet pressure recovery reduction of 3 percent.

The distance, time, and fuel required to climb from 40,000 feet to 70,000 feet (Mach 3.0 cruise altitude) are obtained as follows. Enter figure A4-3 at the average inlet pressure recovery reduction of 9 percent (point G). Move up on the time and distance chart to intersect the line marked 40,000 feet (point H). Move horizontally to the left and note the correction factor as 1.965 (point J). Return to figure A4-2 and the intersection point B which gives 65 nautical miles and 3.9 minutes,

the values for climb to 40,000 feet if the airplane is operated at the design level of the inlet pressure recovery chart.

Multiplying 65 nautical miles and 3.9 minutes by 1.965 gives 128 nautical miles and 7.66 minutes which is the distance and time required to climb from 25,000 feet to 40,000 feet with the airplane operating at an average inlet pressure recovery reduction of 9 percent.

From point B on figure A4-2, follow the guide lines to intersect the Mach 3.0 cruise altitude line (point F), and note that the cruise altitude is 70,000 feet. Move horizontally to the left and note the distance as 250 nautical miles (point G), and the time as 11.6 minutes (point H). This is the distance and time required for the climb from 25,000 feet to 70,000 feet (Mach 3.0 cruise altitude) if the airplane operates at the design inlet pressure recovery.

Enter figure A4-3 and move up from point G (9 percent) to 70,000 feet on the time and distance chart (point K). Move horizontally to the left and note the correction factor as 1.6 (point L).

Multiplying 250 nautical miles and 11.6 minutes by 1.6 gives 400 nautical miles and 18.55 minutes which is the distance and time required to climb from 25,000 feet to 70,000 feet if the airplane operates at an average inlet pressure recovery reduction of 9 percent.

Subtracting the distance and time required to climb from 25,000 feet to 40,000 feet at 9 percent reduction in pressure recovery (128 nautical miles and 7.66 minutes) from the distance and time to climb from 25,000 feet to 70,000 feet (400 nautical miles and 18.55 minutes) at 9 percent reduction gives 272 nautical miles and 10.89 minutes which is the distance and time to climb from 40,000 feet to 70,000 feet with an average inlet pressure recovery reduction of 9 percent.

# INLET PRESSURE RECOVERY CORRECTION FACTORS - SUPERSONIC CLIMB

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

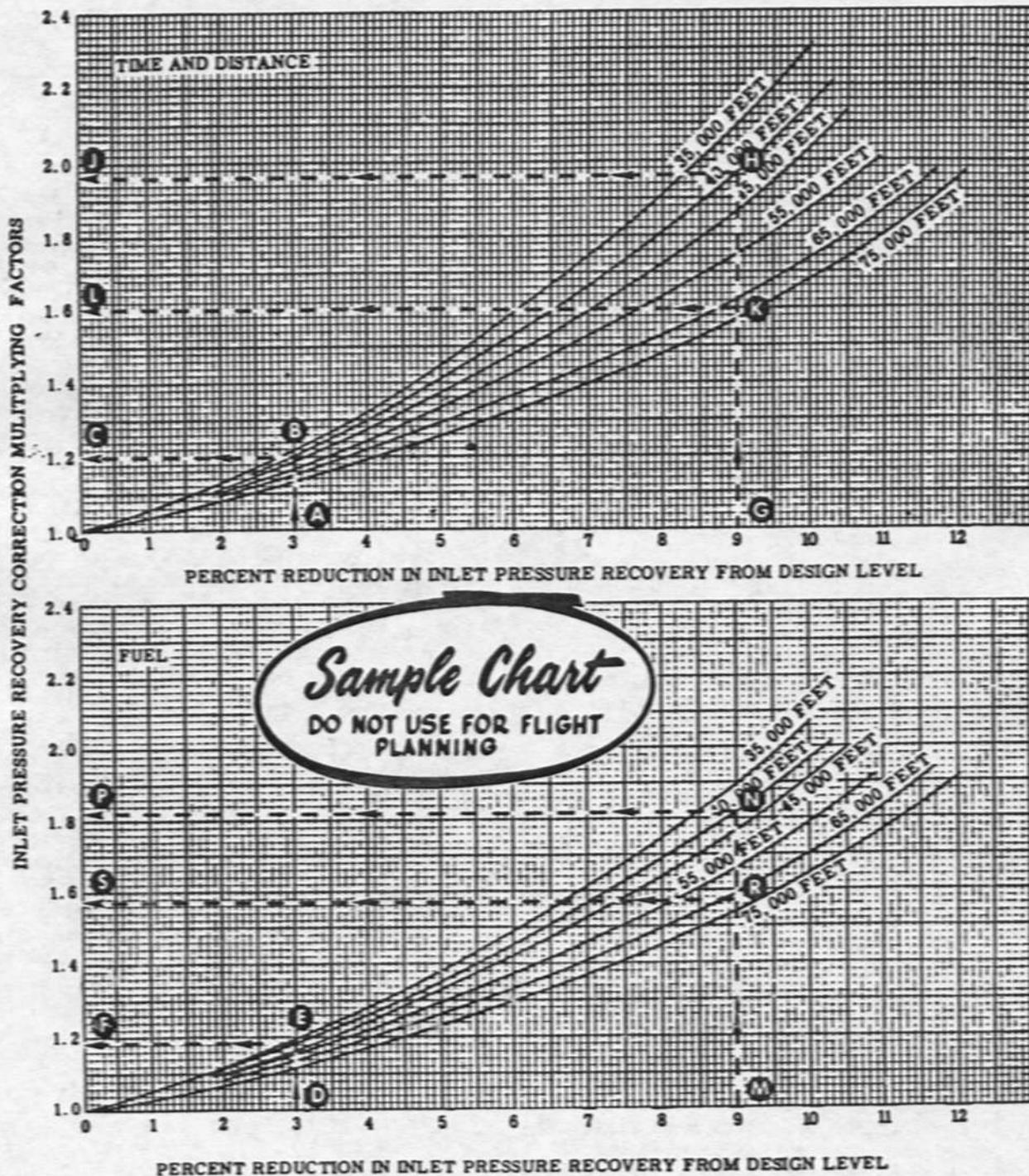


Figure A4-3

To obtain the fuel from 40,000 feet to 70,000 feet, enter figure A4-3 at the average inlet pressure recovery reduction of 9 percent (point M). Move up vertically on the fuel chart to intersect the 40,000 feet line (point N). Move horizontally to the left and note the fuel correction factor as 1.82 (point P). From a previous calculation, the fuel required to climb from 25,000 feet to 40,000 feet, if the airplane operates at the design level of inlet pressure recovery, was determined to be 21,000 pounds.

Therefore, multiplying 21,000 pounds by the fuel correction factor 1.82 gives 38,200 pounds which is the fuel required to climb from 25,000 feet to 40,000 feet with an average inlet pressure recovery of 9 percent.

From point F on figure A4-2, move downward vertically to intersect the gross weight scale and read a gross weight of 362,000 pounds (point J).

Subtracting 362,000 pounds from 410,000 pounds gives 48,000 pounds, which is the fuel required to climb from 25,000 feet to 70,000 feet if the airplane operates at the design inlet pressure recovery.

Enter figure A4-3 and move up from point M (9 percent) to 70,000 feet on the fuel chart (point R). Move horizontally to the left and note the fuel correction factor as 1.57 (point S). Multiplying 48,000 pounds by 1.57 gives 75,400 pounds which is the fuel required to climb from 25,000 feet to 70,000 feet with an average inlet pressure recovery reduction of 9 percent.

Subtracting 38,200 pounds from 75,400 pounds gives 37,200 pounds which is the fuel required to climb from 40,000 feet to 70,000 feet with an average inlet pressure recovery reduction of 9 percent.

The total distance, time, and fuel required to climb from 25,000 feet to 70,000 feet for the given conditions of inlet pressure recovery are determined as follows. Adding the respective values of distance, time, and fuel required to climb from 25,000 feet to 40,000 feet at 3 percent reduction (78 nautical miles;

4.68 minutes; and 24,850 pounds) to those values for climb from 40,000 feet to 70,000 feet at an average of 9 percent reduction (272 nautical miles; 10.89 minutes; and 37,200 pounds) gives a total of 350 nautical miles; 15.57 minutes; and 62,050 pounds, uncorrected for temperature effects.

To correct the preceding distance, time, and fuel required values for temperature, enter figure A4-9 at 10°F. Move up vertically on the time and distance chart to the line marked 65,000 feet and above. Move horizontally to the left and note the time and distance correction factor as 1.13. Following the same procedure on the fuel chart, note the fuel correction as 1.10.

Multiplying 350 nautical miles by 1.13 gives 396 nautical miles; multiplying 15.57 minutes by 1.13 gives 17.60 minutes; and multiplying 62,050 pounds by 1.1 gives 68,200 pounds. These values are the distance time and fuel required, corrected for both inlet pressure recovery reduction and temperature effects, to climb from 25,000 feet to 70,000 feet.

#### SOLUTION - FINAL GROSS WEIGHT AND AVERAGE RATE OF CLIMB.

Subtracting the total fuel used (68,200 pounds) from the initial gross weight (410,000 pounds) gives the final gross weight of 341,800 pounds. Dividing the altitude difference between initial (25,000 feet) and final (70,000 feet) altitudes by the time required to climb (17.6 minutes) gives 2560 feet per minute, the average rate of climb.

# SUBSONIC CLIMB

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MILITARY THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

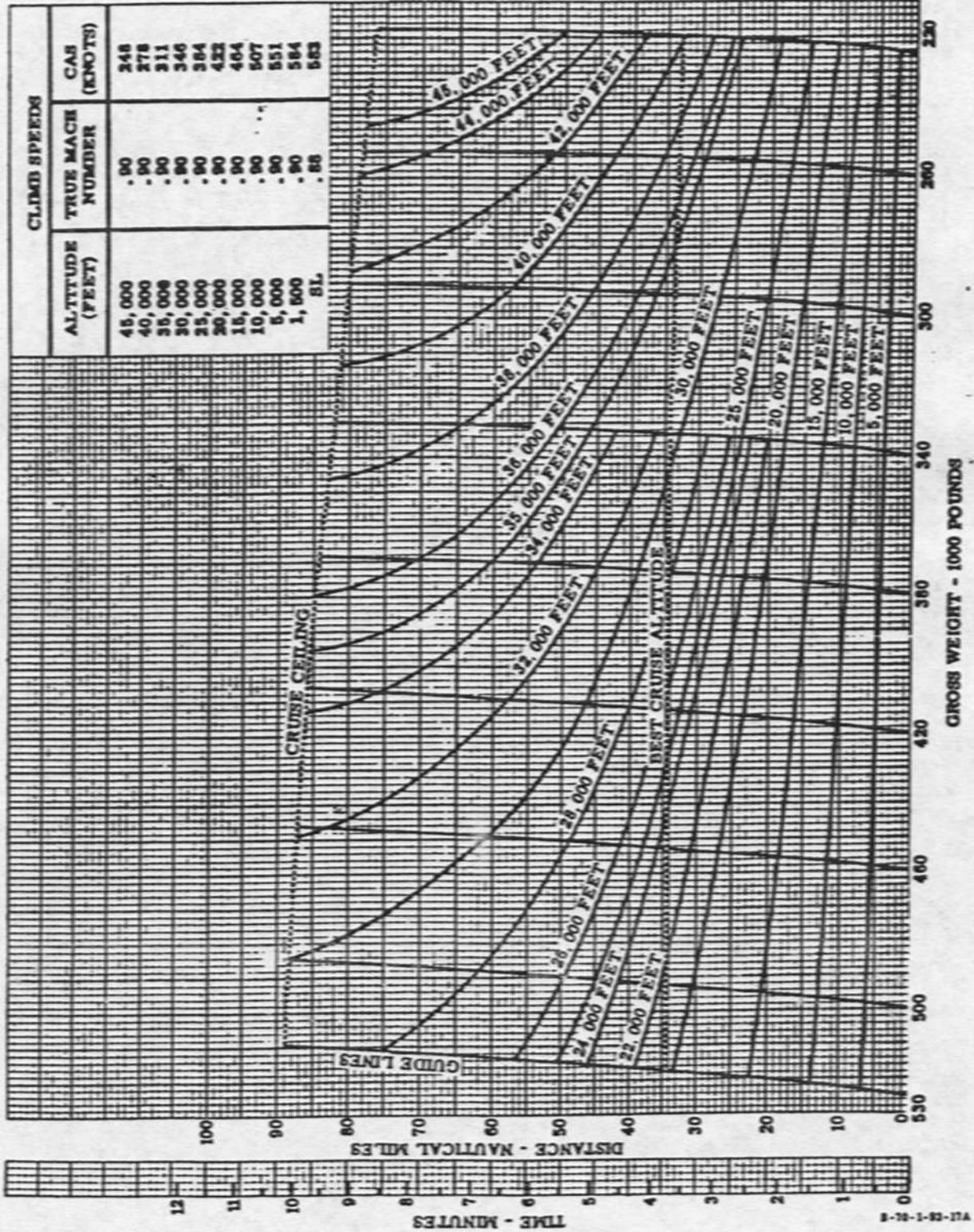


Figure A4-4

# SUBSONIC CLIMB

6 ENGINES, MAXIMUM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

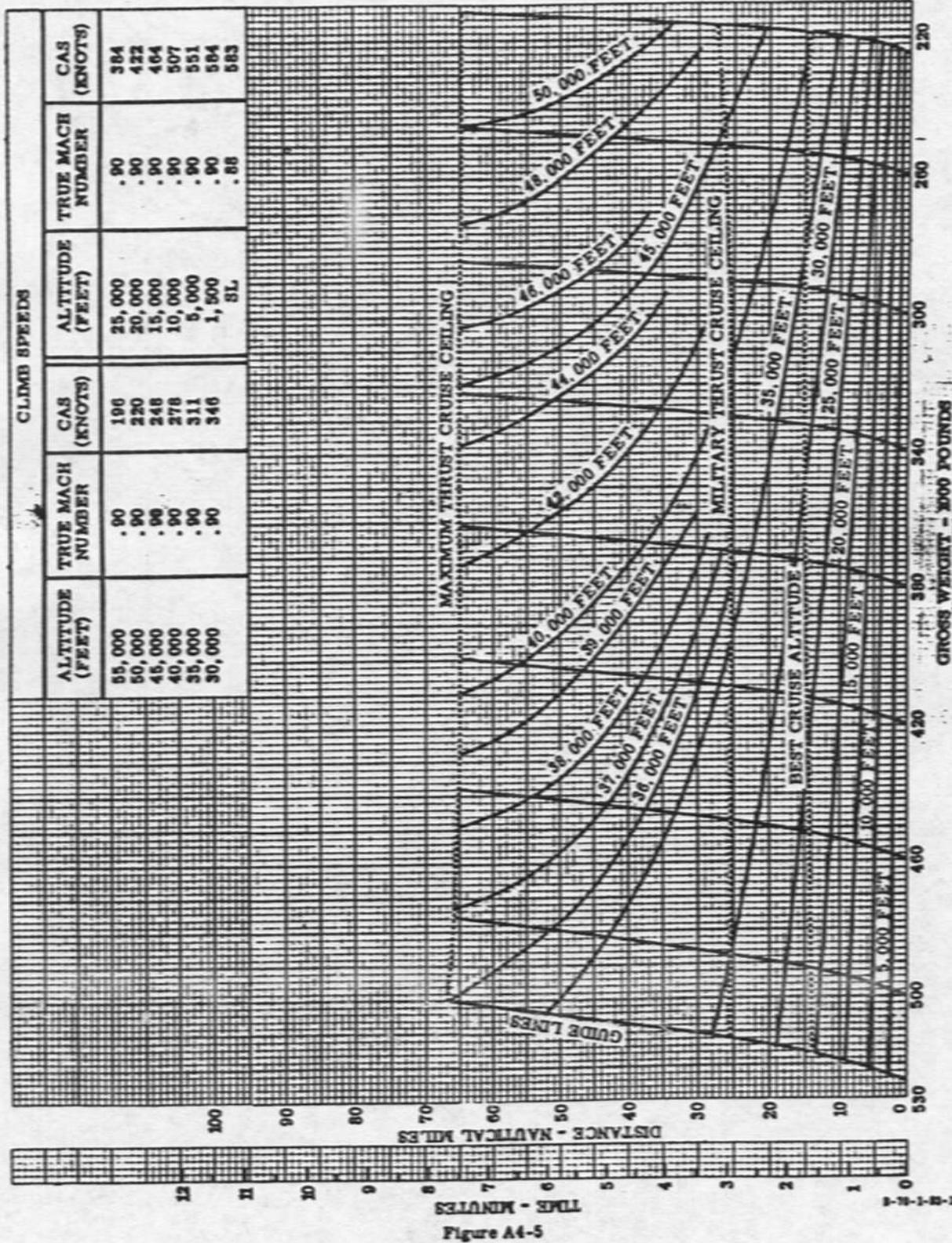


Figure A4-5

# SUPERSONIC CLIMB

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

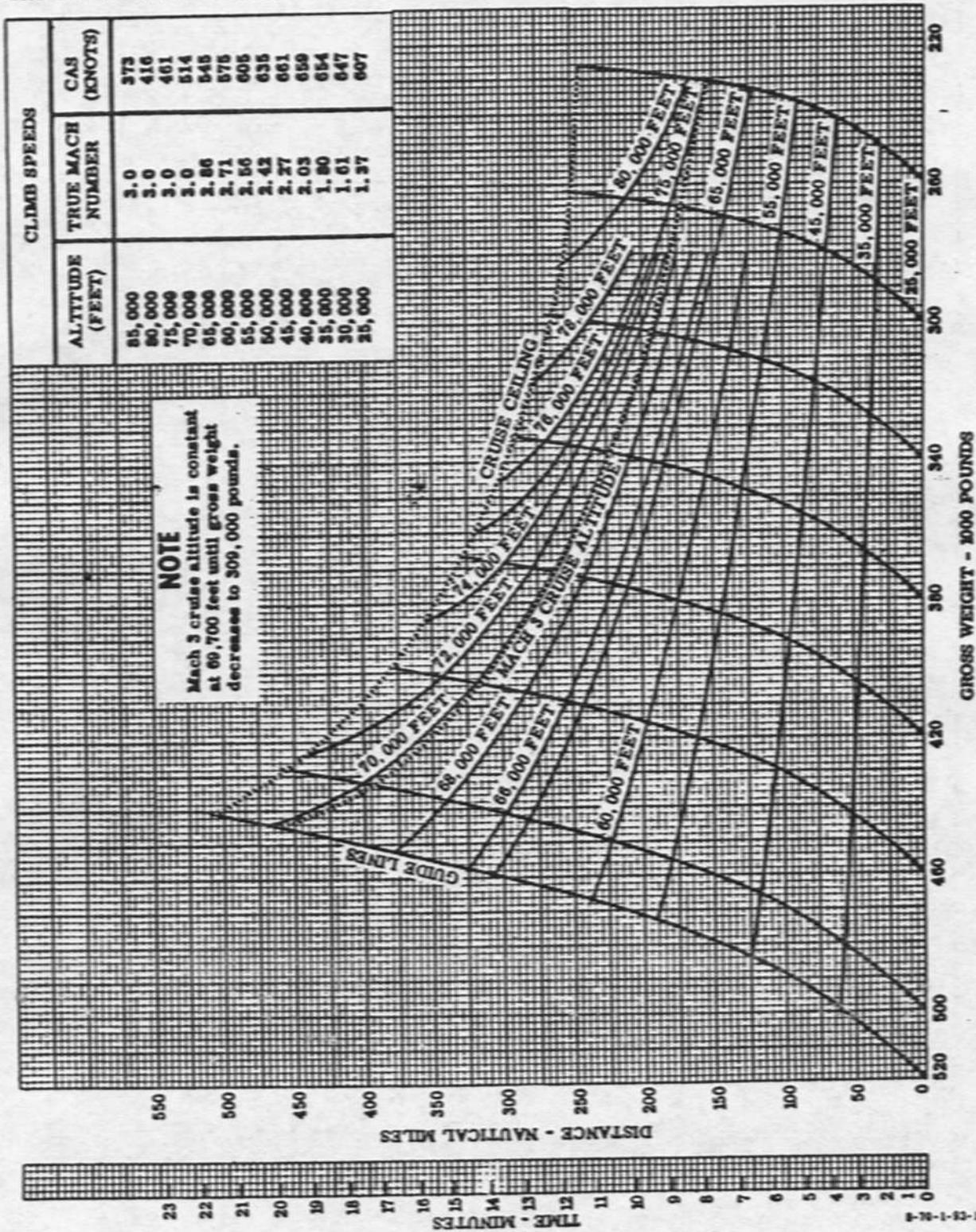


Figure A4-6

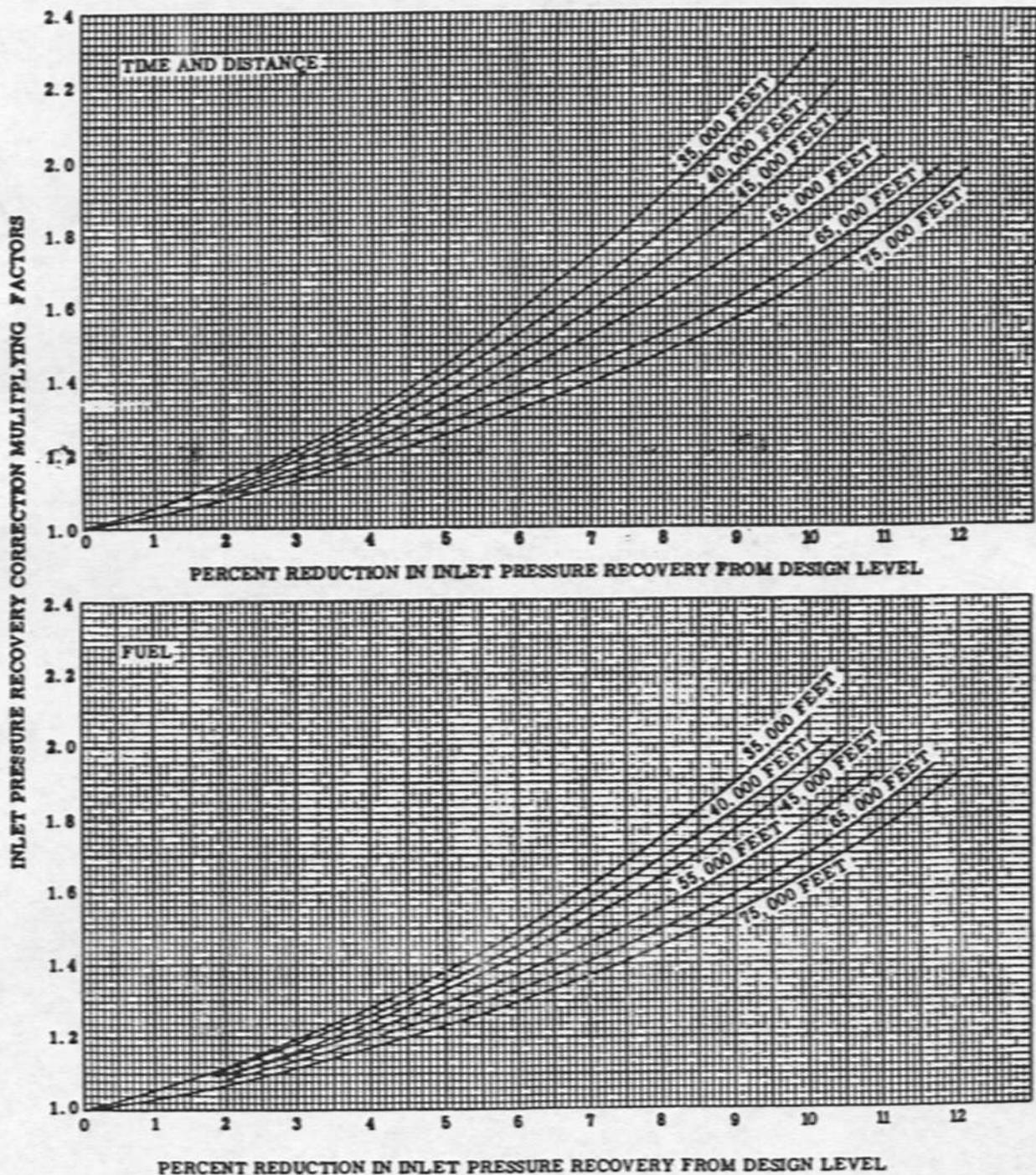
8-70-1-12-13A

# INLET PRESSURE RECOVERY CORRECTION FACTORS - SUPERSONIC CLIMB

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3



8-70-1-83-118

Figure A4-7

# TEMPERATURE CORRECTION FACTORS - SUBSONIC CLIMB

DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, UNIFORM THRUST

MODEL XB-70A  
ENGINES: YJ93-GE-3

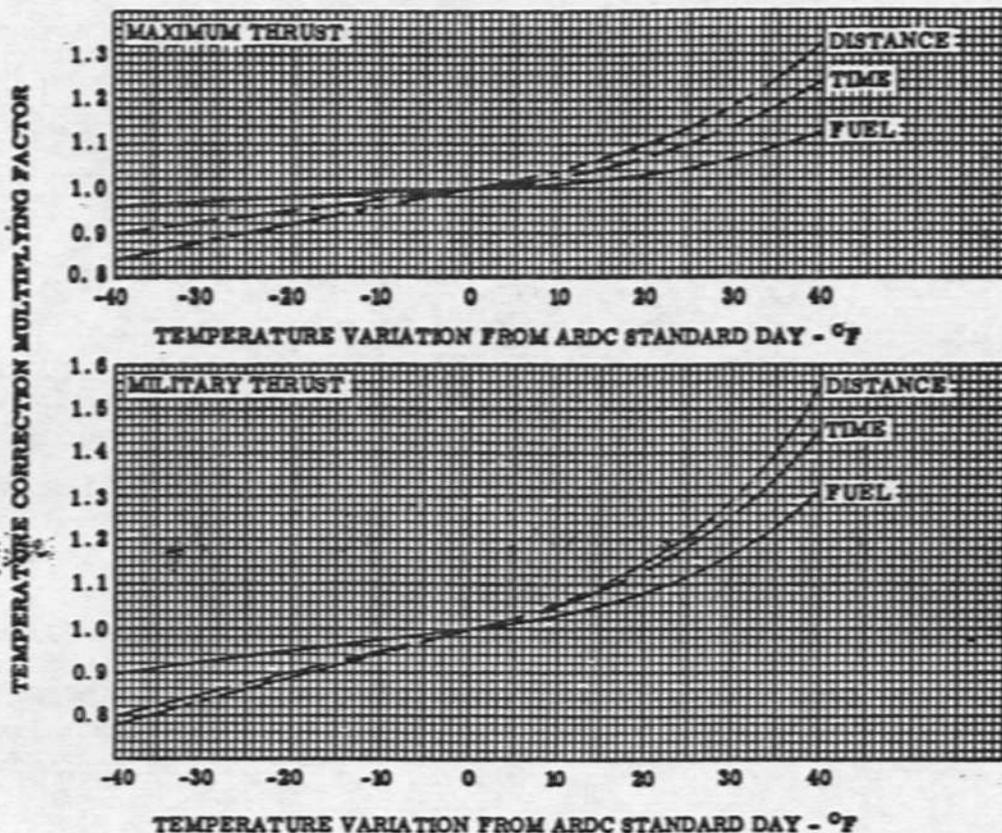


Figure A4-8

# TEMPERATURE CORRECTION FACTORS - SUPERSONIC CLIMB

DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

TEMPERATURE CORRECTION MULTIPLYING FACTOR

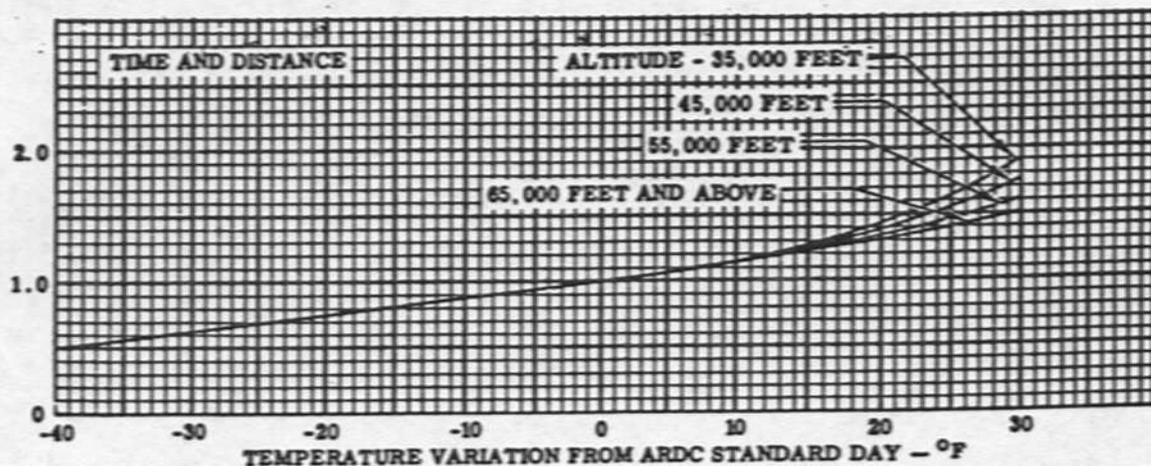
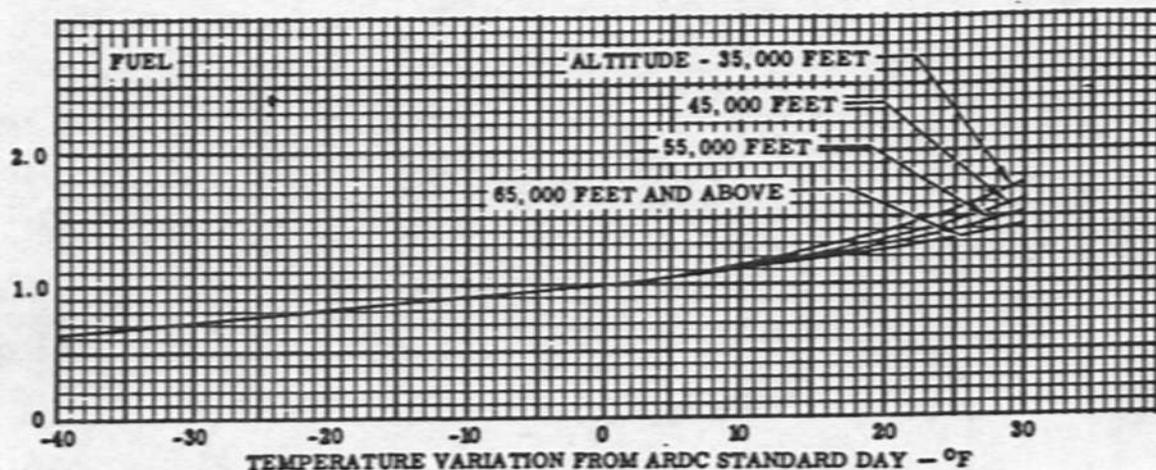


Figure A4-9

## PART 5

## LEVEL FLIGHT ACCELERATION

Underlined page numbers denote charts.

TABLE OF CONTENTS	PAGE	PAGE	
Description.....	A5-1	Effect of Inlet Pressure Recovery On Fuel Required - Level Flight Acceleration (30,000 feet).....	<u>A5-14</u>
Use of Charts.....	A5-1	Temperature Correction Factors - Level Flight Acceleration (Sea Level and 20,000 feet) .....	<u>A5-17</u>
Level Flight Acceleration (Sea Level).....	<u>A5-6</u>	Temperature Correction Factors - Level Flight Acceleration (25,000 feet).....	<u>A5-18</u>
Level Flight Acceleration (20,000 feet).....	<u>A5-7</u>	Temperature Correction Factors - Level Flight Acceleration (30,000 feet).....	<u>A5-19</u>
Level Flight Acceleration (25,000 feet).....	<u>A5-8</u>		
Level Flight Acceleration (30,000 feet).....	<u>A5-10</u>		
Effect of Inlet Pressure Recovery On Fuel Required - Level Flight Acceleration (25,000 feet).....	<u>A5-12</u>		

DESCRIPTION.

Level flight acceleration charts at several constant altitudes are presented on figures A5-2 through A5-5. Time, fuel, and distance are plotted against gross weight, with guide lines to show the reduction in gross weight due to the fuel used during the acceleration. The charts start at the approximate minimum true Mach number and end at the maximum allowable true Mach number, for that altitude. The charts represent Maximum Thrust acceleration only, and normal operating procedures. These charts are based on an AFDC Standard Day and design level inlet pressure recovery.

USE OF CHARTS.

To obtain the level flight acceleration data desired, enter the proper acceleration chart at the gross weight and true Mach number at the start of the acceleration. Note the time, fuel, and distance at this initial point. From this initial gross weight and Mach number point, trace a line parallel to the guide lines until it intersects the desired true Mach

number at the end of the acceleration. Note the time, fuel, and distance at this intersection. The difference between the initial and final values for time, fuel, and distance gives, respectively, the time required to accelerate, the fuel used during the acceleration, and the distance traveled during the acceleration. If the Mach number at start of acceleration is the initial Mach number on the chart, the time required, the fuel used, and the distance traveled may be read directly at the final Mach number. True Mach number may be converted to CAS using figure All-2. The time, distance, and fuel used, as read from the charts, must be corrected for both the inlet pressure recovery reduction and then for the temperature effects.

## NOTE

- To correct chart values for each 1 percent reduction in inlet pressure recovery, increase time and distance by 4 percent at sea

level and 20,000 feet, and by 6 percent at 25,000 and 30,000 feet. Increase fuel used 2.0 percent at sea level, and 2.5 percent at 20,000 feet, and refer to figures A5-4 through A5-7 and the following discussion for 25,000 and 30,000 feet.

- To correct values for temperature, refer to the following discussion.

To correct the fuel required at 25,000 and 30,000 feet for inlet pressure recovery reduction, first determine the fuel used from the acceleration charts. Then, using the proper effect of inlet pressure recovery on fuel required chart (in accordance with altitude and gross weight) enter the left side of the upper chart at the gross weight at start of acceleration. Move horizontally to the right to intersect the line for Mach number at the start of the acceleration. Then move down vertically to intersect the line for the given percent reduction in inlet pressure recovery. Move horizontally to the left to the fuel scale, and note the reading. Again enter the upper chart at the gross weight at start of acceleration and move horizontally to the right to intersect the line for Mach number at the end of the acceleration. From this point, move down vertically to intersect the line for the given percent reduction in inlet pressure recovery. Move horizontally to the left to the fuel scale and note the reading. Subtract the first fuel reading from the second fuel reading. The difference is the fuel used because of the given inlet pressure recovery reduction. Add this to the fuel used as determined from the acceleration charts to obtain the total fuel used during acceleration with the airplane operating at the given reduction in inlet pressure recovery. Note that if the acceleration starts at the lowest Mach number on the upper chart (corresponding to the vertical scale), the fuel increment to be added is that read at the final Mach number.

To correct the fuel used for temperature, first determine the variation of the true OAT from the ARDC standard OAT from the chart in Part 11 of this Appendix. Enter the temperature correction factors chart in Part 5 at this variation in

temperature. Move up vertically to the line representing the fuel, then horizontally to the left and read the multiplying factor. Multiply the fuel corrected for inlet pressure recovery reduction by this factor. This is the fuel required for the acceleration.

To correct the time and distance for temperature, obtain the multiplying factor using the same method as was used for the fuel, except use the time and distance lines on the chart.

#### SAMPLE PROBLEM.

##### GIVEN:

1. Initial gross weight.....470,000 pounds
2. Initial Mach Number.....0.80
3. Initial altitude.....20,000 feet

##### FIND:

1. Fuel required during acceleration
2. Time required to accelerate to Mach 1.19 and distance traveled during acceleration
3. Final gross weight

#### SOLUTION - FUEL REQUIRED DURING ACCELERATION.

Enter the fuel versus gross weight chart on figure A5-1 with 470,000 pounds at Mach 0.80 (point A). Note the initial fuel reading of 3700 pounds (point B). Then move up from point A, parallel to the guide lines on the chart, to intersect the Mach 1.19 line (point C). Note the fuel reading of 10,650 pounds (point D). Subtracting 3700 pounds from 10,650 pounds is 6950 pounds, the amount of fuel required during acceleration, uncorrected for inlet pressure recovery reduction and temperature.

SOLUTION - TIME REQUIRED TO ACCELERATE  
AND DISTANCE TRAVELED.

Enter the time/distance versus gross weight chart on figure A5-1 with 470,000 pounds at Mach 0.80 (point E). Note the distance on the left inside scale as 7.0 nautical miles (point F), and the time on the left outside scale as 1.1 minutes (point G). Move up parallel to the guide lines from point E to intersect the Mach 1.19 line (point H). Following the chase-through lines, note the distance as 22.7 nautical miles (point J), and the time as 2.6 minutes (point K). Subtracting 7.0 nautical miles from 22.7 nautical miles gives 15.7 nautical miles, the distance traveled during acceleration, uncorrected for inlet pressure recovery reduction and temperature. Subtracting 1.1 minutes from 2.6 minutes gives 1.5 minutes, the time required to accelerate to Mach 1.19, uncorrected for inlet pressure recovery reduction and temperature.

## SOLUTION - FINAL GROSS WEIGHT.

Move down vertically from point C (Mach 1.19) to the base of the chart and read 463,050 pounds, or subtract the amount of fuel consumed from the initial gross weight (470,000 minus 6950 gives 463,050 pounds) to obtain the final gross weight, uncorrected for inlet pressure recovery and temperature.

## NOTE

The weight difference between the initial and final gross weights is related directly to the amount of fuel consumed.

T. O. 1B-70(X)A-1A

# LEVEL FLIGHT ACCELERATION

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST  
ALTITUDE - 20,000 FEET  
LIMIT MACH - 1.19

MODEL: XB-70A  
ENGINES: YJ93-GE-3

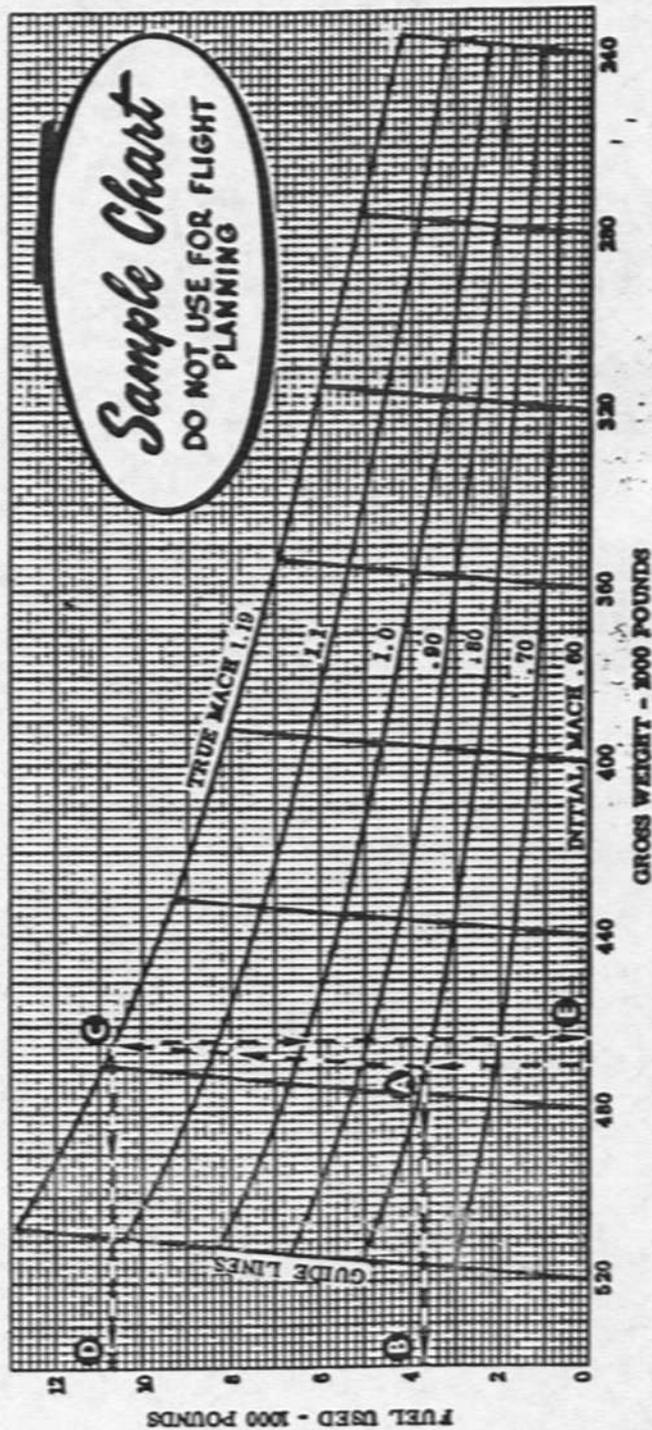
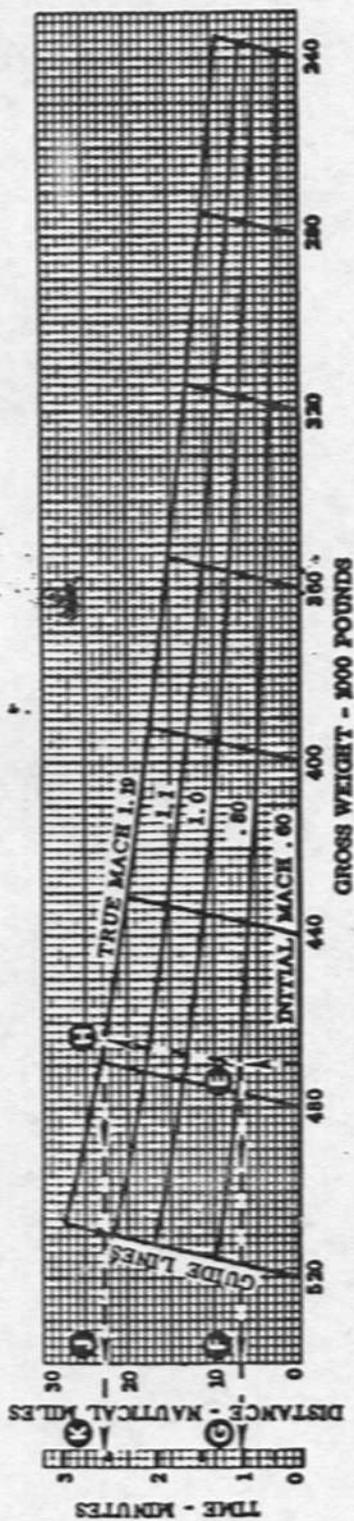


Figure A5-1

[REDACTED]  
T.O. 1B-70(X)A-1A

THIS PAGE INTENT: LEFT BLANK

T. O. 1B-70(X)A-1A

# LEVEL FLIGHT ACCELERATION

ARDC STANDARD DAY  
DATA AS OF : 1 OCT 1961  
BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST  
ALTITUDE - SEA LEVEL  
LIMIT MACH - .88

MODEL: XB-70A  
ENGINES: YF93-GE-3

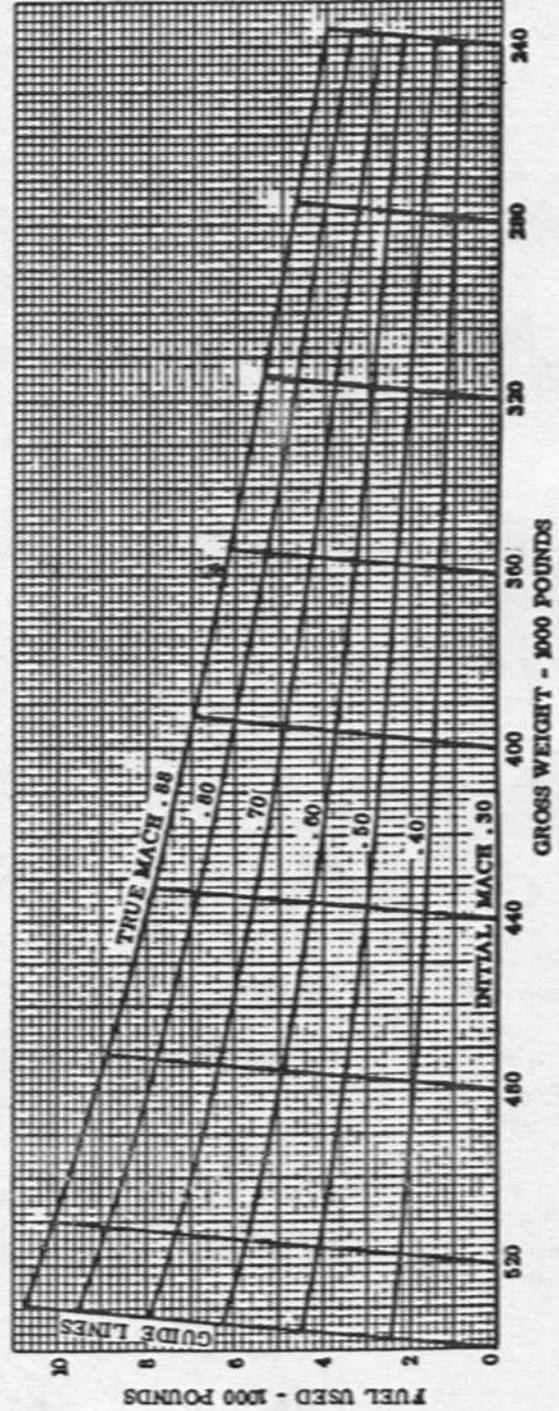
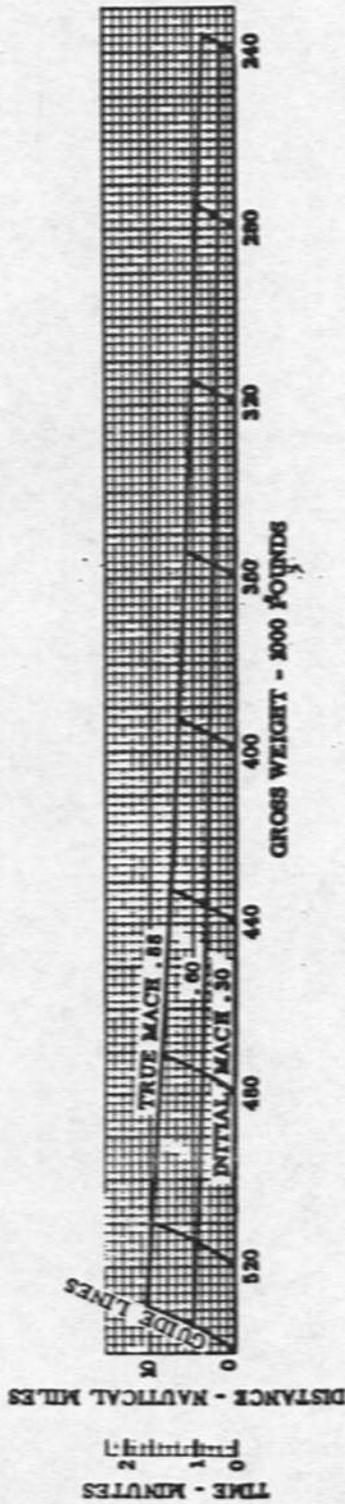


Figure A5-2

# LEVEL FLIGHT ACCELERATION

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST  
 ALTITUDE - 20,000 FEET  
 LIMIT MACH - 1.19

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

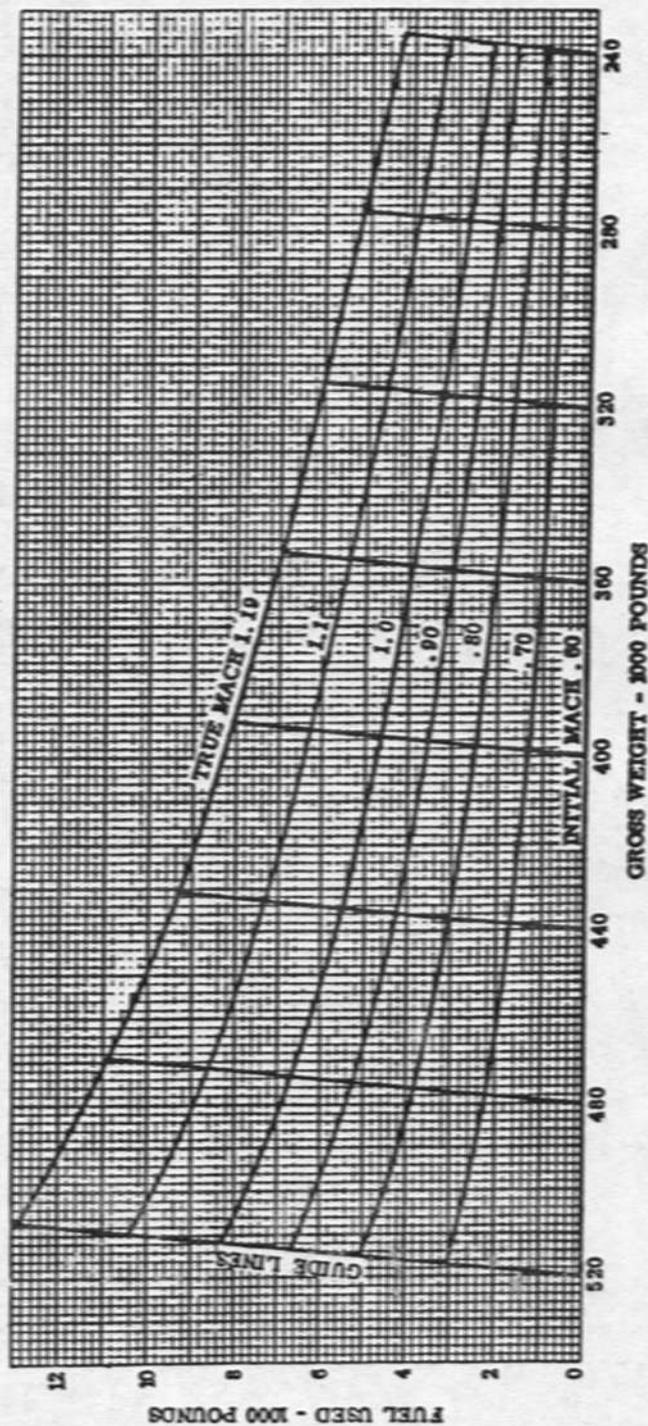


Figure A5-3

T. O. 1B-70(X)A-1A

# LEVEL FLIGHT

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES,  
ALTITUDE -  
LIMIT

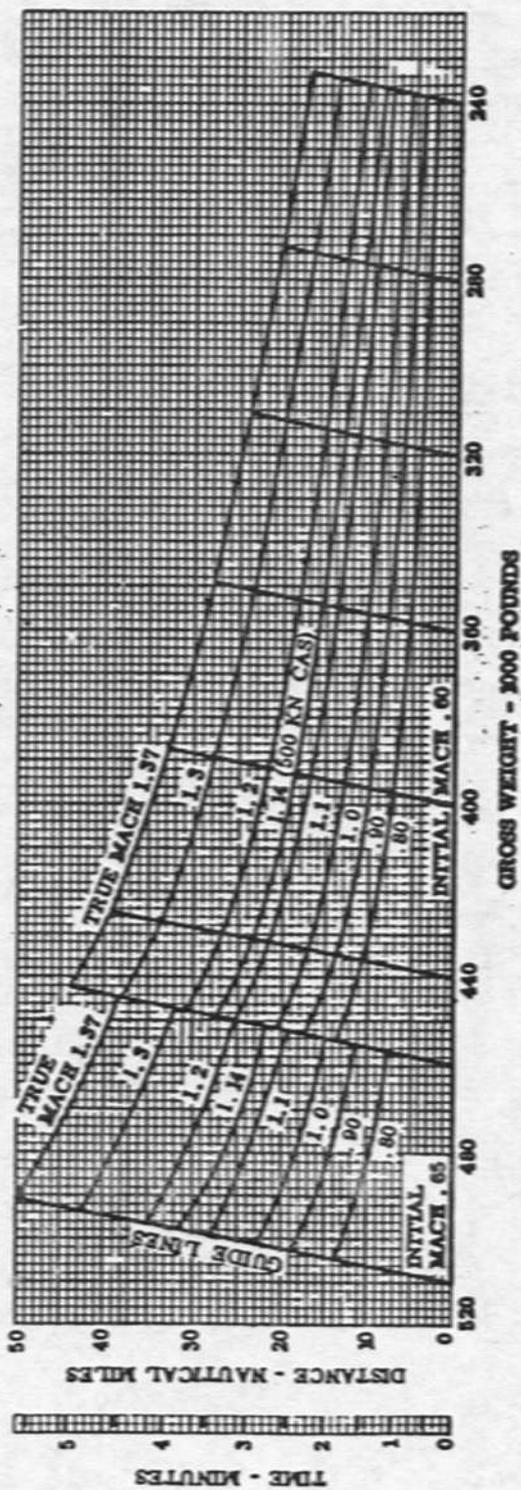


Figure A5-4 (Sheet 1 of 2)

1-70-1-25-36A

# ACCELERATION

MAXIMUM THRUST  
35,000 FEET  
MACH - 1.37

MODEL: XB-70A  
ENGINES: YJ93-GE-3

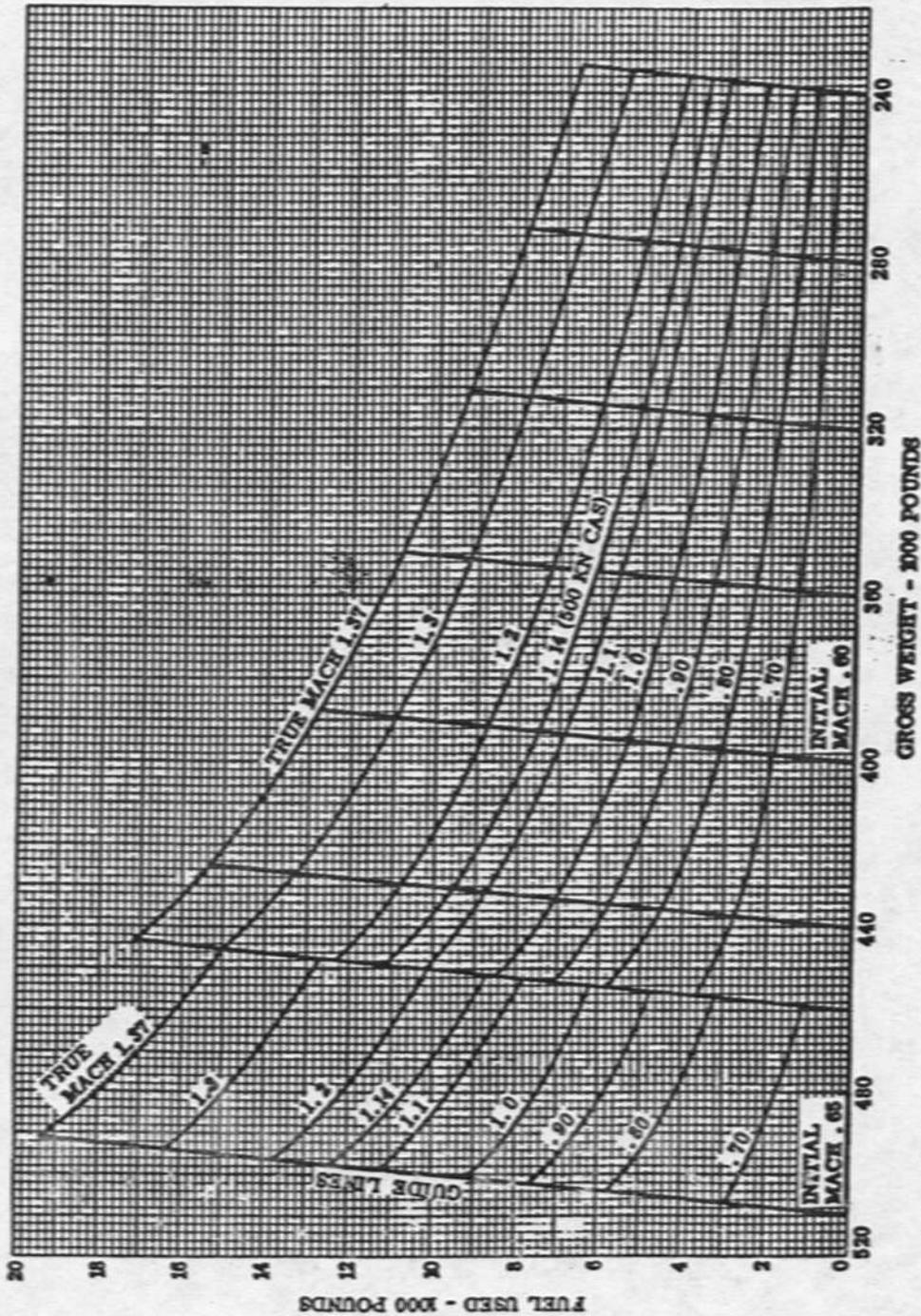
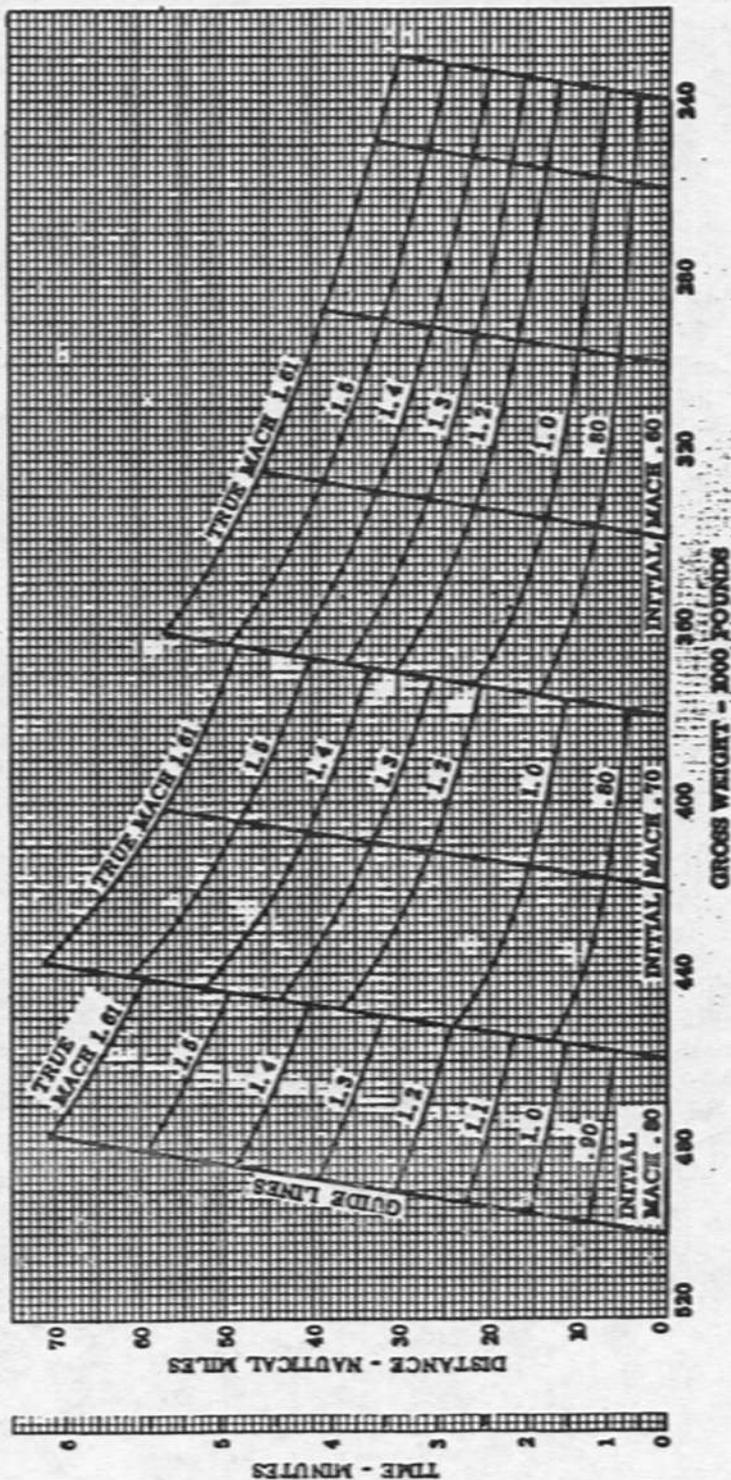


Figure A5-4 (Sheet 2 of 2)

# LEVEL FLIGHT

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES,  
 ALTITUDE -  
 LIMIT



# ACCELERATION

MAXIMUM THRUST  
30,000 FEET  
MACH - 1.61

MODEL: XB-70A  
ENGINES: YJ93-GE-3

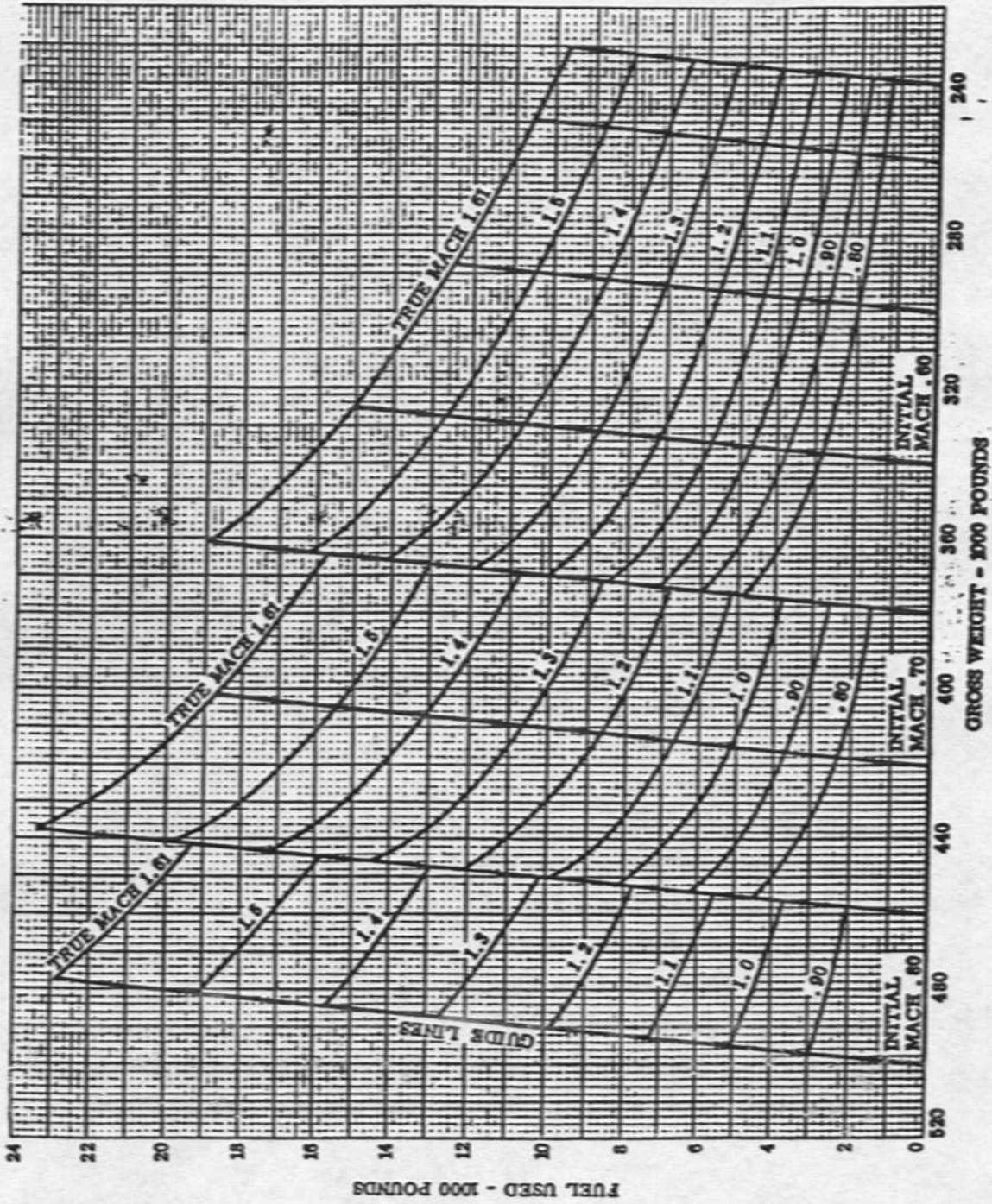
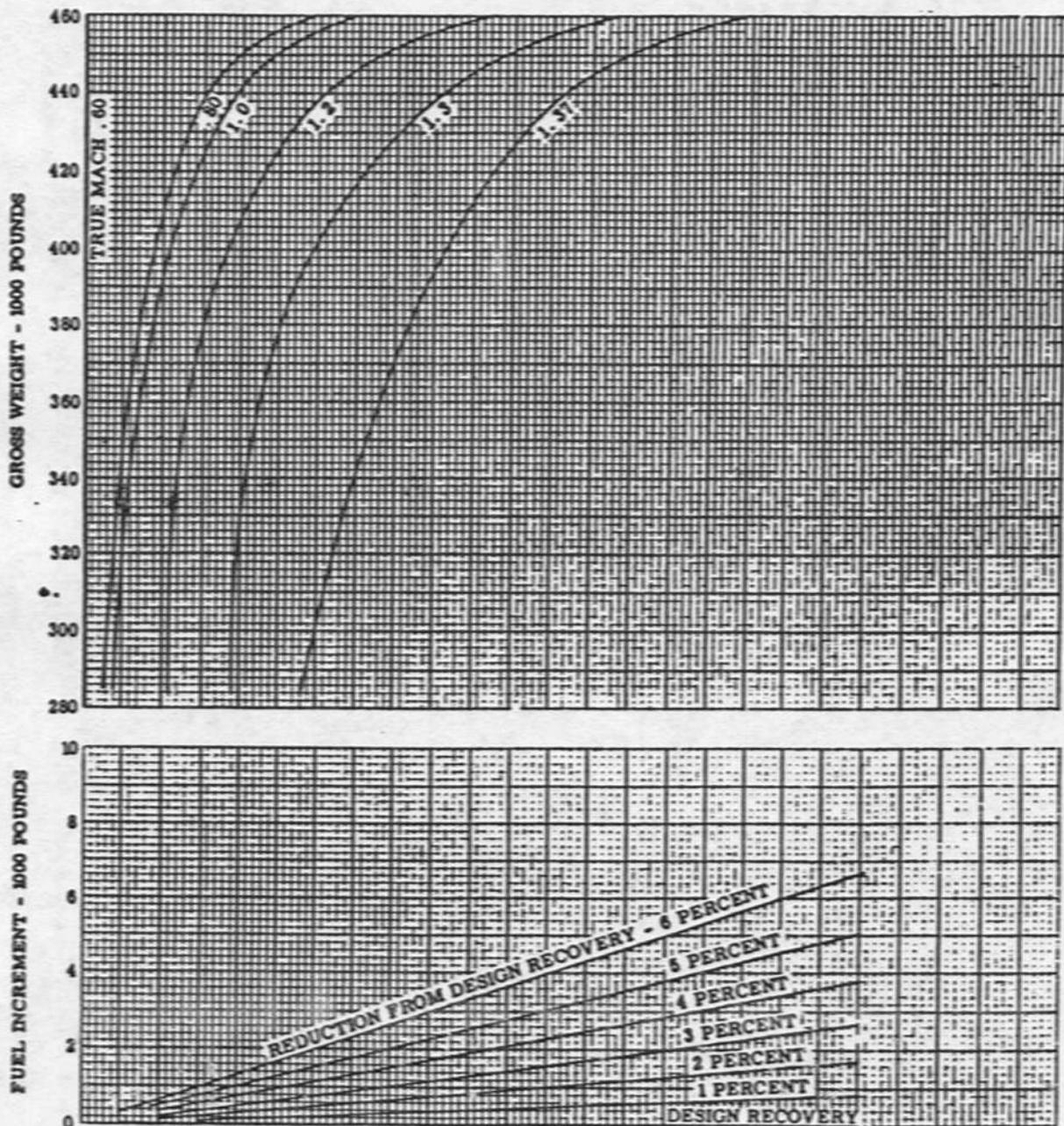


Figure A5-5 (Sheet 2 of 2)

# EFFECT OF INLET PRESSURE RECOVERY ON

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES,  
 ALTITUDE -  
 LIMIT



# FUEL REQUIRED - LEVEL FLIGHT ACCELERATION

MAXIMUM THRUST  
25,000 FEET  
MACH - 1.37

MODEL: XB 70A  
ENGINES: YJ93-GE-3

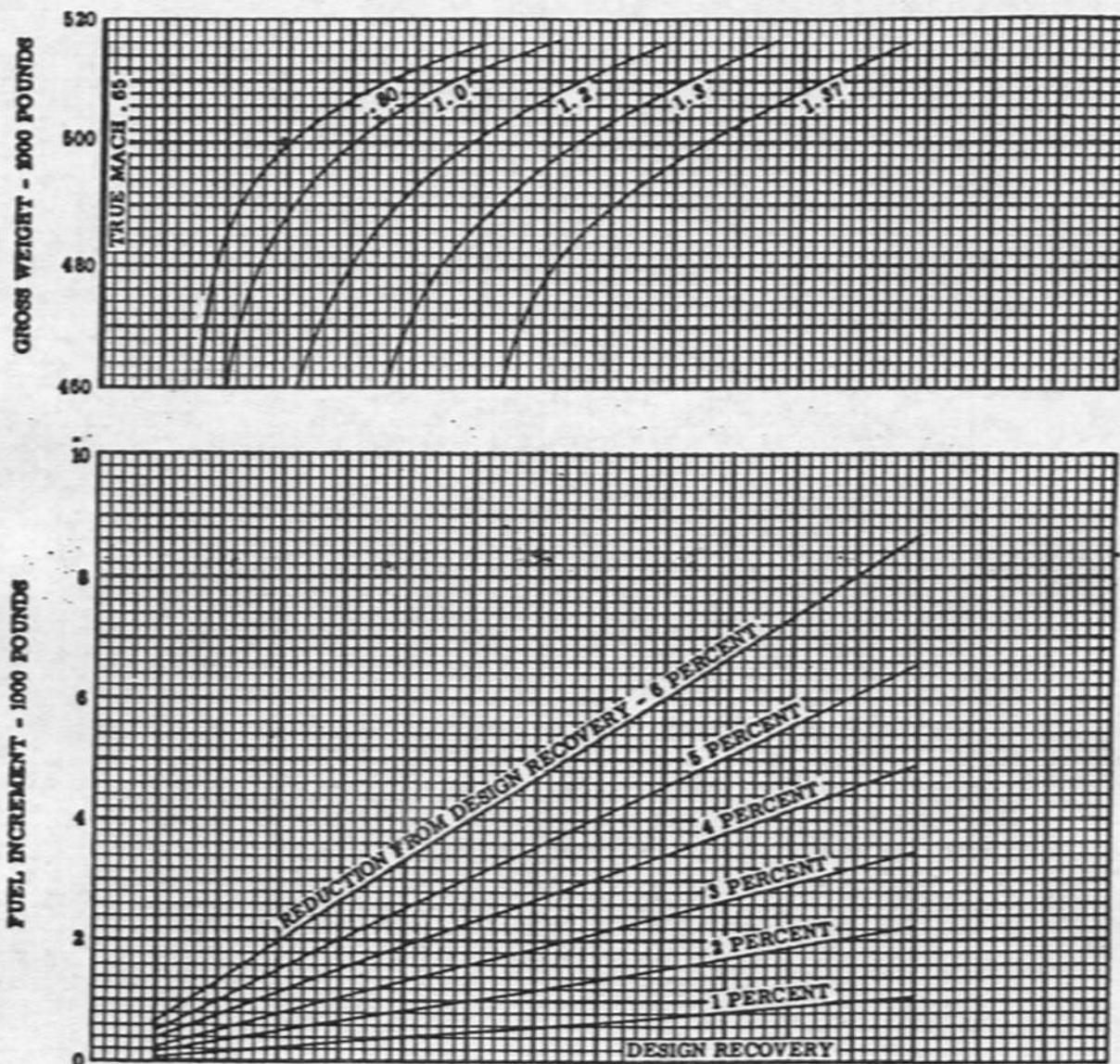
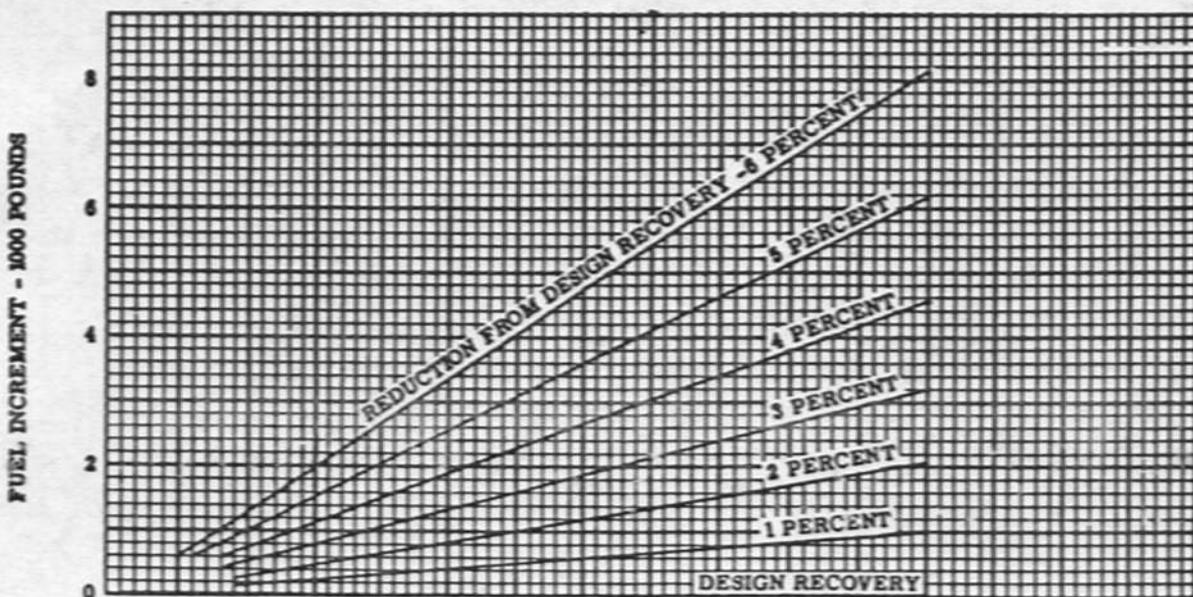
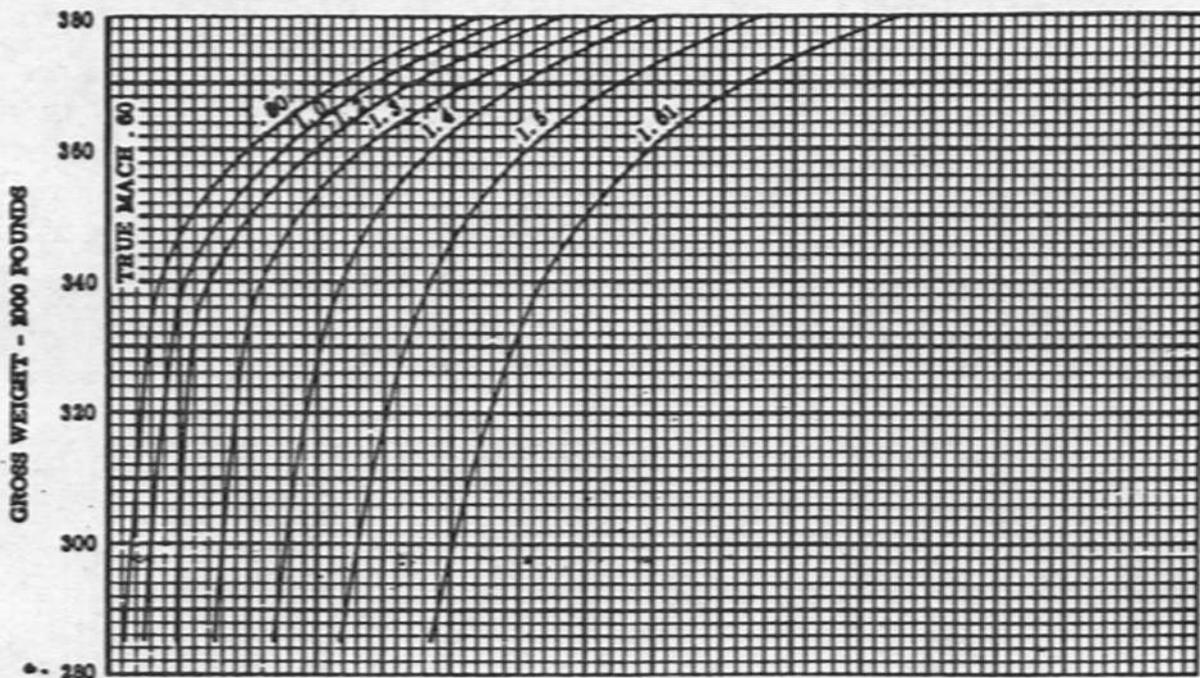


Figure A5-6 (Sheet 2 of 2)

# EFFECT OF INLET PRESSURE RECOVERY ON

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1963  
 BASED ON: ESTIMATED DATA

6 ENGINES,  
 ALTITUDE -  
 LIMIT



# FUEL REQUIRED - LEVEL FLIGHT ACCELERATION

MAXIMUM THRUST  
 30,000 FEET  
 MACH - 1.61

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

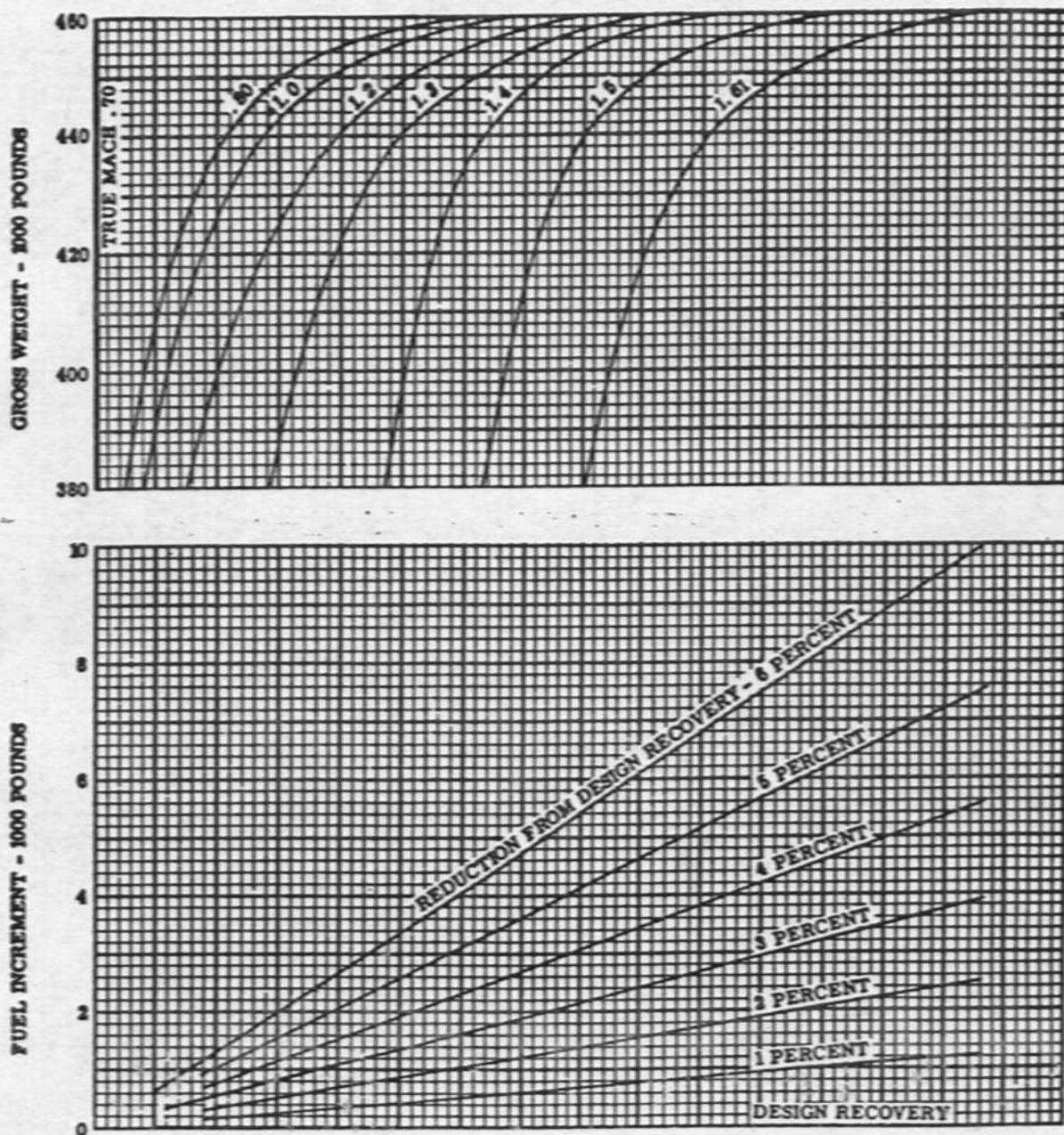


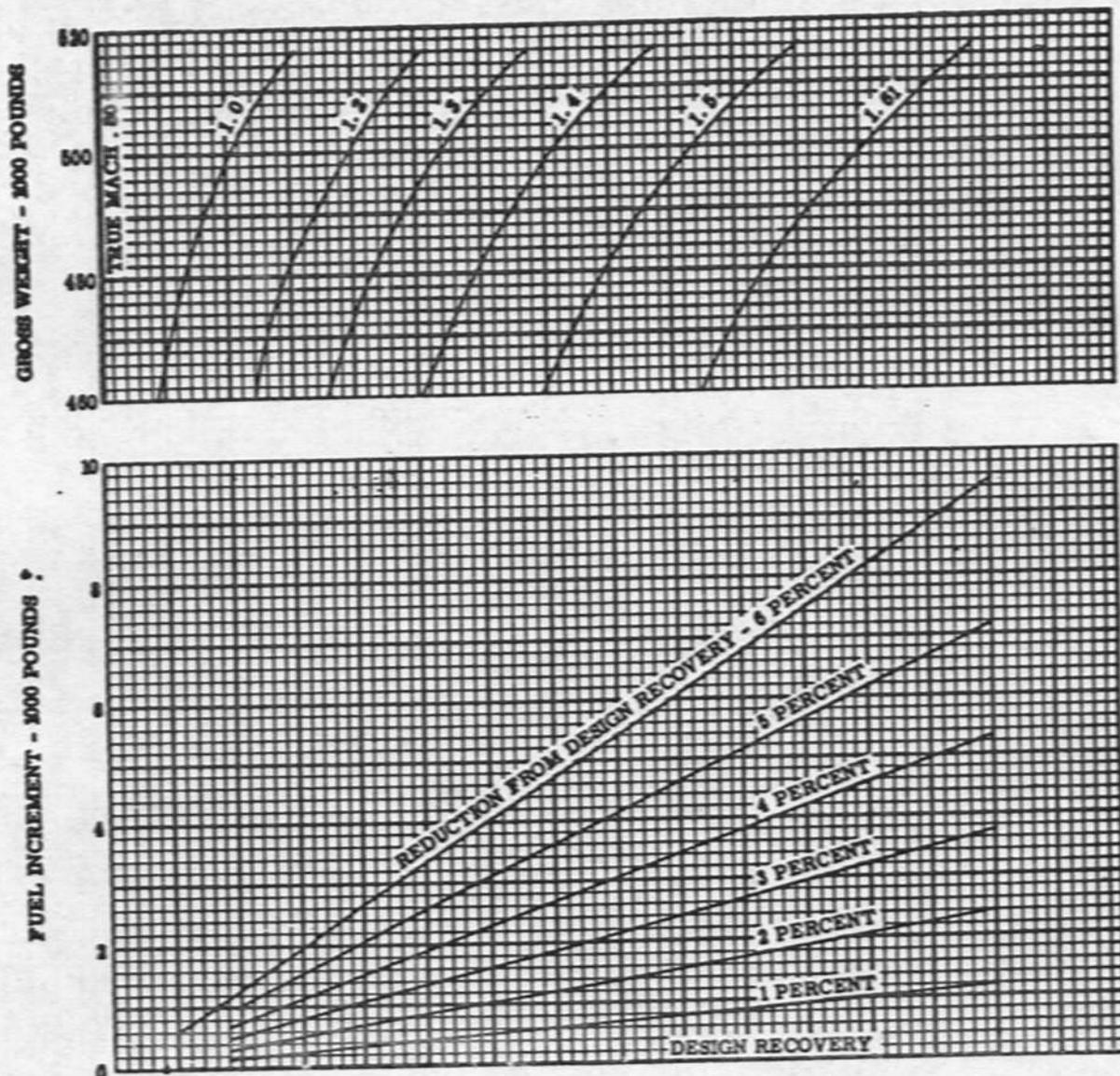
Figure A5-7 (Sheet 2 of 3)

# EFFECT OF INLET PRESSURE RECOVERY ON FUEL REQUIRED - LEVEL FLIGHT ACCELERATION

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST  
 ALTITUDE - 30,000 FEET  
 LIMIT MACH - 1.61

MODEL: XB-70A  
 ENGINES: YJ93-GE-3



# TEMPERATURE CORRECTION FACTORS - LEVEL FLIGHT ACCELERATION

DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST  
ALTITUDE - SEA LEVEL AND  
20,000 FEET

MODEL: XB-70A  
ENGINES: YJ93-GE-3

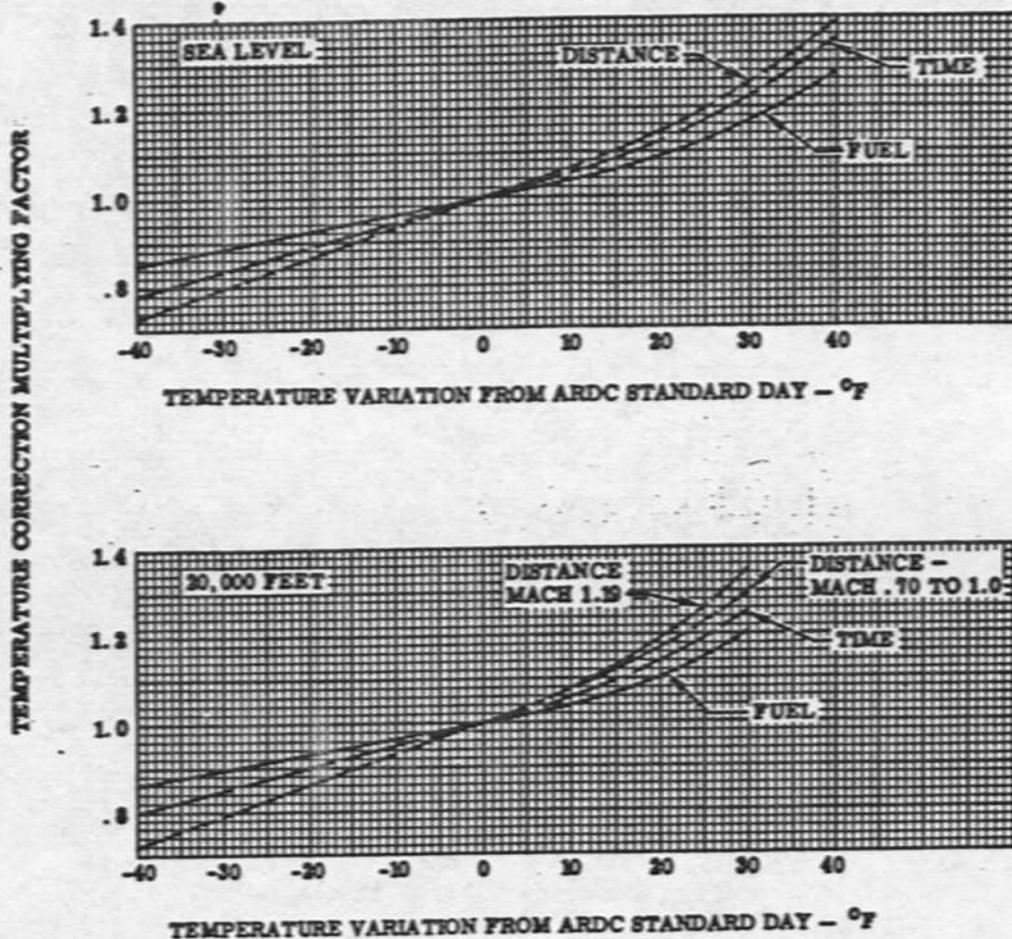


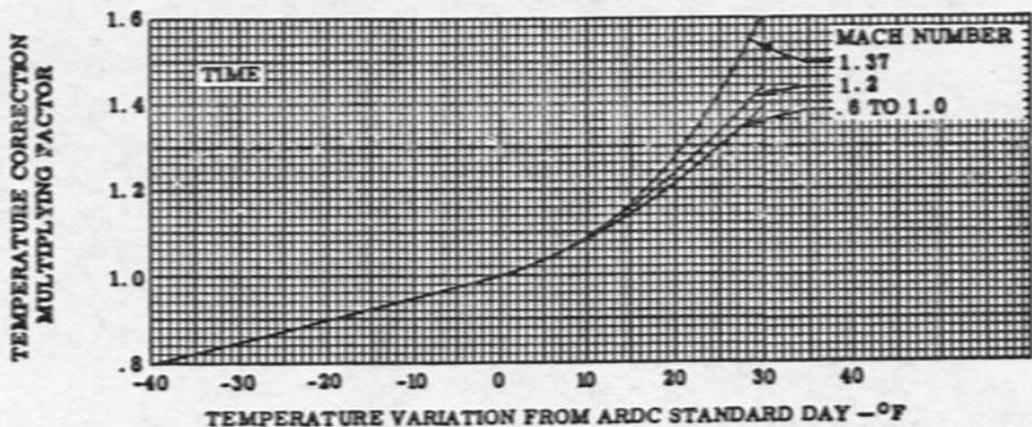
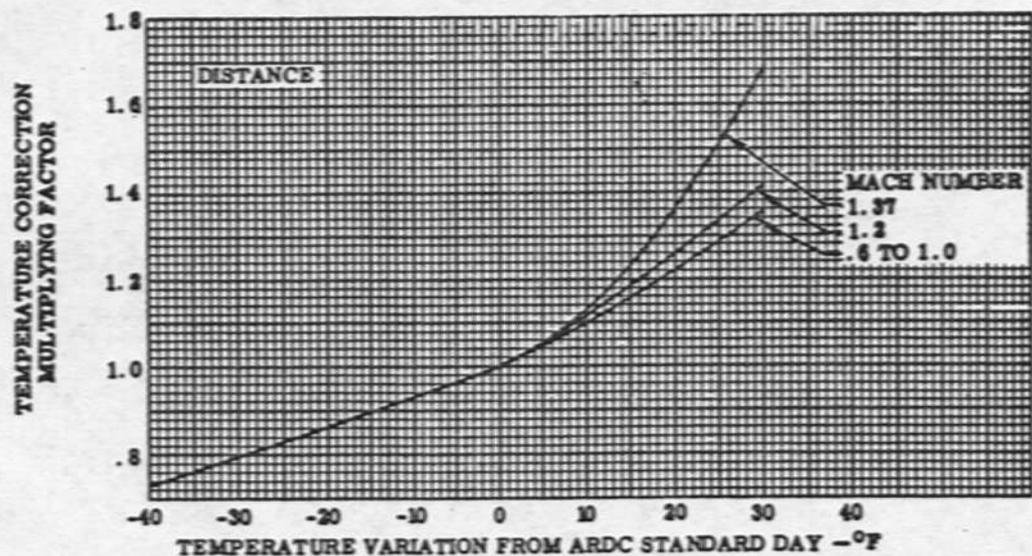
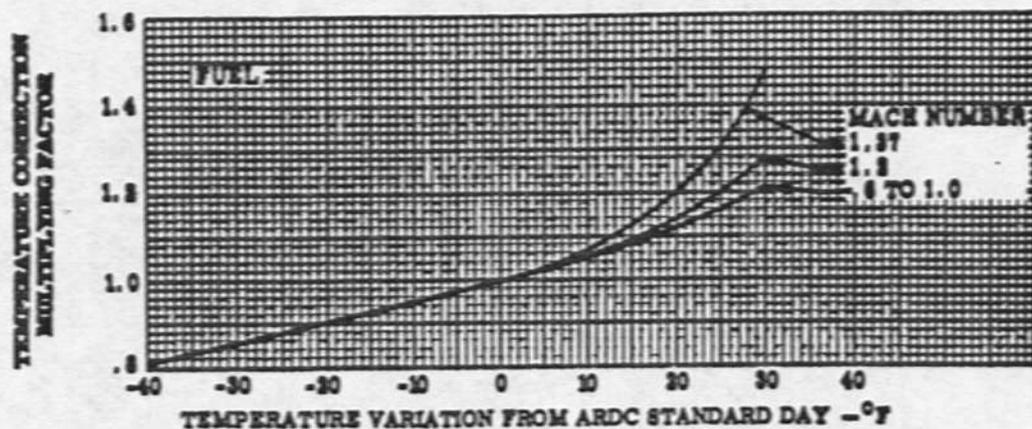
Figure A5-8

# TEMPERATURE CORRECTION FACTORS - LEVEL FLIGHT ACCELERATION

DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST  
ALTITUDE - 25,000 FEET

MODEL: XB-70A  
ENGINE: Y793-GE-3



8-70-1-93-222

Figure A5-9

# TEMPERATURE CORRECTION FACTORS - LEVEL FLIGHT ACCELERATION

DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MAXIMUM THRUST  
ALTITUDE - 30,000 FEET

MODEL: XB-70A  
ENGINES: YJ93-GE-3

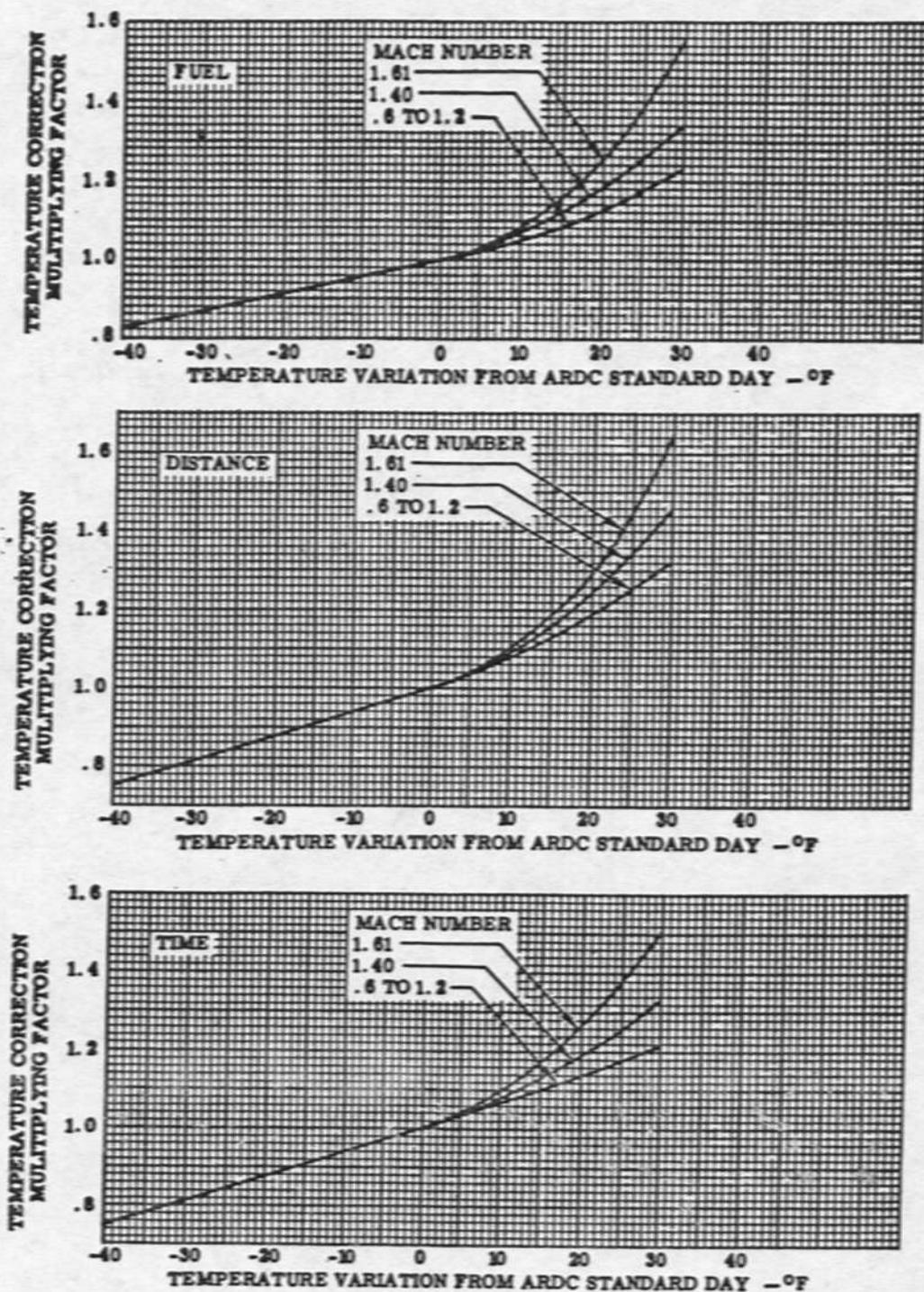


Figure A5-10

8-70-1-83-123

PART 6

RANGE

Underlined page numbers denote charts.

TABLE OF CONTENTS	PAGE	PAGE
Range.....	A6-1	Range - Supersonic - 45,000 feet..... <u>A6-28</u>
Description.....	A6-2	Range - Supersonic - 50,000 feet..... <u>A6-29</u>
Use of Charts.....	A6-3	Range - Supersonic - 55,000 feet..... <u>A6-30</u>
Range - Subsonic - 15,000 feet.....	<u>A6-18</u>	Range - Supersonic - 60,000 feet..... <u>A6-31</u>
Range - Subsonic - 20,000 feet.....	<u>A6-19</u>	Range - Supersonic - 65,000 feet..... <u>A6-32</u>
Range - Subsonic - 25,000 feet.....	<u>A6-20</u>	Range - Supersonic - 70,000 feet..... <u>A6-33</u>
Range - Subsonic - 30,000 feet.....	<u>A6-21</u>	Range - Supersonic - 75,000 feet..... <u>A6-34</u>
Range - Subsonic - 35,000 feet.....	<u>A6-22</u>	Range at Mach 3.0 Cruise..... <u>A6-35</u>
Range - Subsonic - 40,000 feet.....	<u>A6-23</u>	
Range - Subsonic - Maximum.....	<u>A6-24</u>	
Range - Supersonic - 30,000 feet.....	<u>A6-25</u>	
Range - Supersonic - 35,000 feet.....	<u>A6-26</u>	
Range - Supersonic - 40,000 feet.....	<u>A6-27</u>	

RANGE.

Optimum cruise control of a multi-engine airplane can become a complicated procedure requiring continuous, precise manipulation of the individual throttles to maintain the maximum cruising efficiency. However, it is a normal characteristic of this airplane that minimum specific fuel consumption (best cruise efficiency) is obtained when all engines are at uniform thrust settings. Only when the thrust required is between minimum afterburner and Military Thrust must mixed thrust settings be selected to maintain stabilized flight. Mixed thrust is defined as any combined operation of the six engines at afterburner and non-afterburner thrust settings. This region of mixed thrust settings occurs only between Mach 1.0 and maximum allowable speed and at altitudes below 50,000 feet. Stabilized cruise above 50,000 feet will

require uniformly varying afterburner thrust; cruise below Mach 1.0 can be accomplished with uniform non-afterburner thrust settings.

In all cases, the mixed thrust settings are established for pairs of engines (i.e., engines 1 and 6, 2 and 5, 3 and 4) to retain symmetry and avoid the additional complication associated with trimming the airplane for asymmetrical thrust conditions. Wherever possible, four engines are maintained at a constant thrust setting with the variable

thrust (to compensate for weight reduction) furnished by the remaining two engines in order to further simplify the cruise control operation.

#### DESCRIPTION.

The range charts are divided into three categories: (1) subsonic cruise, (2) supersonic cruise at constant altitudes and (3) Mach 3.0 cruise only. Due to the variation of cruise thrust required for each regime, the data is presented in a slightly different format for each category.

#### SUBSONIC CRUISE.

Range charts at constant altitude show specific range (nautical miles per 1000 pounds of fuel) versus Mach number for various gross weights on figures A6-7 through A6-12. Lines of maximum range, maximum endurance, and various uniform thrust settings are superimposed on each chart. The lines of maximum range denote the speed required to obtain maximum time for a given amount of fuel (minimum fuel flow). Separate curves giving throttle position (quadrant index markings) versus engine thrust are included for each condition. Best subsonic cruise is obtained at constant .90 Mach number and the data is shown as cruise altitude, specific range per 1000 pounds of fuel, and engine thrust setting versus gross weight on figure A6-13.

The specific range for subsonic cruise, as read from the charts, must be corrected for inlet pressure recovery reduction only. However, the thrust setting must be corrected for both the inlet pressure recovery reduction and then for the temperature effects. No corrections need to be applied to the best cruise altitude.

#### NOTE

- For each 1 percent reduction of inlet pressure recovery, decrease specific range by 0.6 percent and increase the thrust setting by 1 percent.

- To correct chart values for temperature, the thrust setting changes linearly from .10 percent per degree F at .4 Mach, to .25 percent per degree F at .9 Mach, and from .25 percent per degree F at .9 Mach to .40 percent per degree G at Mach 1.0.

#### SUPERSONIC CRUISE.

Constant altitude range charts show specific range (nautical miles per 1000 pounds of fuel) versus Mach number for various gross weights on figures A6-14 through A6-23. Lines of engine thrust settings (suitably identified as uniform or mixed) are superimposed on each chart. Present flight limit Mach numbers and corresponding thrust settings are noted. Curves of throttle position (quadrant index markings) versus engine thrust setting are included.

The supersonic cruise specific range and thrust setting, as read from the charts, must be corrected for both the inlet pressure recovery reduction and then for the temperature effects.

#### NOTE

- To correct chart values for each 1 percent reduction in inlet pressure recovery, decrease specific range by 1.3 percent for altitudes of 50,000 feet and above and add 1.5 percent to the thrust setting.
- To correct values for temperature, use the following corrections for each degree F. For temperatures higher than the ARDC Standard Day temperature, decrease specific range by 0.3 percent from Mach 1.0 to Mach 2.8 and by .25 percent at Mach 3.0; increase thrust

setting 0.5 percent from Mach 1.0 to Mach 2.8 and .25 percent at Mach 3.0; and increase minimum Mach limits by .006. For temperatures lower than the ARDC Standard Day temperature, increase specific range by 0.3 percent from Mach 1.0 to Mach 2.8 and by .25 percent at Mach 3.0; decrease thrust setting 0.5 percent from Mach 1.0 to Mach 2.8 and .25 percent at Mach 3.0; and decrease minimum Mach limits by .006.

### MACH 3.0 CRUISE.

Specific range (nautical miles per 1000 pounds of fuel), cruise thrust settings, and cruise altitude are shown as functions of gross weight on figure A6-24. The thrust settings shown represent uniform conditions; i.e., all engines are at the same setting. Engine fuel flow may be obtained by dividing the true airspeed by the specific range. For the altitude shown, the true airspeed is 1721 knots for the ARDC Standard Day.

The Mach 3.0 cruise specific range and cruise thrust setting as read from the chart must be corrected for both the inlet pressure recovery reduction and then for the temperature effects. Cruise altitude is corrected for pressure recovery reduction, but no correction need be applied for temperature.

#### NOTE

- To correct chart values for each 1 percent reduction in inlet pressure recovery, decrease cruise specific range by 1.3 percent; add 1.5 percent to the cruise thrust setting; and reduce Mach 3.0 cruise altitude by 100 feet for altitudes above 70,000 feet (this becomes significant only for pressure recovery reductions of 10 percent or greater).
- To correct values for temperature, use the following corrections for each degree F. For temperatures higher than the ARDC Standard Day temperature, decrease cruise specific range by .25 percent and increase thrust setting .25 percent. For temperatures lower

than the ARDC Standard Day temperature, increase cruise specific range by .25 percent, and decrease thrust setting .25 percent.

- At -80°F OAT, the airplane cruises at minimum afterburner thrust. Below this temperature the preceding correction factors do not apply. The specific range becomes constant at the -80°F value and the thrust setting remains at minimum afterburner.

### USE OF CHARTS.

#### MAXIMUM CRUISE RANGE (SUBSONIC) SAMPLE PROBLEM.

#### GIVEN:

1. Initial cruise gross weight.....364,000 pounds
2. Fuel available for cruise.....30,000 pounds
3. Outside air temperature....Refer to solution

#### FIND:

1. Final and average cruise gross weights
2. Initial, final, and average cruise altitudes
3. Cruise Mach number, CAS, and average TAS
4. Average specific range
5. Cruise distance
6. Cruise time
7. Best thrust setting and throttle position

#### NOTE

- Gross weight, altitude, and speed vary during maximum range cruise flight because of fuel consumption.
- In this sample problem, the temperature effect on subsonic specific range is negligible.

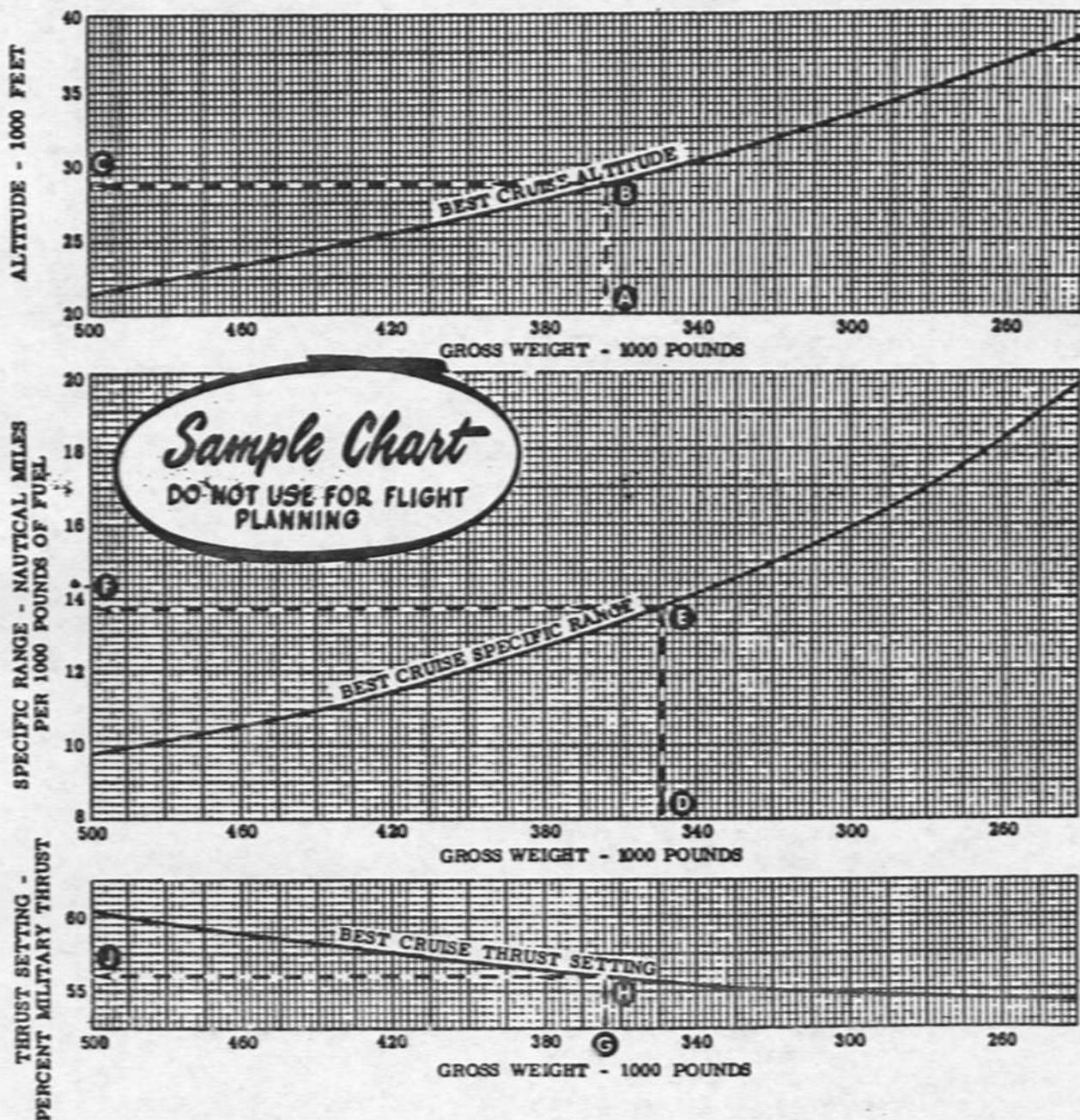
T. O. 1B-70(X)A-1A

# MAXIMUM RANGE - SUBSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES - UNIFORM THRUST  
.9 MACH

MODEL: XB-70A  
ENGINES: YJ93-GE-3



8-70-1-22-101

Figure A6-1

**SOLUTION - FINAL AND AVERAGE CRUISE GROSS WEIGHTS.**

The final cruise gross weight is determined by subtracting the weight of the available cruise fuel from the initial cruise gross weight. Thus, 364,000 pounds minus 30,000 pounds gives 334,000 pounds, the final cruise gross weight.

The average cruise gross weight is determined by subtracting one-half the weight of the available cruise fuel from the initial gross weight. Thus, 364,000 pounds minus 15,000 pounds gives 349,000 pounds, the average cruise gross weight.

**SOLUTION - INITIAL, FINAL, AND AVERAGE CRUISE ALTITUDES.**

Using the altitude chart on figure A6-1, enter at the initial gross weight of 364,000 pounds (point A) and move up vertically to intersect the best cruise altitude line (point B). From this point move horizontally to the left and read 28,700 feet (point C), the initial cruise altitude. Using the same procedure, enter the same chart at the final cruise gross weight of 334,000 pounds to find the final cruise altitude of 30,700 feet; then re-enter the chart at the average gross weight of 349,000 pounds to find the average cruise altitude of 29,700 feet.

**SOLUTION - CRUISE MACH NUMBER, CAS, AND AVERAGE TAS.**

As noted on figure A6-1, Mach number for maximum cruise range is .9. The CAS during cruise is obtained from figure All-2. Enter figure All-2 at Mach .9 and move horizontally to the right to intersect an altitude line for the initial cruise altitude of 28,700 feet. Then move down vertically to the base of the chart to read an initial cruise CAS of 357 knots. Enter figure All-2 again at Mach .9 and move horizontally to the right to intersect an altitude line for the final cruise altitude of 30,700 feet. Then move down vertically to the base of the chart and read a final cruise CAS of 341 knots.

To solve for average cruise TAS requires that the ARDC Standard Day outside air temperature be known. For the average

cruise altitude of 29,700 feet the temperature is  $-47^{\circ}\text{F}$  (ARDC Standard Day). Using the upper chart on figure All-3, enter at  $-47^{\circ}\text{F}$  and move up vertically to intersect the Mach .9 line. Then move horizontally to the left to the TAS scale and read 530 knots, the average cruise TAS.

**NOTE**

During flight, the OAT can be determined by entering the lower chart on figure All-3 at the total temperature scale, then moving horizontally to the right to intersect the Mach number line. From this point move down vertically to the base of the chart and read the OAT in Fahrenheit or centigrade.

**SOLUTION - AVERAGE SPECIFIC RANGE.**

To determine the specific range in nautical miles per 1000 pounds of fuel available for cruise, enter the specific range chart on figure A6-1 at the average cruise gross weight of 349,000 pounds (point D) and move up vertically to intersect the best cruise specific range line (point E). Moving from this point horizontally to the left, read the average specific range as 13.75 nautical miles per 1000 pounds of fuel (point F), uncorrected for inlet pressure recovery reduction.

**SOLUTION - CRUISE DISTANCE.****NOTE**

If the curve showing the variation of specific range with gross weight is not linear for the range of cruise gross weights, the average gross weight cannot be used to determine cruise distance. Instead, the gross

# RANGE - SUBSONIC

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 30,000 FEET  
 6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

*Sample Chart*  
 DO NOT USE FOR FLIGHT  
 PLANNING

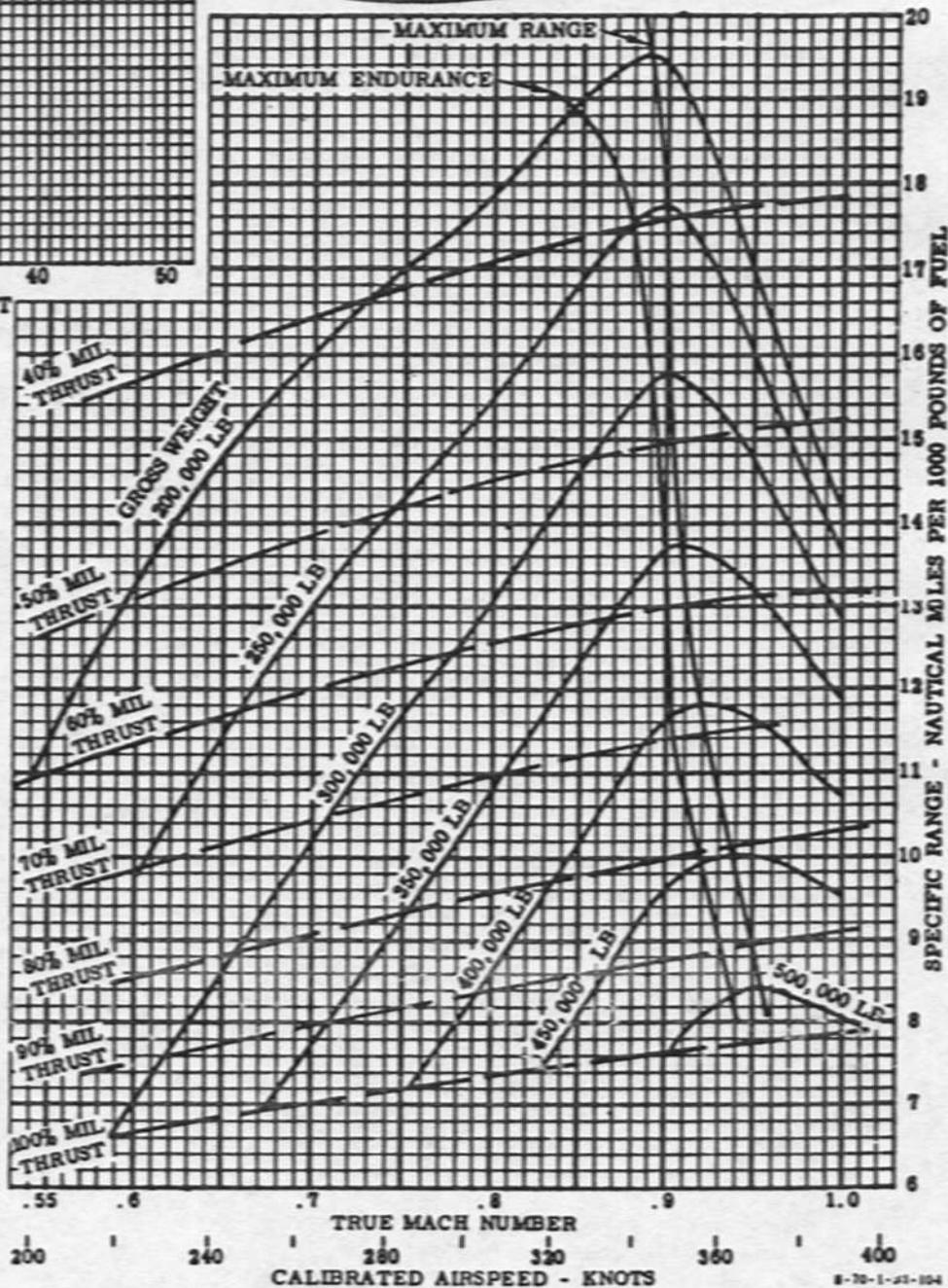
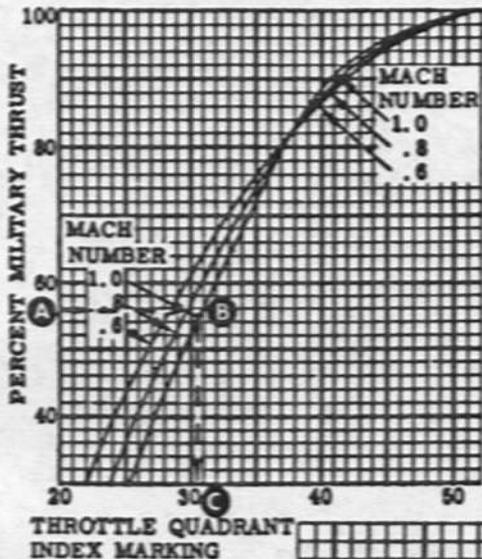


Figure A6-2

weight range must be divided in suitable increments, using smaller fuel weights for which linearity is obtained. Then, the specific range and cruise distance must be determined for each increment. The sum of the individual cruise distances gives the total cruise distance.

The cruise distance, in nautical miles, is determined by the following equation:

$$\text{Specific range} \times \frac{\text{Cruise fuel available}}{1000} = \text{Cruise distance}$$

Therefore:

$$13.75 \times \frac{30,000}{1000} =$$

$$412.5 \text{ (413) nautical miles}$$

#### SOLUTION - CRUISE TIME.

The cruise time, in hours, is determined by dividing the cruise distance by the average true airspeed. Thus,

$$\text{Cruise time} = \frac{\text{Cruise distance}}{\text{Average TAS}}$$

Therefore:

$$\frac{413}{530} = .78 \text{ hours or } 46.8 \text{ minutes}$$

#### SOLUTION - BEST THRUST SETTING AND THROTTLE POSITION.

Enter the thrust setting chart on figure A6-1 at the initial gross weight of 364,000 pounds (point G) and move up vertically to intersect the best thrust setting line (point H). From this point move horizontally to the left to the percent of Military Thrust scale and read 55.7 (point J), the percent of Military Thrust at the start of cruise. To determine the thrust setting at the end of cruise, use the same procedure. Enter the same chart at the final gross weight of 334,000 pounds and read the thrust setting as 55.3,

the percent of Military Thrust at the end of cruise. (This thrust setting is uncorrected for inlet pressure recovery reduction and temperature.)

Use the throttle quadrant index marking chart on the subsonic range chart for 30,000 feet (figure A6-2) to determine the approximate throttle position. Enter the chart at 55.7 percent Military Thrust (point A) and move horizontally to the right to intersect the Mach .90 line (point B). Then move down vertically to the base of the chart, and read the corresponding position of the throttles as the 30.5-degree index mark on the quadrant (point C), the approximate throttle position at the start of cruise. Repeat this procedure to determine the end of cruise throttle position, entering the same chart at 55.3 percent Military Thrust (uncorrected for inlet pressure recovery reduction and temperature). Read the corresponding position of the throttles as the 30-degree index mark on the quadrant, the approximate throttle position.

#### NOTE

When the throttle positions at the start and end of cruise are close together ( $\pm 2$  degrees on the throttle quadrant), an average throttle position may be used.

#### CONSTANT ALTITUDE MAXIMUM ENDURANCE SAMPLE PROBLEM.

GIVEN:

1. Altitude.....25,000 feet
2. Fuel available for cruise.....16,000 pounds
3. Initial maximum endurance gross weight.....325,000 pounds
4. Outside air temperature.....-30°F (AFDC Standard Day)

## FIND:

1. Final and average maximum endurance gross weights
2. Maximum endurance Mach number, CAS, and average TAS
3. Average specific range
4. Maximum endurance distance
5. Maximum endurance time
6. Thrust setting and throttle positions

## SOLUTION - FINAL AND AVERAGE MAXIMUM ENDURANCE GROSS WEIGHTS.

The gross weight at the end (final) of the maximum endurance period is the fuel available for cruise subtracted from the gross weight at the start of the maximum endurance period. Thus, 325,000 pounds minus 16,000 pounds gives 309,000 pounds the final maximum gross weight.

The average maximum endurance gross weight is determined by subtracting one-half the weight of the available cruise fuel from the initial maximum endurance gross weight. Thus, 325,000 pounds minus 8,000 pounds gives 317,000 pounds, the average gross weight.

## SOLUTION - MAXIMUM ENDURANCE MACH NUMBER, CAS, AND AVERAGE TAS.

Enter figure A6-3 where the initial gross weight line for 325,000 pounds intersects the maximum endurance line (point A). From this point move down vertically to the two scales (Mach number and CAS) at the bottom of the chart (point B). Read the Mach number as .848 and the CAS as 358 knots for the start of maximum endurance. Repeat the same procedure for the final maximum endurance gross weight of 309,000 pounds and read the Mach number as .831 and CAS as 352 knots for the end of maximum endurance. The Mach number will vary from .848 to .831 and CAS will vary from 358 to 352 knots during this period of maximum endurance.

The average true airspeed is determined by entering figure A6-3 where the average

gross weight of 317,000 pounds intersects the maximum endurance line. Move down vertically from this point to the Mach scale at the bottom of the chart and read the average Mach number as .84. After finding the average Mach number, use figure All-3 to find the average TAS. Enter this figure at the OAT of -30°F and move up vertically to intersect the interpolated Mach .84. From this point move horizontally to the left to the true airspeed scale and read 505 knots, the average TAS.

## SOLUTION - AVERAGE SPECIFIC RANGE.

To find the average specific range in nautical miles per 1000 pounds of fuel, enter the airspeed/specific range chart on figure A6-3 where the average gross weight of 317,000 pounds intersects the maximum endurance line (point C). From this point move horizontally to the right to the specific range scale (point D). Read the specific range as 13.25 nautical miles per 1000 pounds of fuel, uncorrected for inlet pressure recovery reduction.

## SOLUTION - MAXIMUM ENDURANCE DISTANCE.

The distance, in nautical miles, is determined by the following equation:

$$\text{Average specific range} \times \frac{\text{Fuel available}}{1000} =$$

Distance

Therefore:

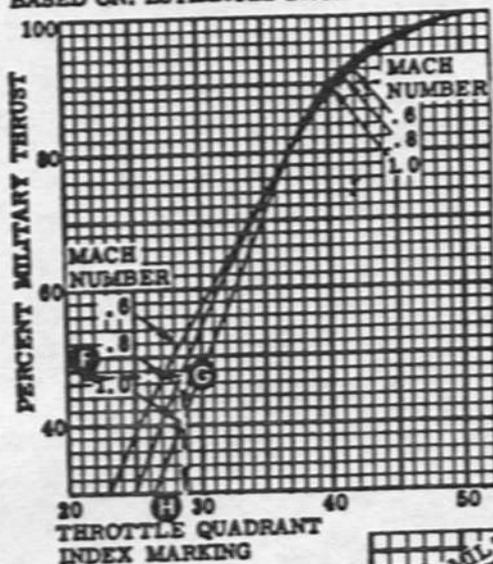
$$13.25 \times \frac{16000}{1000} = 212 \text{ nautical miles}$$

# RANGE - SUBSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 25,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3



*Sample Chart*  
DO NOT USE FOR FLIGHT  
PLANNING

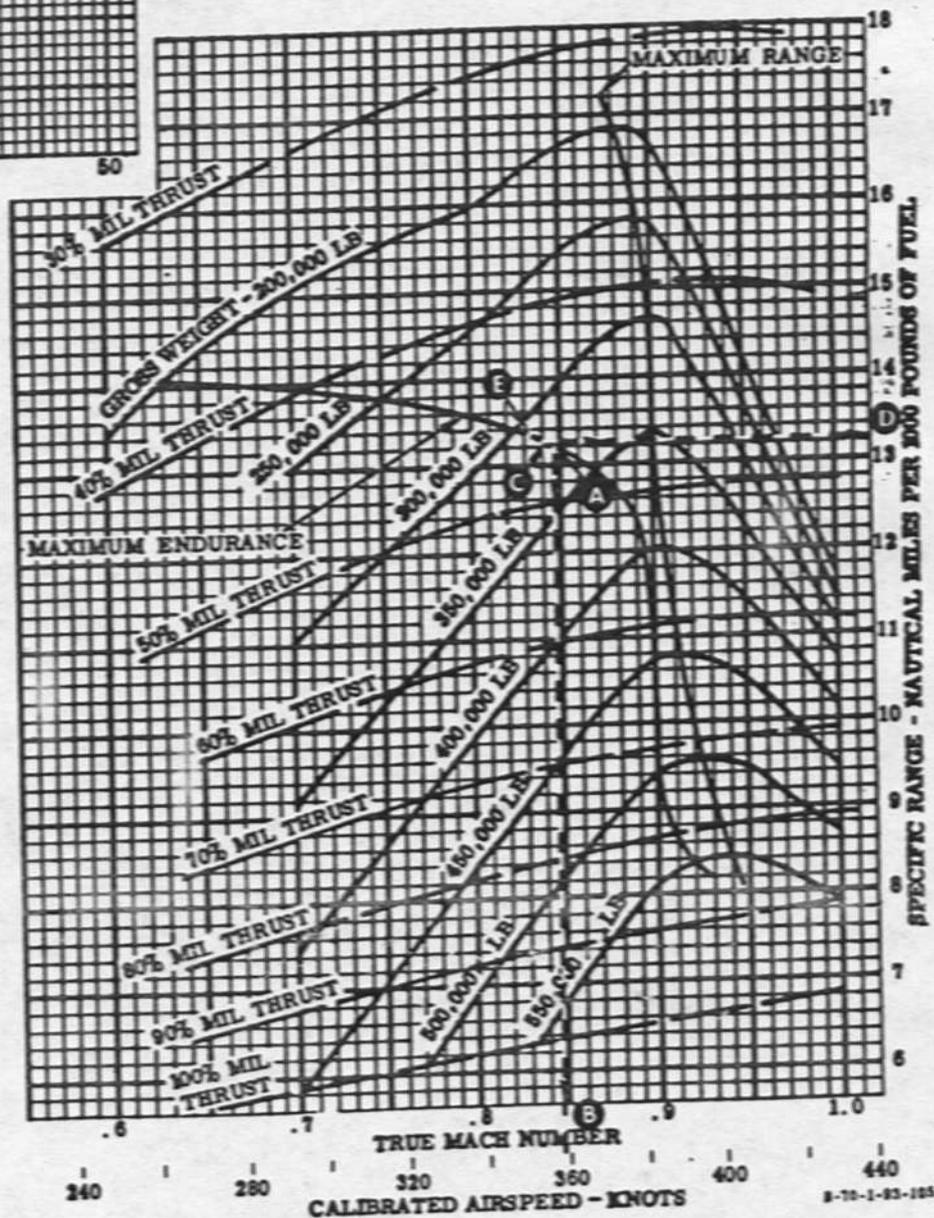


Figure A6-3

SOLUTION - MAXIMUM ENDURANCE TIME.

The maximum endurance time, in hours, is determined by dividing the distance by the average true airspeed:

$$\frac{\text{Maximum endurance distance}}{\text{Average TAS}} =$$

Maximum endurance time

$$\text{or } \frac{212}{505} = .420 \text{ hours or } 25.2 \text{ minutes}$$

SOLUTION - THRUST SETTING AND THROTTLE POSITIONS.

The percent of Military Thrust during maximum endurance is determined by interpolation between the percent thrust lines shown on figure A6-3. At the start of maximum endurance (point A) the percent of Military Thrust is approximately 47. At the end of maximum endurance (point E) the percent of Military Thrust is approximately 46, uncorrected for inlet pressure recovery reduction and temperature.

To determine the throttle position, enter the throttle quadrant index marking chart on figure A6-3 at the percent of Military Thrust for the start of maximum endurance, 47 percent (point F). Move horizontally to the right to intersect the Mach number line for the start of maximum endurance, .848 Mach (point G). Then move down vertically to the base of the chart and read the position of the throttle as the 28.7-degree index mark on the quadrant (point H). Repeat this procedure for the percent of Military Thrust of 46.0 and read 28.0, the quadrant index mark for throttle position at the end of maximum endurance. (This thrust setting is uncorrected for inlet pressure recovery reduction and temperature.) Note that for this period of maximum endurance there is very little throttle movement.

NOTE

When the throttle positions at the start and end of the maximum endurance period are close together ( $\pm 2$  degrees on the throttle quadrant), an average throttle position may be used.

CRUISE RANGE (SUPERSONIC) SAMPLE PROBLEM.

GIVEN:

1. Altitude.....35,000 feet
2. Speed.....Mach 1.3
3. Initial cruise gross weight.....364,000 pounds
4. Fuel available for cruise.....30,000 pounds
5. Outside air temperature.....- 66°F

FIND:

1. Final and average cruise gross weights
2. Calibrated airspeed and true airspeed
3. Average specific range
4. Cruise distance
5. Cruise time
6. Thrust setting and throttle positions

SOLUTION - FINAL AND AVERAGE CRUISE GROSS WEIGHTS.

The final cruise gross weight is determined by subtracting the fuel available for cruise from the initial gross weight. Thus, 364,000 pounds minus 30,000 pounds gives 334,000 pounds, the final cruise gross weight.

The average gross weight during cruise is determined by subtracting one-half the weight of the available cruise fuel from the initial gross weight. Thus, 364,000 pounds minus 15,000 pounds gives 349,000 pounds, the average gross weight.

**SOLUTION - CALIBRATED AIRSPEED AND TRUE AIRSPEED.**

From figure All-2 note that the calibrated airspeed (CAS) for Mach 1.3 at 35,000 feet is 468 knots.

To determine true airspeed, enter the upper chart on figure All-3 at -66°F and move up vertically to intersect the interpolated Mach number of 1.3. Then, move horizontally to the left to read a TAS of 750 knots.

**SOLUTION - AVERAGE SPECIFIC RANGE.**

To determine the specific range per 1000 pounds of fuel available for cruise, enter figure A6-4, at Mach 1.3 (point A). Move up vertically to intersect a gross weight line interpolated for the average gross weight of 349,000 pounds (point B). From this point, move horizontally to the specific range scale and read 7.95 nautical miles per 1000 pounds of fuel (point C). This is uncorrected for inlet pressure recovery reduction and temperature.

**SOLUTION - CRUISE DISTANCE.**

The cruise distance, in nautical miles, is determined by the following equation:

$$\text{Specific range} \times \frac{\text{Cruise fuel available}}{1000} =$$

Cruise distance

Therefore:

$$7.95 \times \frac{30,000}{1000} = 238.5 \text{ (239) nautical miles}$$

**SOLUTION - CRUISE TIME.**

The cruise time, in hours, is determined by dividing the cruise distance by the true airspeed or

$$\frac{\text{Cruise distance}}{\text{Average TAS}} = \text{Cruise time}$$

Therefore:

$$\frac{239}{750} = .319 \text{ hours or 19.14 minutes}$$

**SOLUTION - THRUST SETTING AND THROTTLE POSITIONS.**

On figure A6-4, the intersections of the initial cruise gross weight line (364,000 pounds) and the final cruise gross weight line (334,000 pounds) with the Mach 1.3 line show that mixed thrust settings must be used during the entire cruise period. Four engines, in symmetrical pairs, are at minimum Afterburner Thrust; both engines of the other symmetrical pair are at equal percentage of Military Thrust settings as required for cruise. Interpolation of the percent thrust lines show the engines at 92 percent Military Thrust at the start of cruise with reduction to 85 percent at end of cruise. To determine the throttle position for the two engines at a percentage of Military Thrust at start of cruise, enter the throttle quadrant index marking chart at 92 percent Military Thrust (point D). Move horizontally to the right to intersect the 1.3 Mach line (point E) and then down vertically to the base of the chart and read 41.0 degrees (point F); the start of cruise throttle position. In a like manner, using 85 percent of Military Thrust, determine the throttle position of 37.5 degrees, the throttle position at the end of the cruise period. The determined thrust settings are uncorrected for inlet pressure recovery reduction and temperature.

**MACH 3.0 CRUISE SAMPLE PROBLEM.**

1. Initial cruise gross weight.....398,000 pounds
2. Fuel available for cruise.....138,000 pounds
3. Speed.....Mach 3.0
4. Outside air temperature.....- 70°F

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 35,000 FEET

MODEL: XB-70A  
ENGINES: YJ93-GE-3

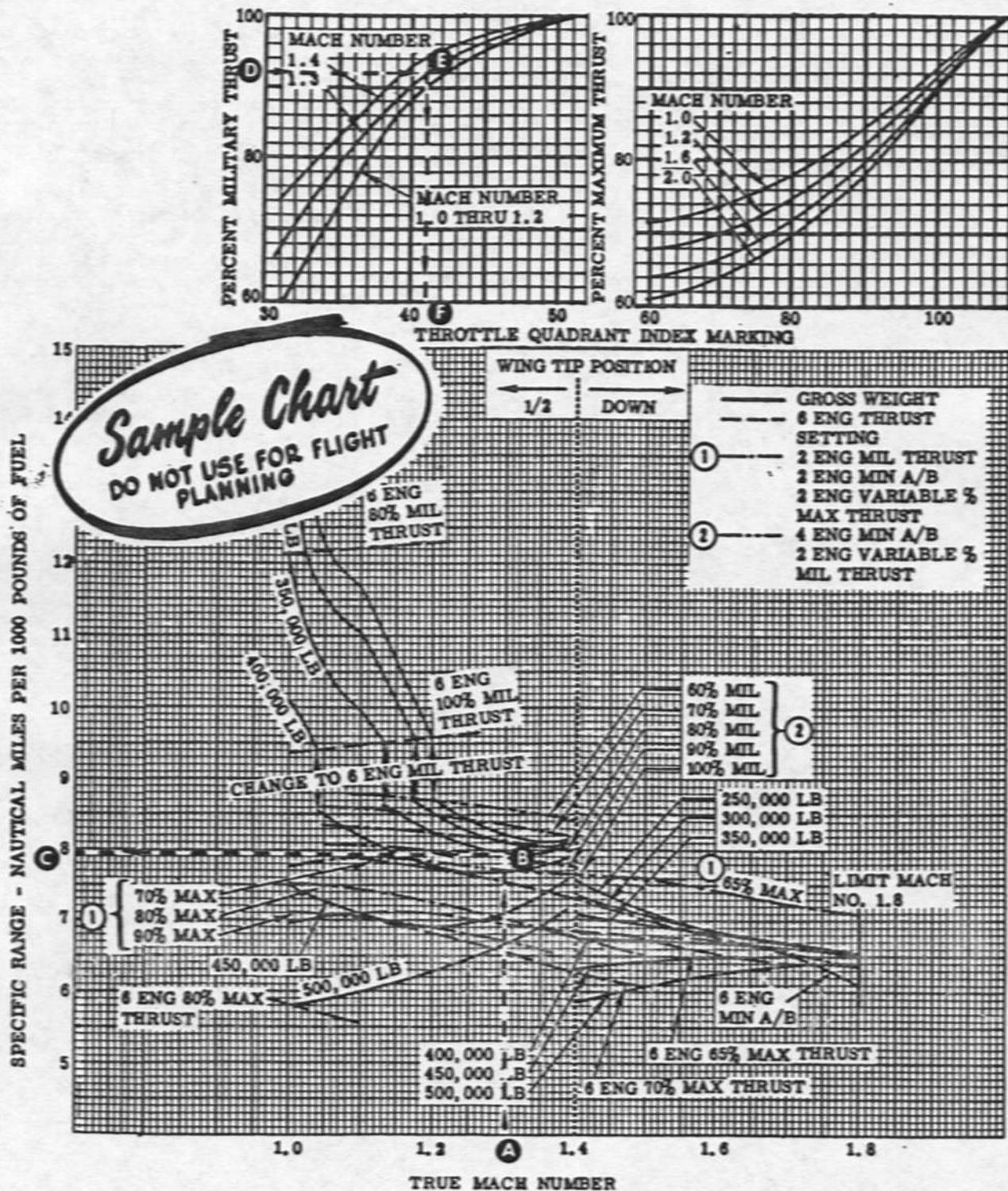


Figure A6-4

FIND:

1. Final and average cruise gross weights
2. Cruise altitude
3. CAS and TAS
4. Specific range per 1000 pounds of fuel
5. Cruise distance
6. Cruise time
7. Thrust setting and throttle positions

SOLUTION - FINAL AND AVERAGE CRUISE GROSS WEIGHTS.

The final cruise gross weight is the initial cruise gross weight minus the weight of the fuel used during the cruise. Thus, 398,000 pounds minus 138,000 pounds gives 260,000 pounds, the final gross weight.

The average cruise gross weight is determined by subtracting one-half the weight of the available cruise fuel from the initial cruise gross weight. Thus, 398,000 pounds minus 69,000 pounds gives 329,000 pounds, the average gross weight.

SOLUTION - CRUISE ALTITUDE.

Because the gross weight varies from the start of cruise to the end of cruise, the altitude chart on figure A6-5 is used to determine the starting and ending cruise altitudes for this problem. Enter the chart at the initial cruise gross weight of 398,000 pounds (point A) and move up vertically to intersect the cruise altitude line (point B). Move horizontally to the altitude scale at the left of the chart and read 69,700 feet (point C), the altitude for the start of Mach 3.0 cruise. To determine the final cruise altitude, enter the same chart at the final gross weight of 260,000 pounds (point D), and move up vertically to intersect the best cruise altitude line (point E). From this point move horizontally to the left to the altitude scale and read 72,900 feet (point F), the altitude at the end of Mach 3.0 cruise. Note that the altitude of 69,700 feet remains constant until the gross weight is 309,000 pounds, and then

increases to 72,900 feet at end of Mach 3.0 cruise. These altitudes are uncorrected for inlet pressure recovery reduction and temperature.

SOLUTION - CAS AND TAS.

From figure All-2, note that during the cruise at 69,700 feet the CAS remains constant at 517 knots. During the best cruise altitude phase the CAS decreases, becoming 483 knots at the final altitude of 72,900 feet.

To determine the true airspeed, enter the upper chart on figure All-3 at  $-70^{\circ}\text{F}$ . Move up vertically to intersect the Mach 3.0 line and then horizontally to the left to read a TAS of 1720 knots.

SOLUTION - SPECIFIC RANGE PER 1000 POUNDS OF FUEL.

For the gross weight range of this problem (398,000 to 260,000 pounds), the variation of specific range with gross weight is nearly linear. Therefore, the average gross weight, which is midway between the gross weights at the start and end of the cruise, can be used to determine the average specific range.

To determine the specific range, enter the specific range chart on figure A6-5 at the average gross weight of 329,000 pounds (point G). Move up vertically to intersect the minimum cruise altitude line (point H) and then left horizontally to the specific range scale (point J). Read 22.1 nautical miles per 1000 pounds of fuel. The specific range is uncorrected for inlet pressure recovery reduction and temperature.

If the curve showing the variation of specific range with gross weight is not linear for the range of cruise gross weights, the average gross weight cannot be used to determine specific range. Therefore, smaller gross weight increments must be used for which linearity is obtained. Range is then determined for each increment and the sum is the specific range for the cruise period.

# RANGE AT MACH 3.0 CRUISE

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

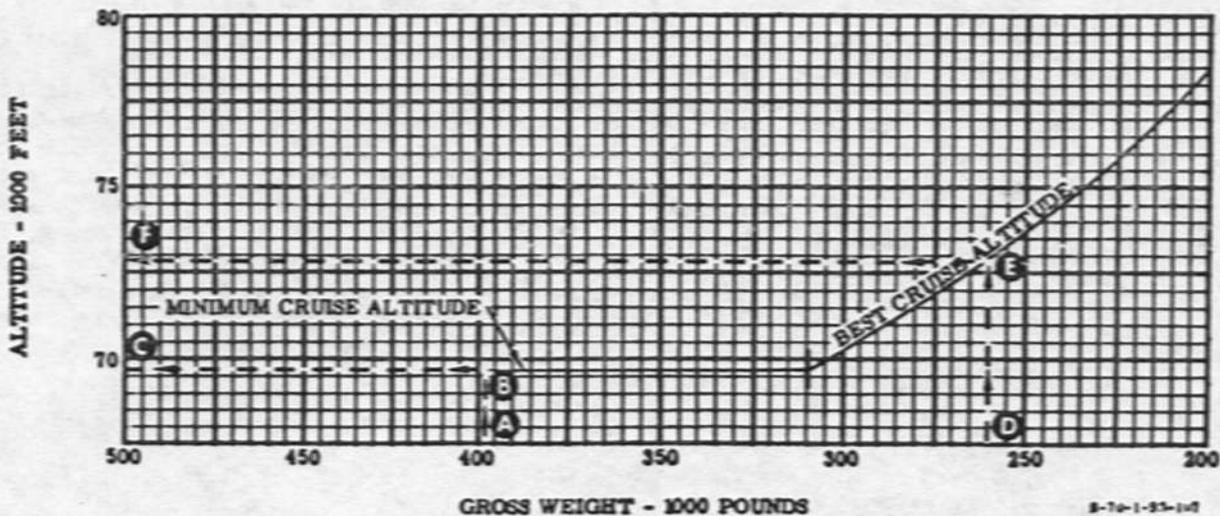
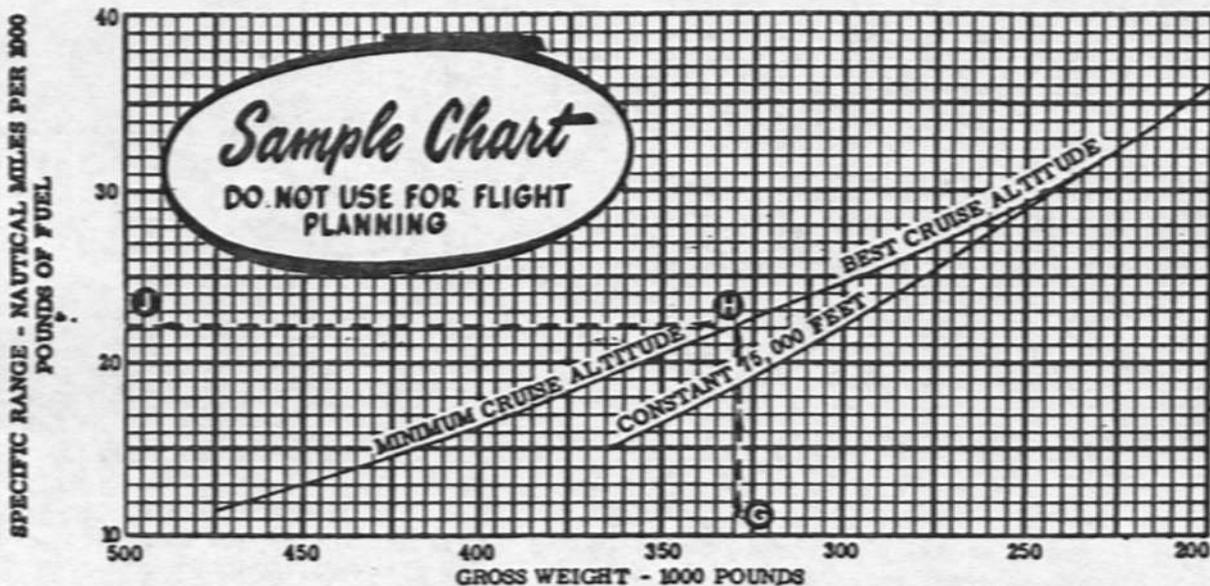
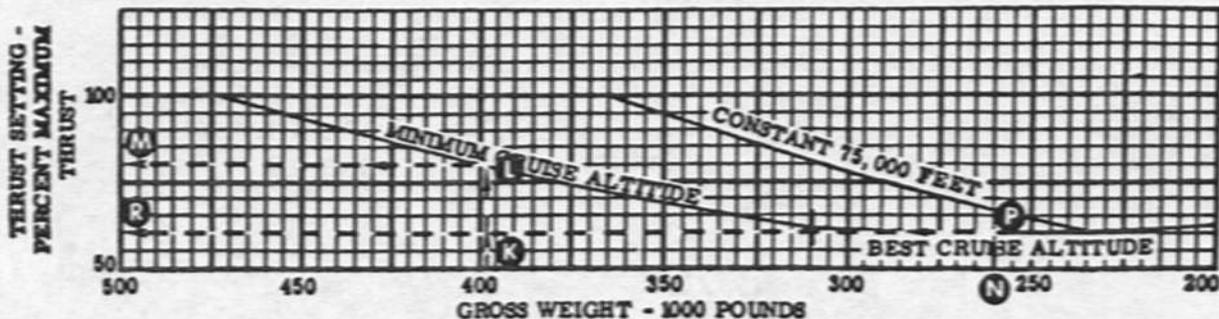


Figure A6-5

B-70-1-95-107

SOLUTION - CRUISE DISTANCE.

The cruise distance, in nautical miles, is determined by the following equation:

$$\text{Specific range} \times \frac{\text{Cruise fuel available}}{1000} =$$

Cruise distance

Therefore:

$$22.1 \times \frac{138,000}{1000} = 3050 \text{ nautical miles}$$

NOTE

If the curve showing the variation of specific range with gross weight is not linear for the range of cruise gross weight, the average gross weight cannot be used to determine cruise distance. Instead, the gross weight range must be divided in suitable increments, using smaller fuel weights, for which linearity is obtained. Then, the specific range and cruise distance must be determined for each increment. The sum of the individual cruise distances gives the total cruise distance.

SOLUTION - CRUISE TIME

The cruise time, in hours, is determined by the following equation:

$$\frac{\text{Cruise distance}}{\text{TAS}} = \text{Cruise time}$$

Therefore:

$$\frac{3050 \text{ nautical miles}}{1720 \text{ knots}} =$$

1.77 hours or 1 hour 46.2 minutes

SOLUTION - THRUST SETTING AND THROTTLE POSITIONS.

The thrust setting, which should be uniform on all six engines, varies during the cruise period. To determine the thrust at the start of the cruise, enter the thrust setting chart on figure A6-5 at

the initial gross weight of 398,000 pounds (point K). Move up vertically to intersect the minimum cruise altitude line (point L), then move left horizontally to the thrust setting scale and read the thrust required, 80 percent of Maximum Thrust (point M). While cruising at the constant altitude of 69,700 feet (minimum cruise altitude for Mach 3.0), the thrust setting must be reduced as the gross weight decreases. When 309,000 pounds is reached, the thrust setting is determined as 61 percent of Maximum Thrust. For the remaining portion of the cruise period the thrust setting remains essentially the same, although a slight decrease is necessary as the altitude increases. At the final cruise gross weight of 260,000 pounds (point N), move up vertically to the best cruise altitude line (point P). Then move horizontally to the left to the thrust setting scale and read 60 percent (point R), the final cruise thrust setting. This thrust setting is uncorrected for inlet pressure recovery reduction and temperature. The throttle positions corresponding to the thrust settings can be read on the throttle quadrant index marking chart on figure A6-6.

NOTE

Use the supersonic range chart corresponding to the cruise altitude being flown to determine the throttle quadrant index markings.

Enter the throttle quadrant index marking chart at 80 percent maximum Thrust (point A). Move horizontally to the right to intersect the Mach 3.0 line (point B), then down vertically to the base of the chart and read the corresponding position of the throttles as the 94-degree index mark on the quadrant (point C), the throttle position at the start of Mach 3.0 cruise. Starting with

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 70,000 FEET  
 6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

**Sample Chart**  
 DO NOT USE FOR FLIGHT  
 PLANNING

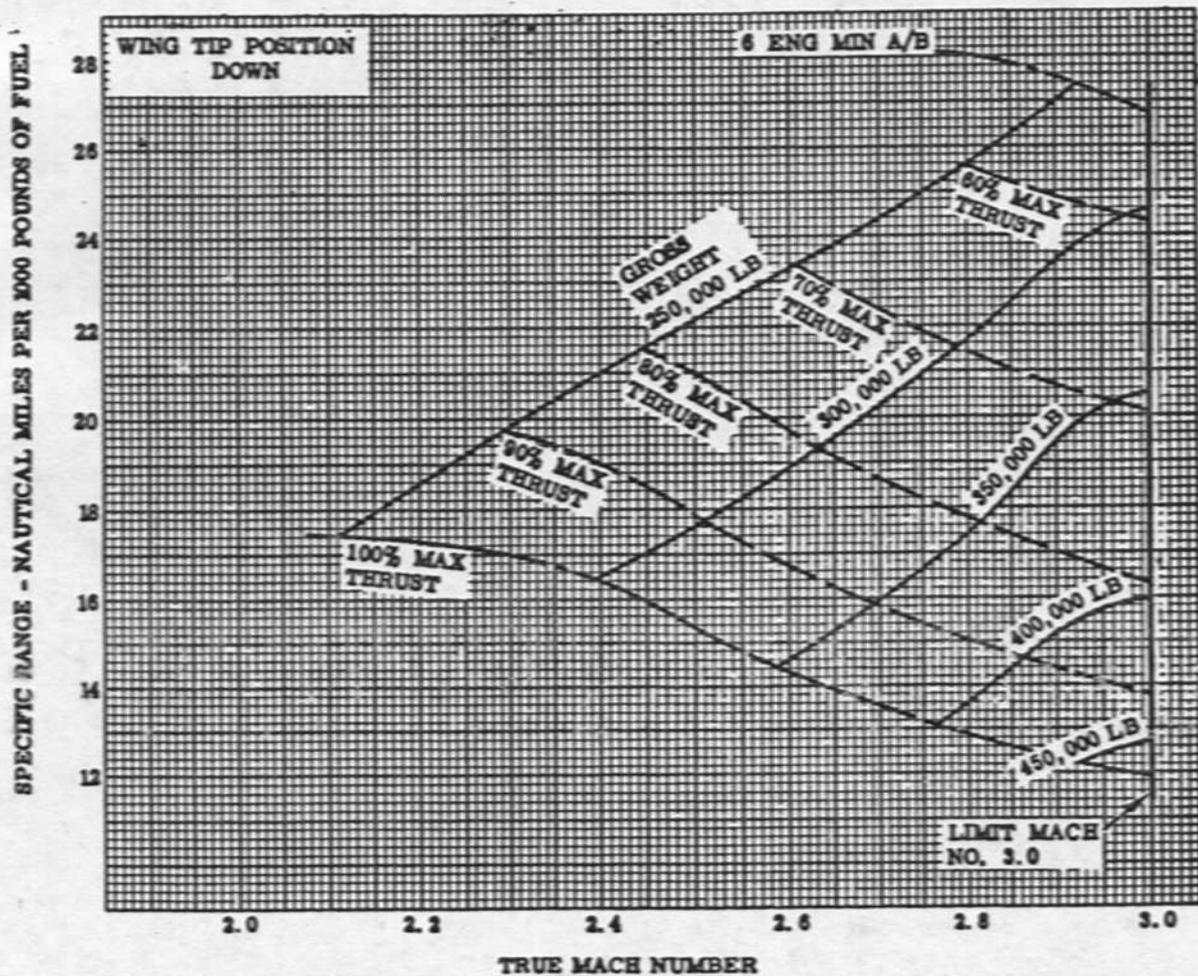
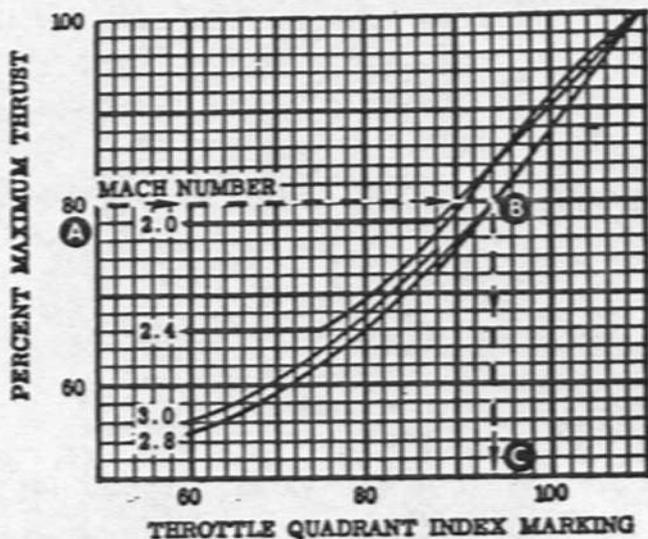


Figure A6-6

(  
(  
the percent of Maximum Thrust (61 percent) for the end of constant altitude cruise, repeat the same procedure to find the throttle position as the 71-degree mark on the quadrant. To determine the throttle position at the end of cruise (72,900 feet), repeat the same procedure, entering the chart with the end of cruise percent of Maximum Thrust (60 percent). Note that the throttle position from the end of constant altitude cruise to the end of the cruise period remains essentially constant, becoming 69 degrees at the end of cruise. These throttle settings are uncorrected for inlet pressure recovery reduction and temperature.

T. O. 1B-70(X)A-1A

# RANGE - SUBSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 15,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

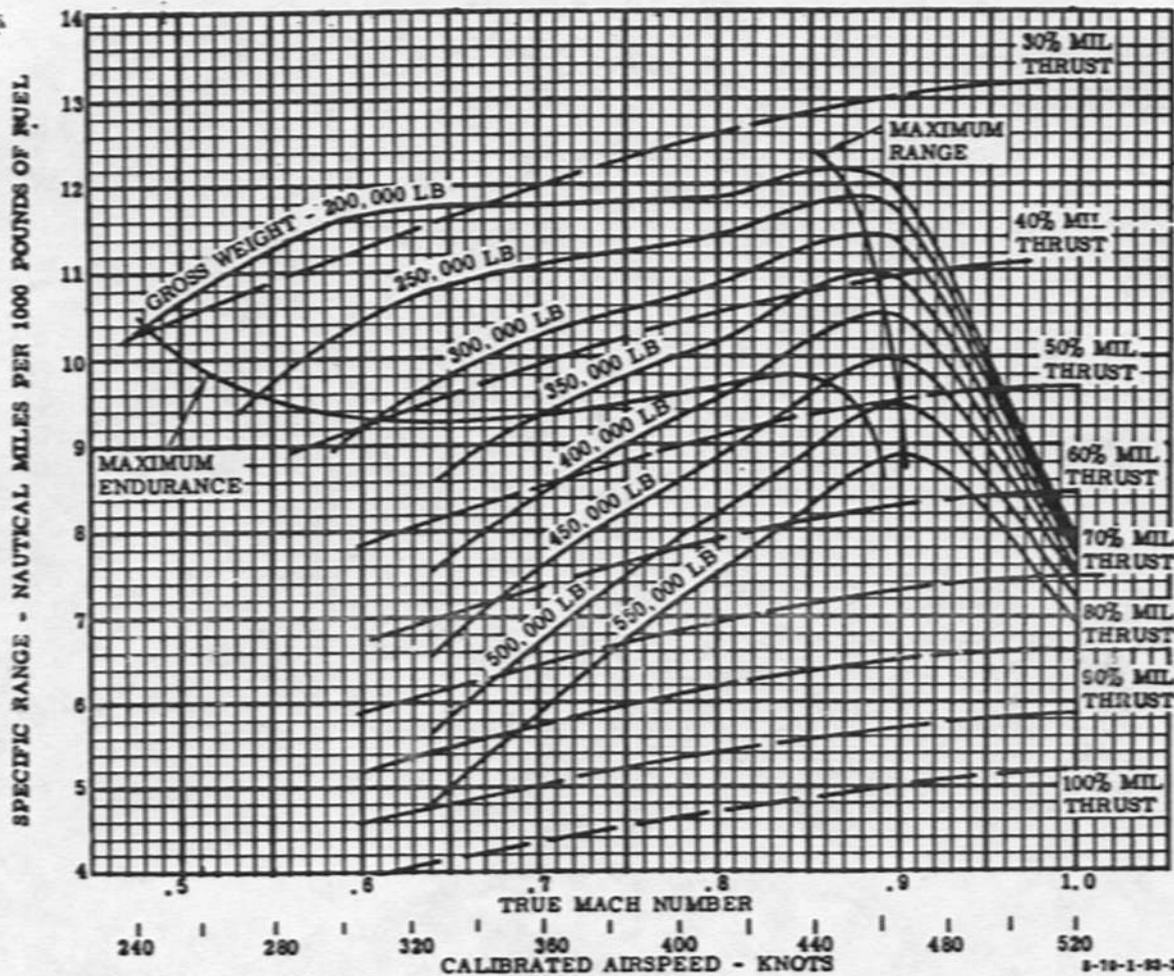
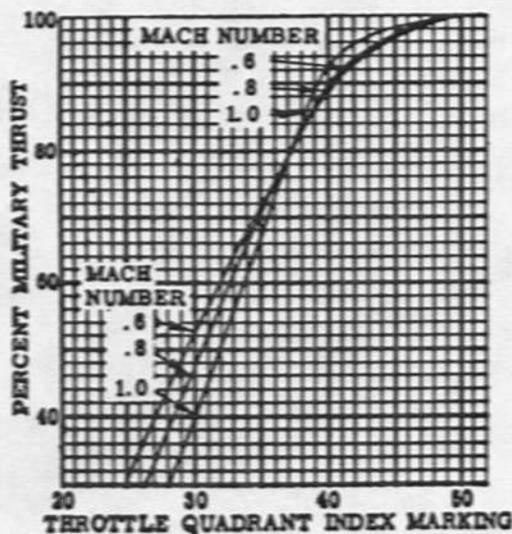


Figure A6-7

8-10-1-62-27

# RANGE - SUBSONIC

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 20,000 FEET  
 6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

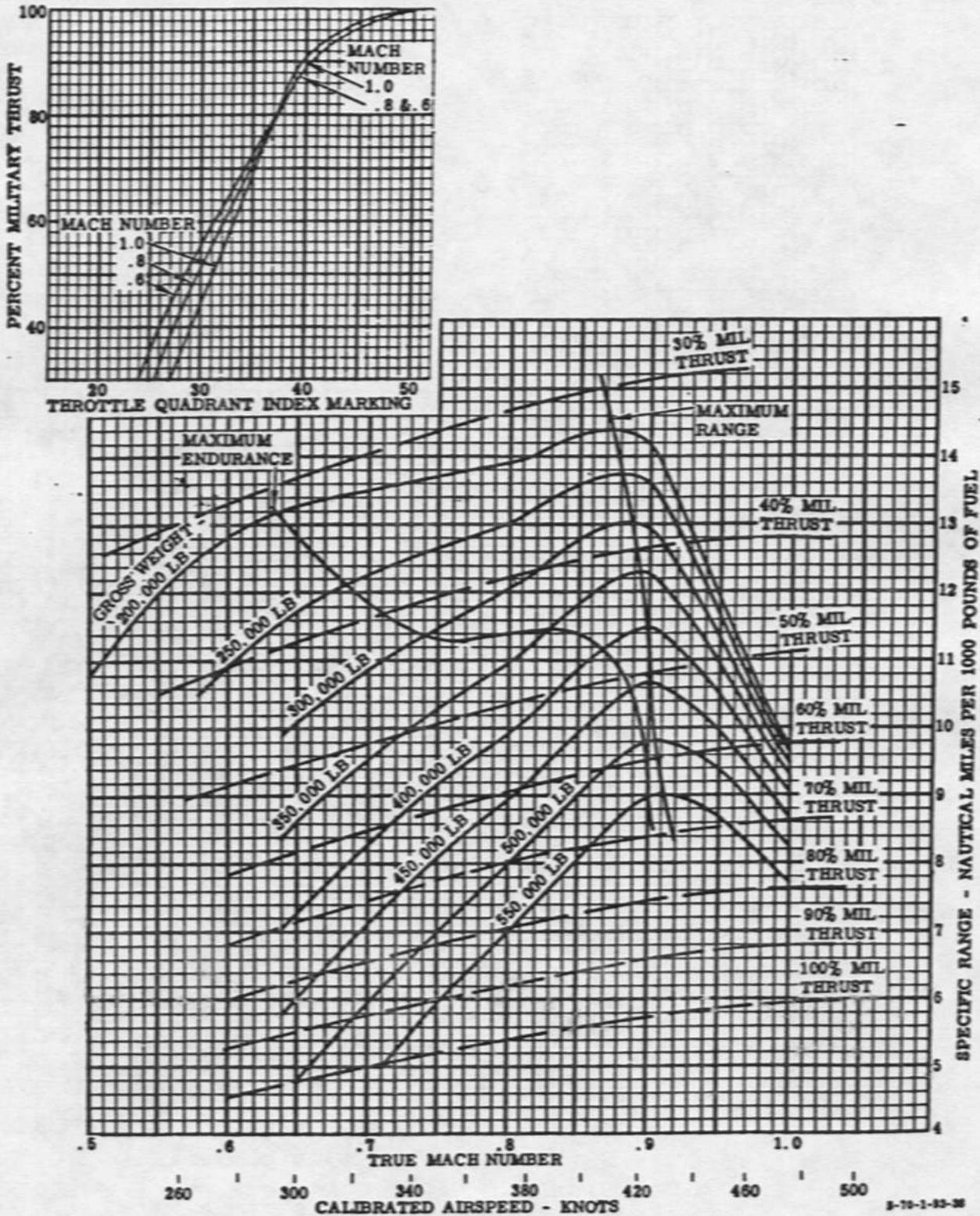


Figure A6-8

T. O. 1B-70(X)A-1A

# RANGE - SUBSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 25,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

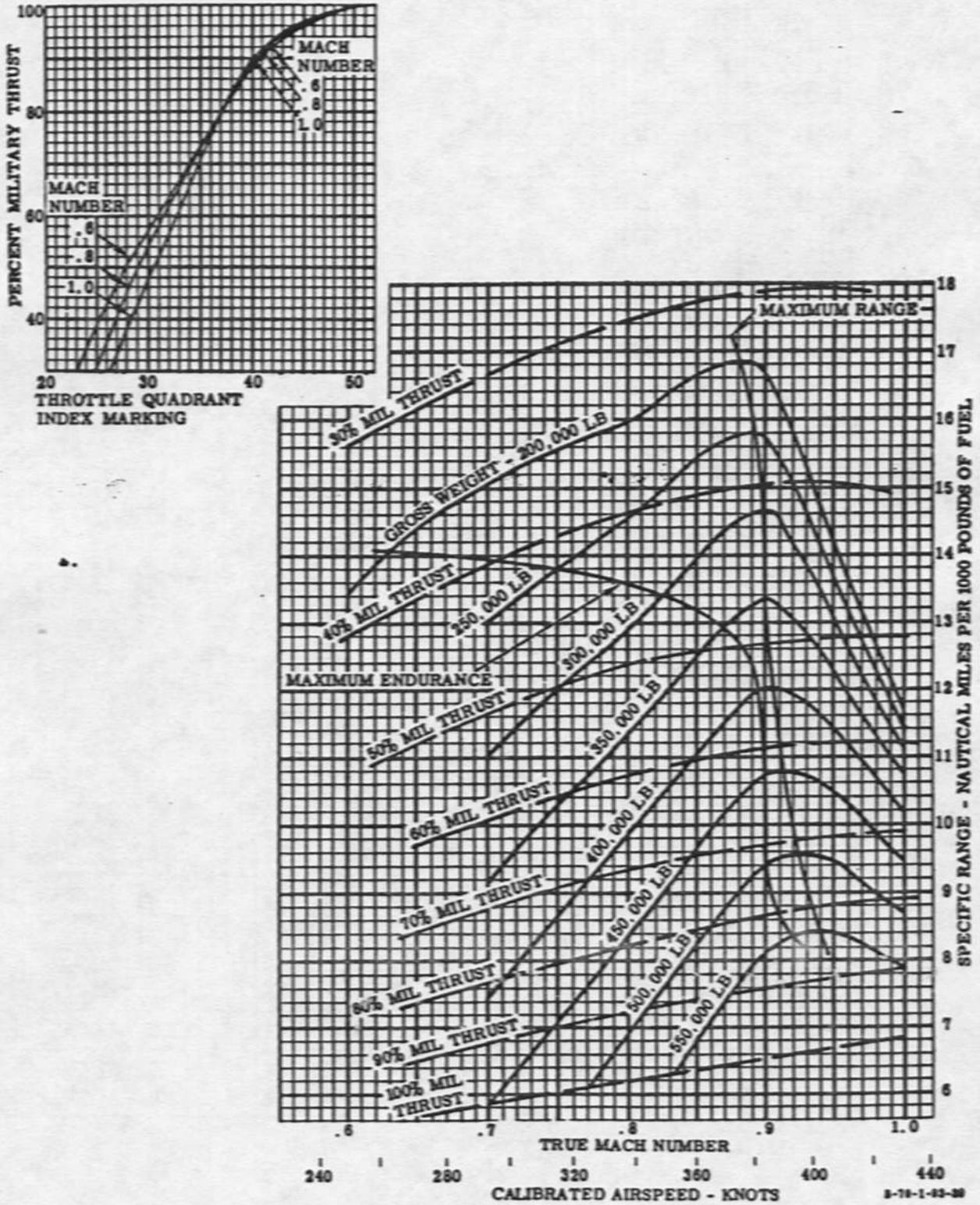


Figure A8-9

# RANGE - SUBSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 30,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

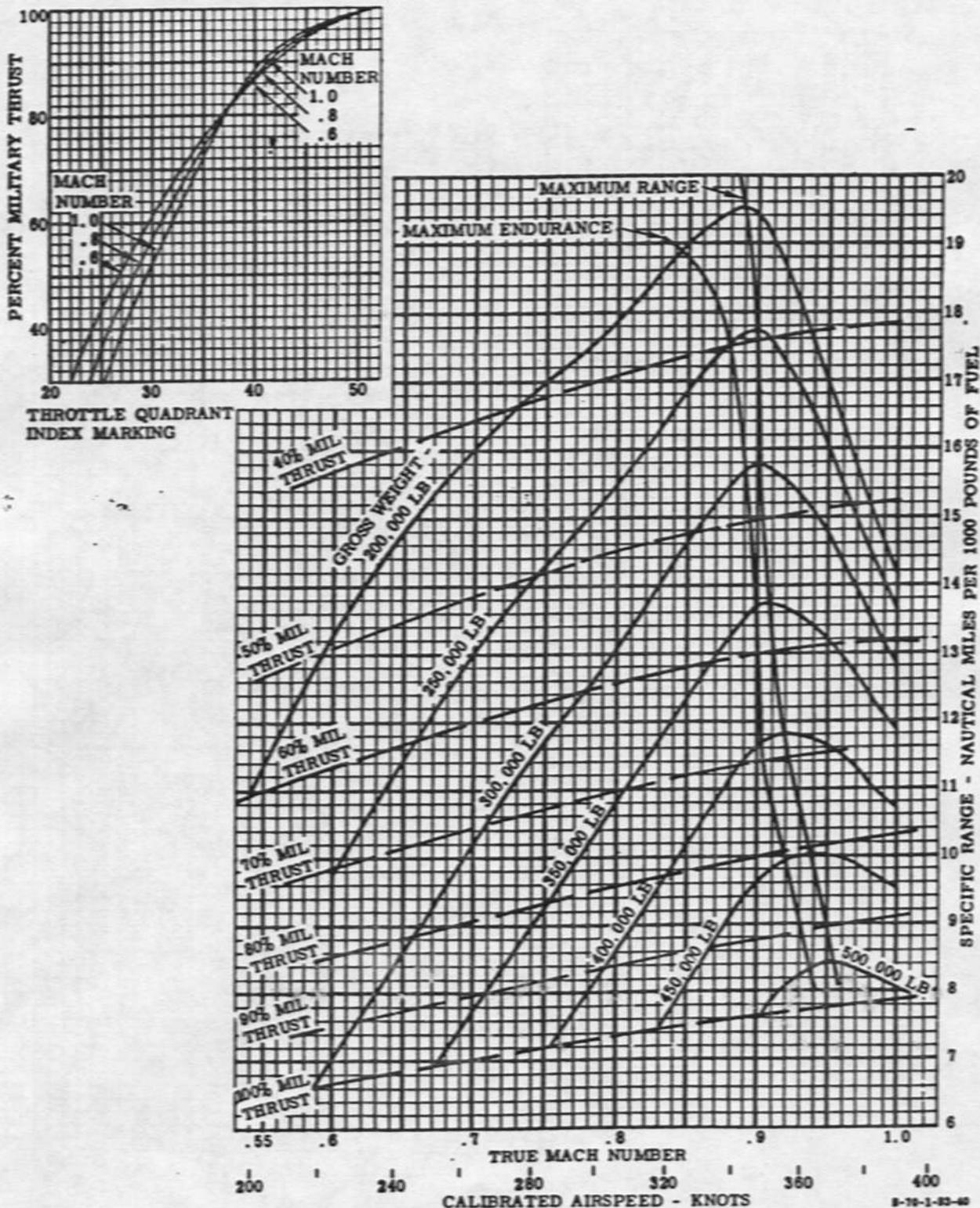


Figure A6-10

T. O. 1B-70(X)A-1A

# RANGE - SUBSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 35,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: Y793-GE-3

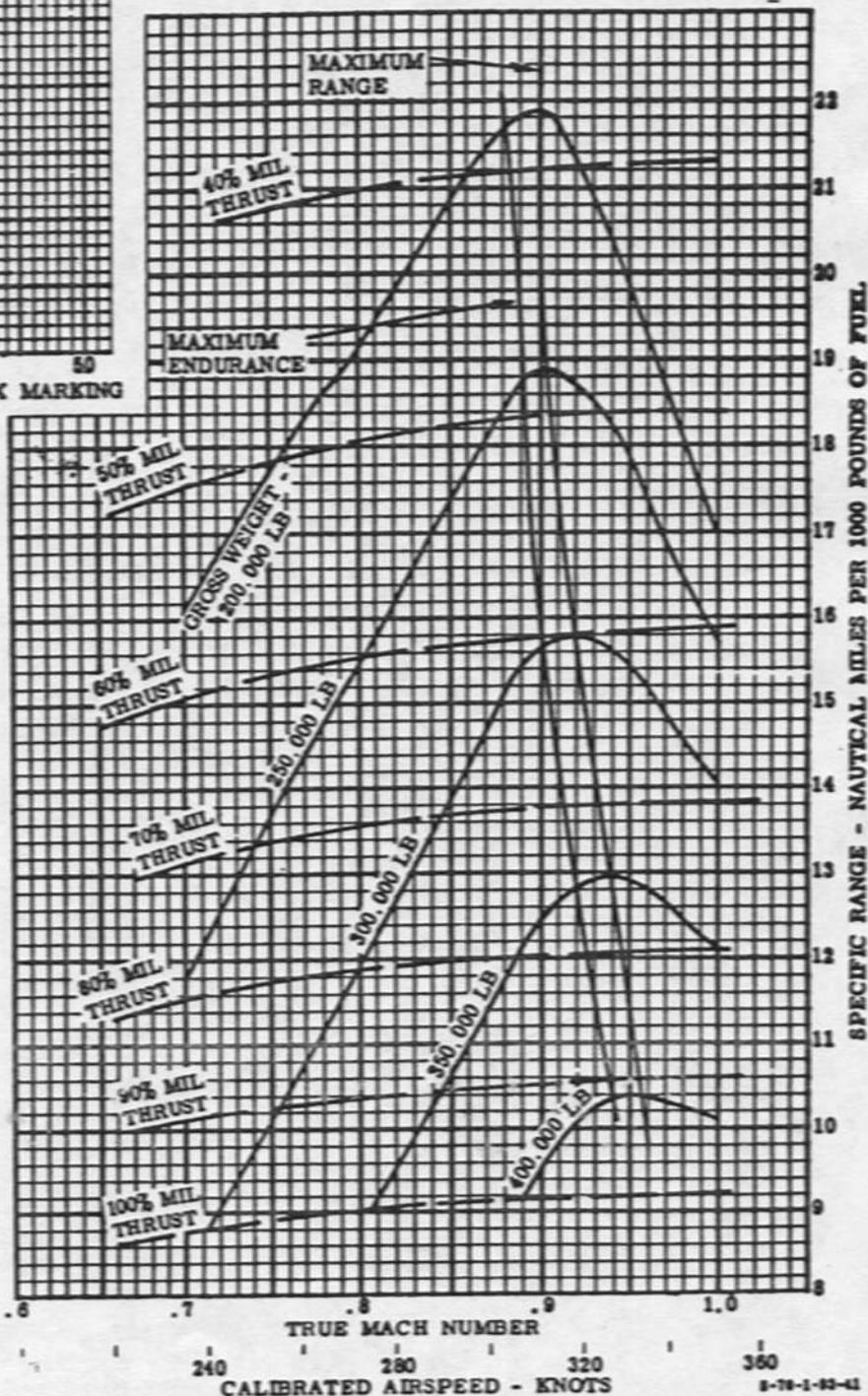
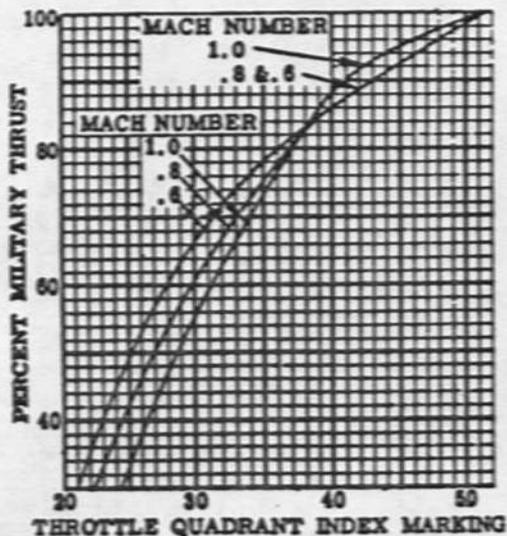


Figure A6-11

# RANGE - SUBSONIC

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 40,000 FEET  
 6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

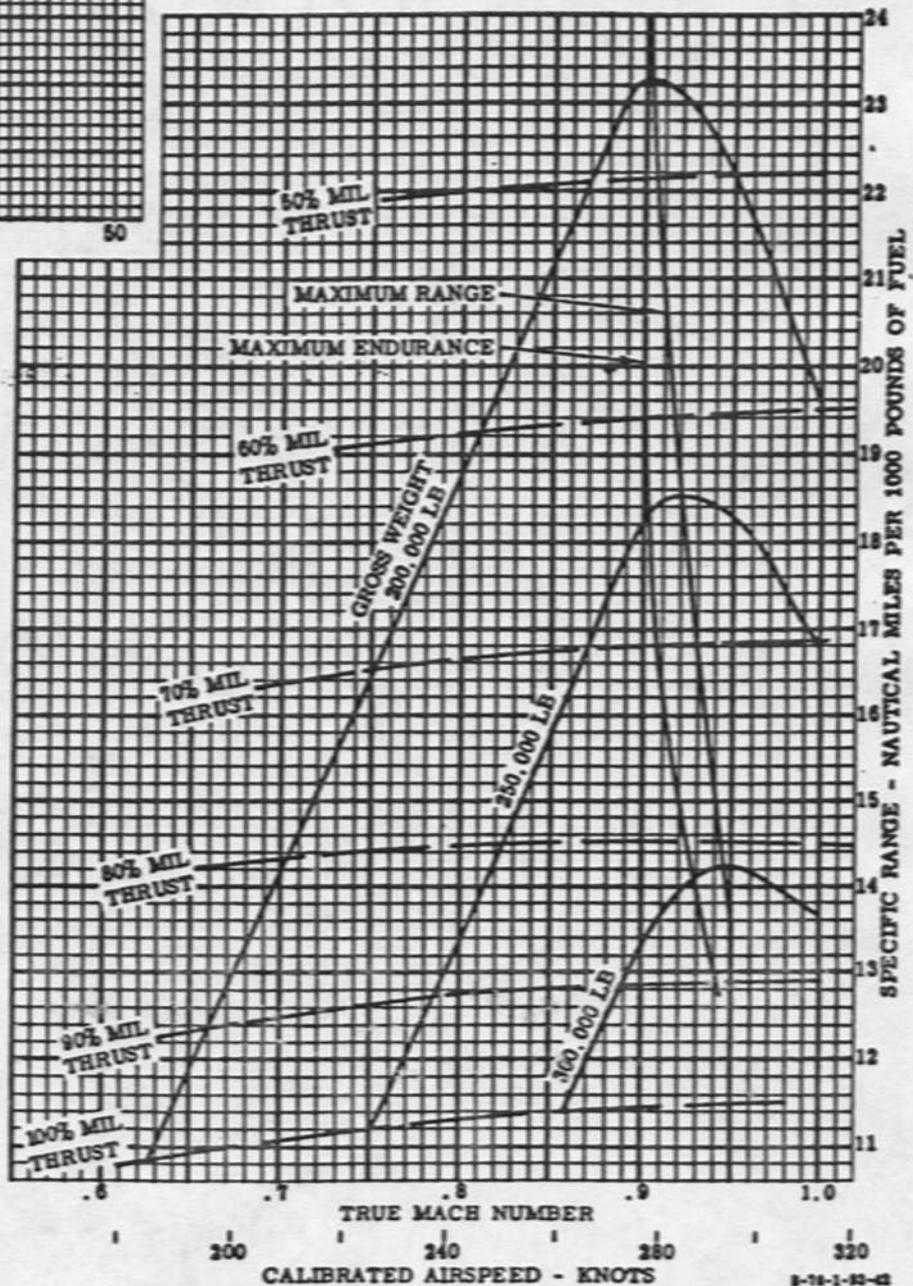
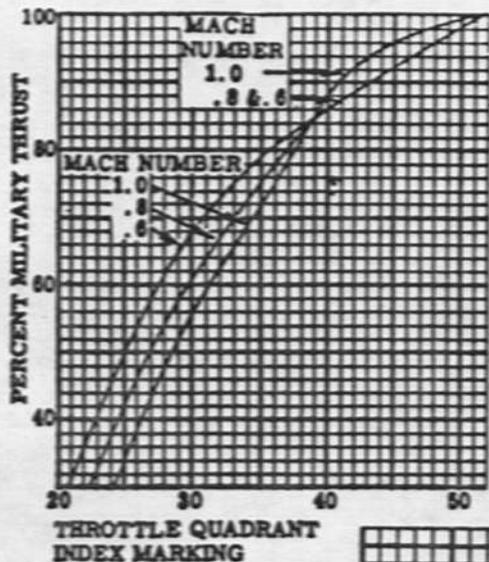


Figure A6-12

# MAXIMUM RANGE - SUBSONIC

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1963  
 BASED ON: ESTIMATED DATA

6 ENGINES - UNIFORM THRUST  
 .9 MACH

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

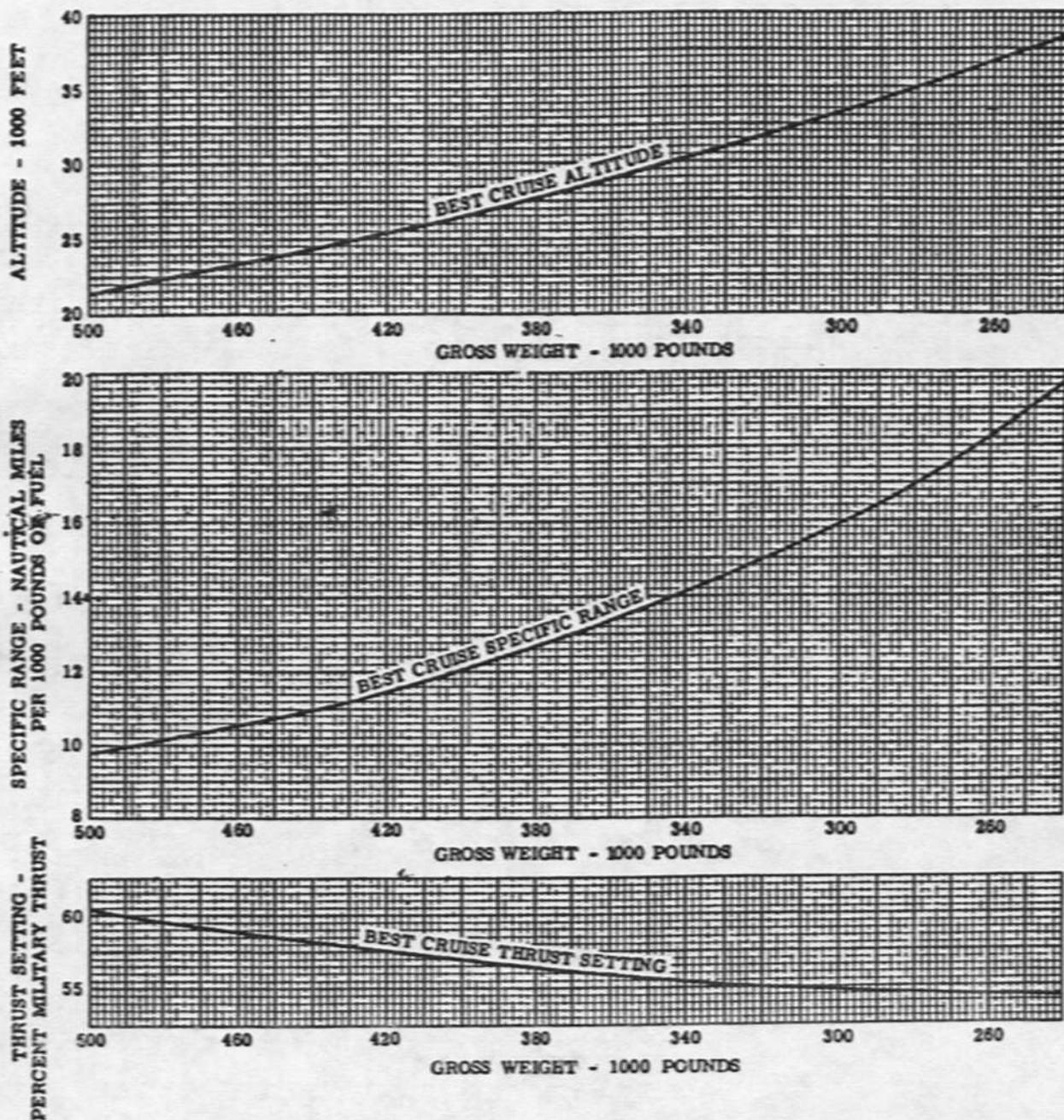


Figure A6-13

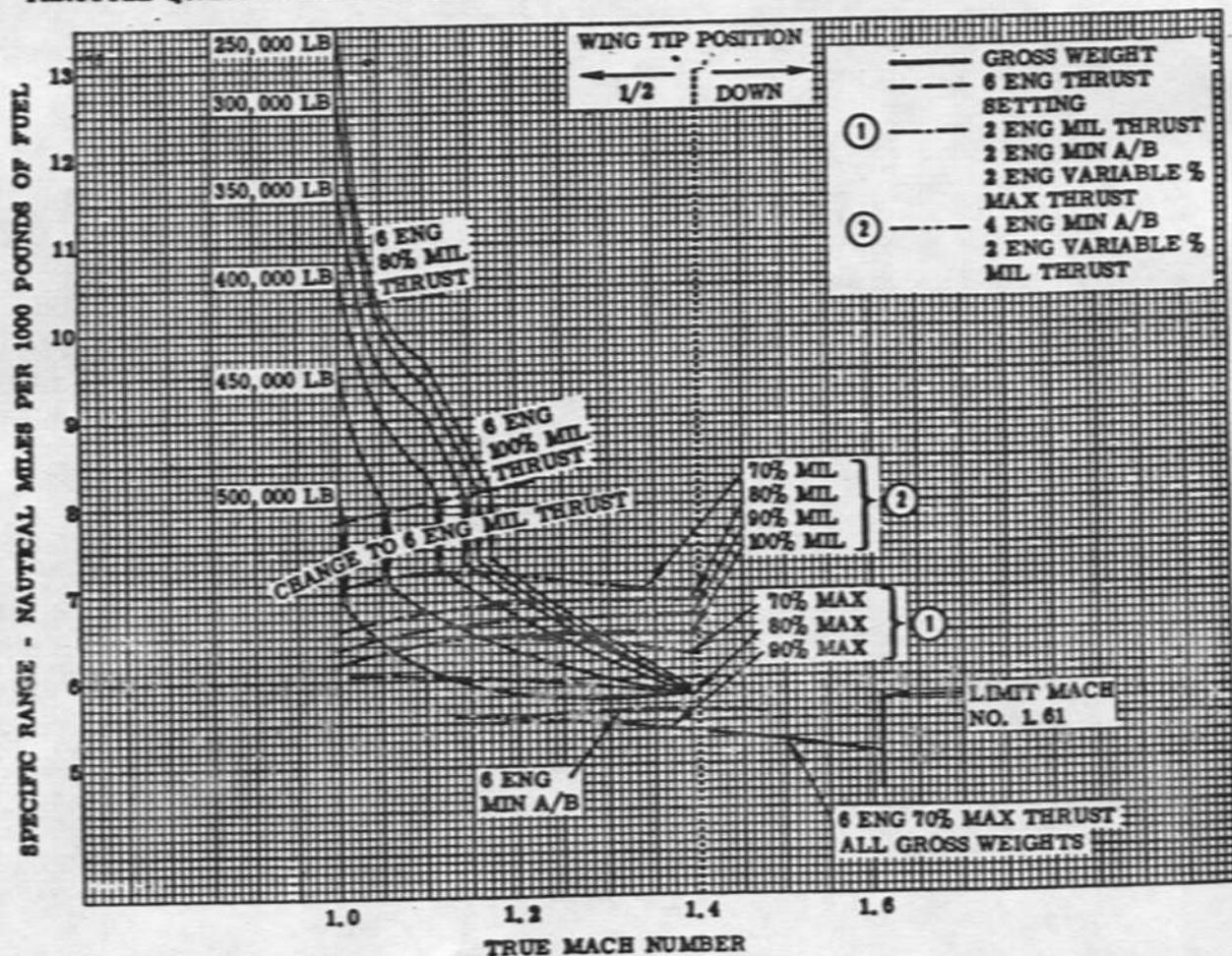
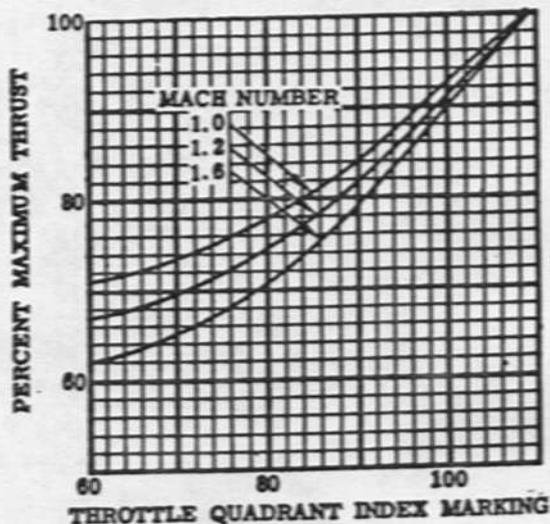
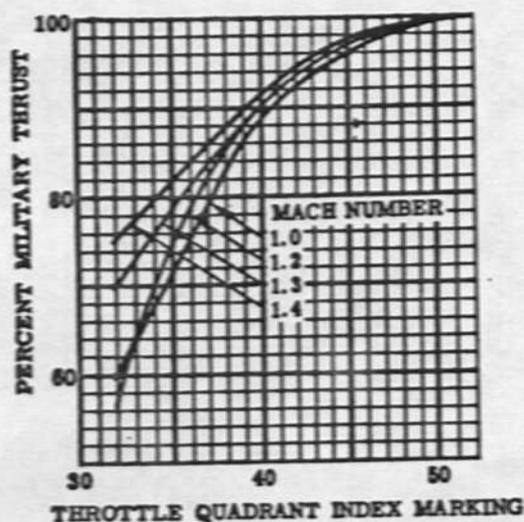
T. O. 1B-70(X)A-1A

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 30,000 FEET

MODEL: XB-70A  
ENGINES: YJ93-GE-3



B-70-1-82-66A

Figure A6-14

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 35,000 FEET

MODEL: XB-70A  
ENGINES: YJ93-GE-3

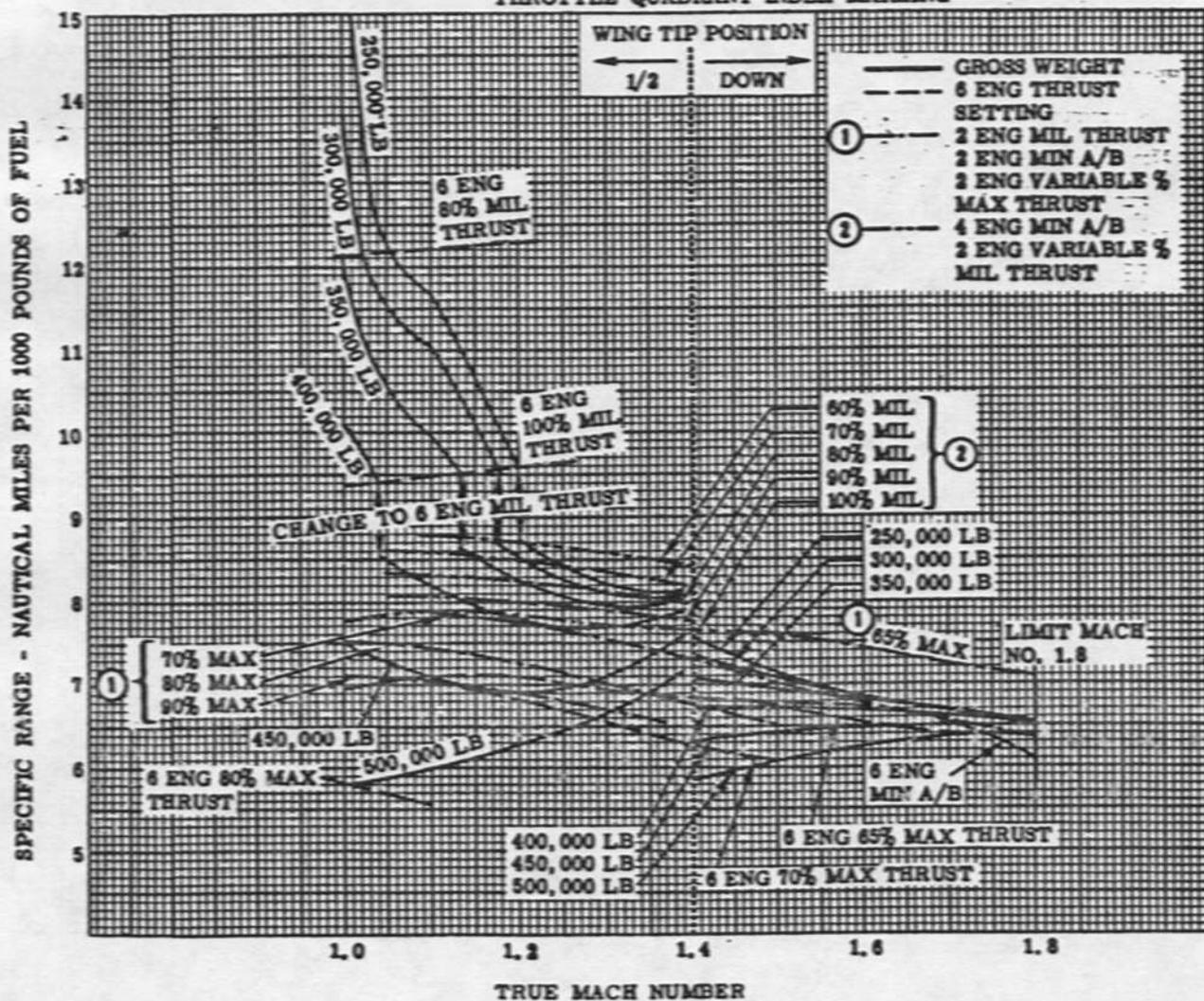
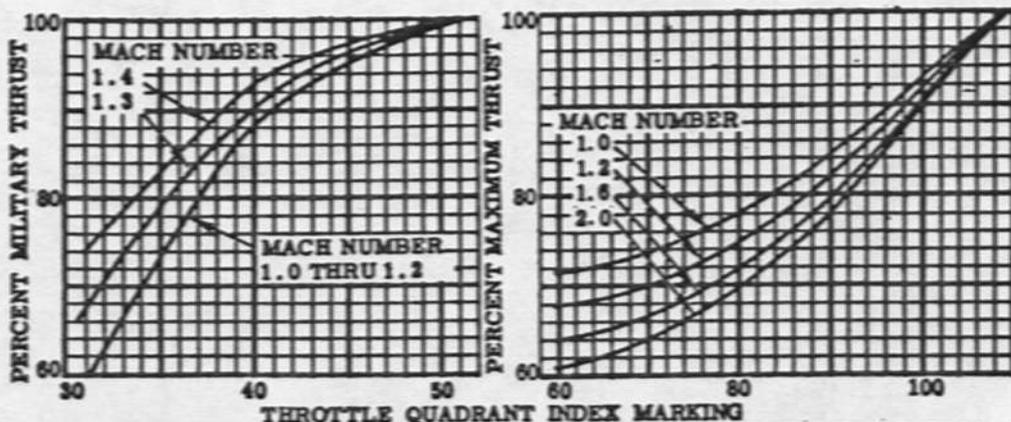


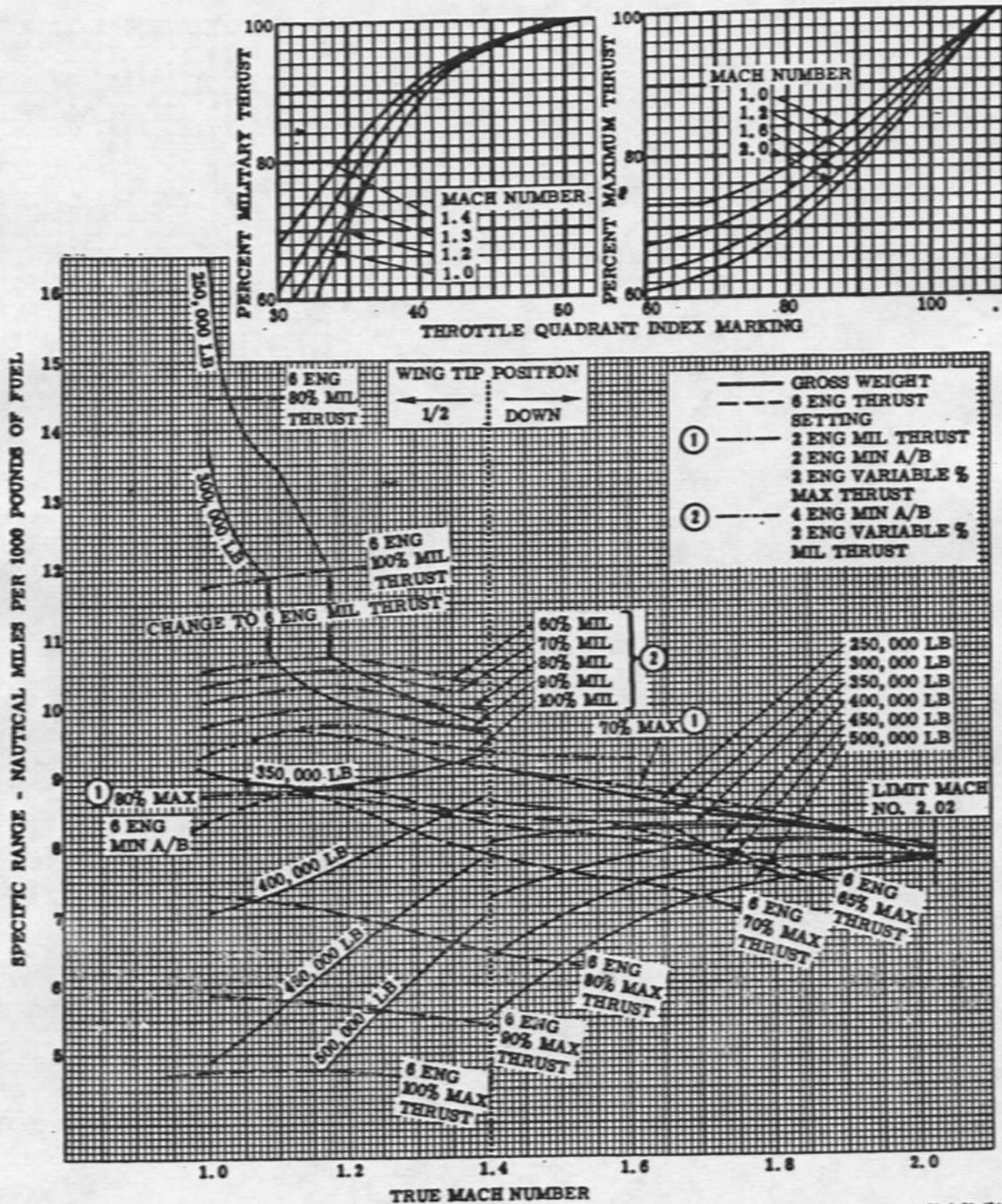
Figure A6-15

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 40,000 FEET

MODEL: XB-70A  
ENGINES: YJ93-GE-3



8-70-1-82-48A

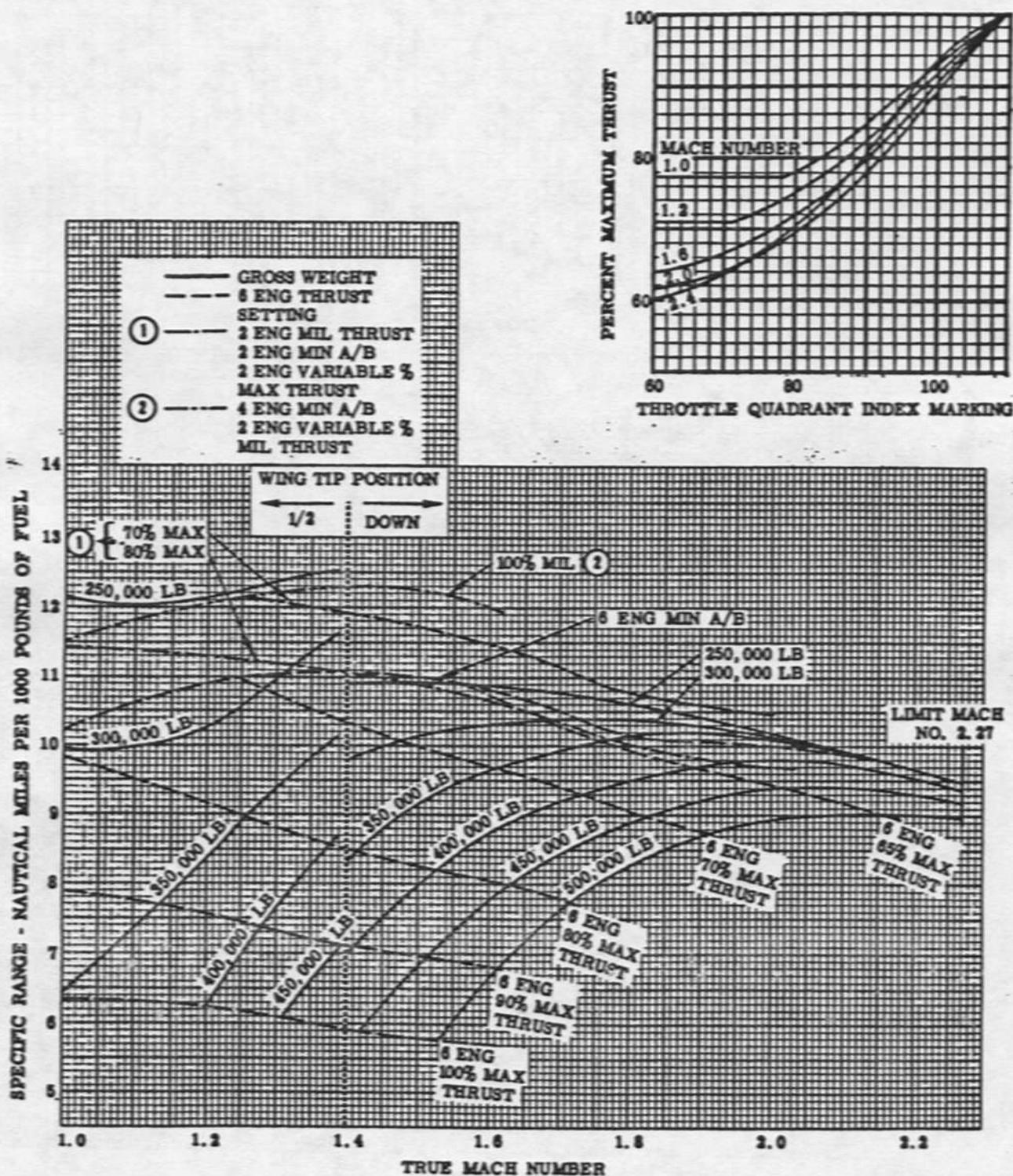
Figure A6-16

## RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 45,000 FEET

MODEL: XB-70A  
ENGINES: YJ93-GE-3



8-70-1-92-54A

Figure A6-17



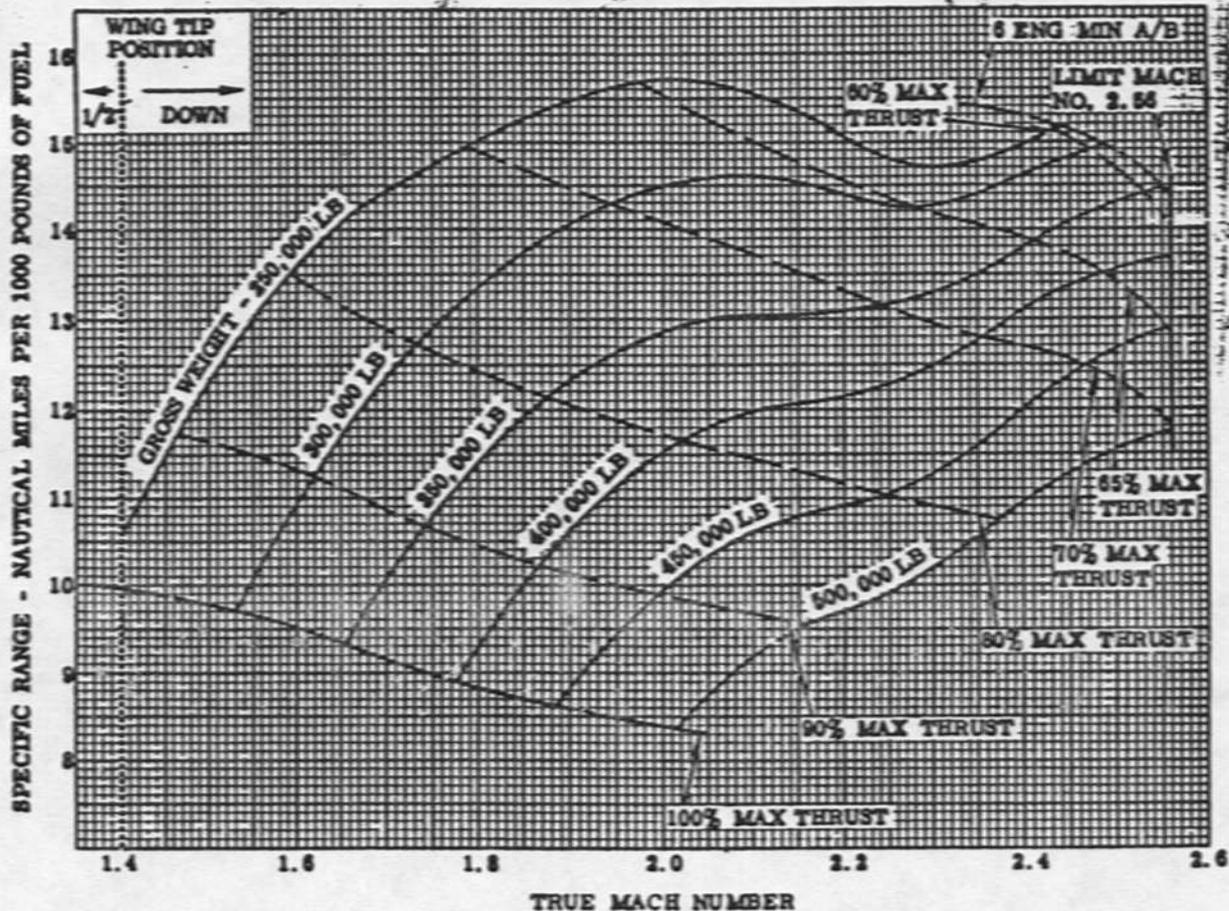
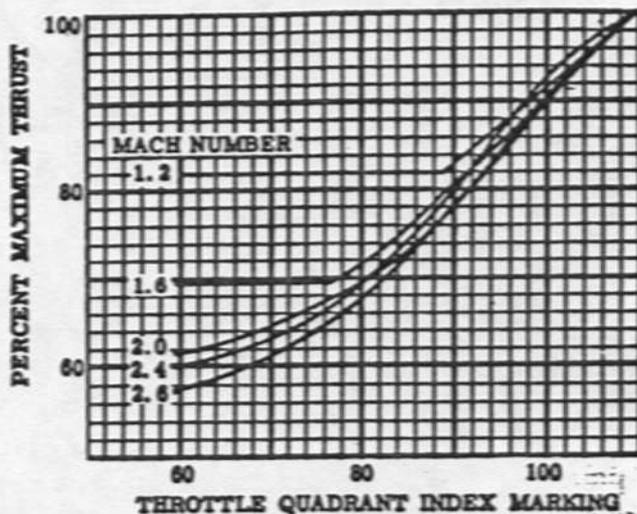
T.O. B-70(X)A-1A

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 55,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3



B-70-1-83-54A

Figure A5-19

T.O. 1B-70(X)A-1A

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1963  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 60,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL XB-70A  
ENGINES: YJ93-GE-3

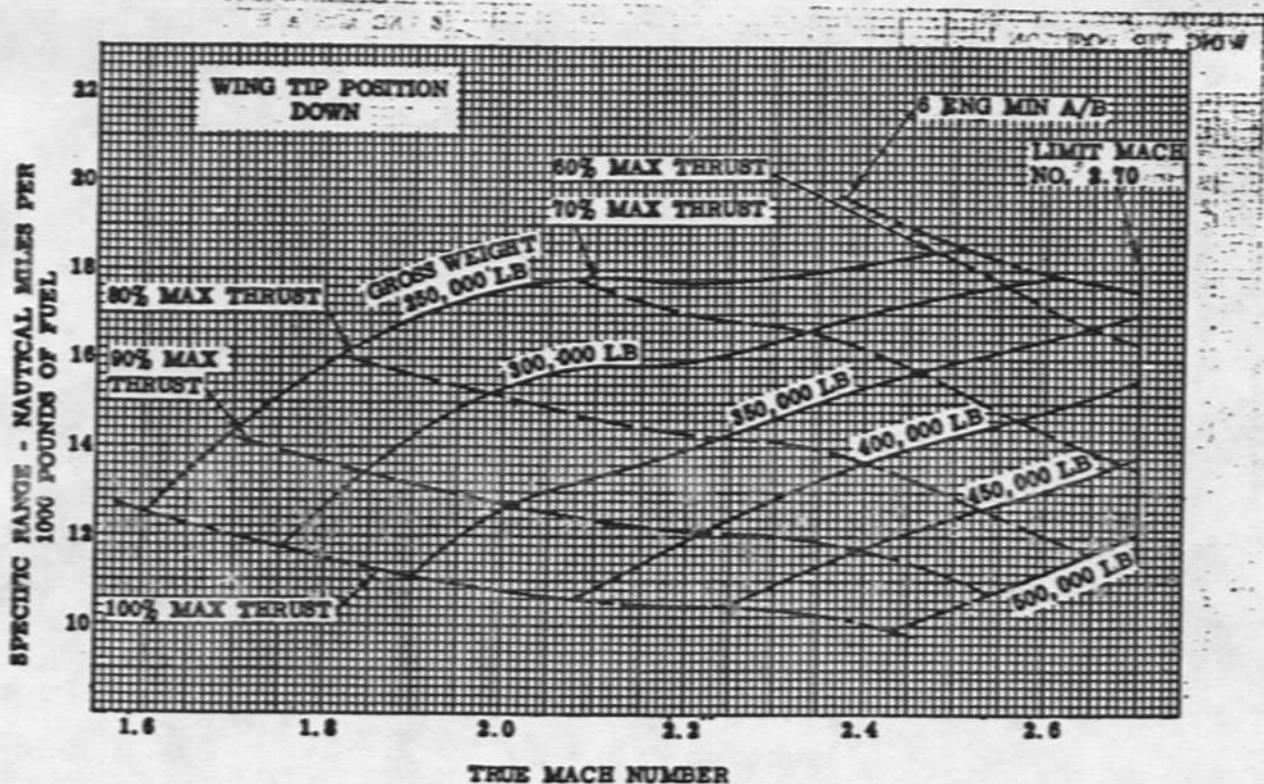
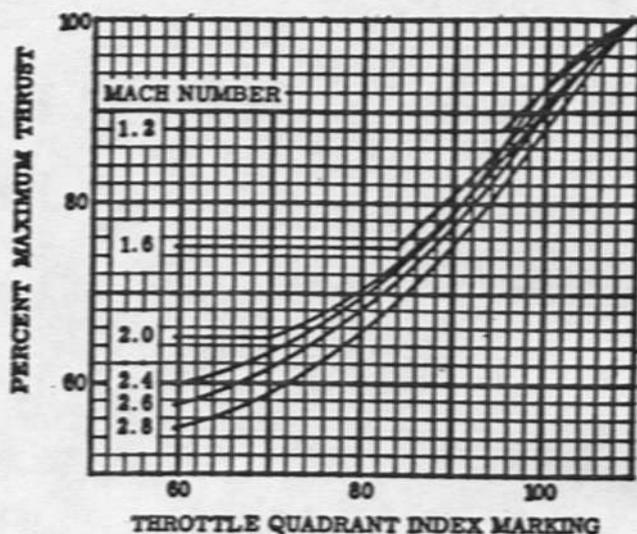


Figure A6-20

1-70-1-82-5A

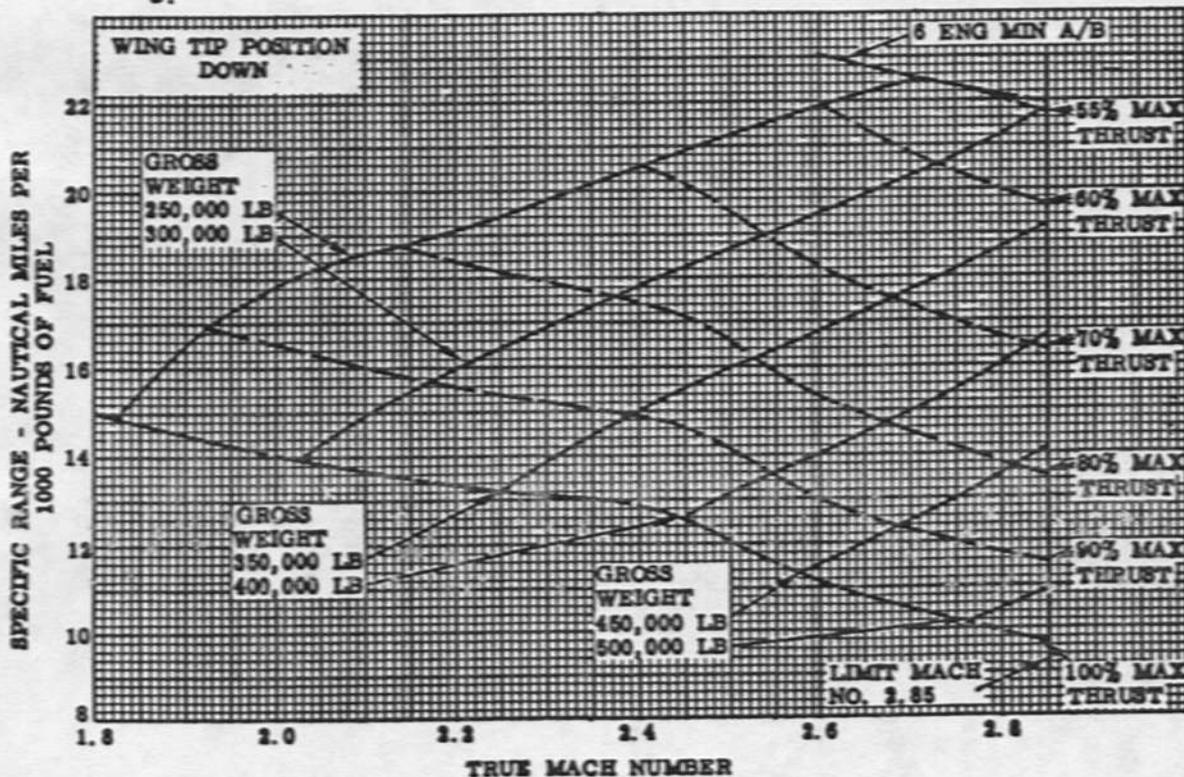
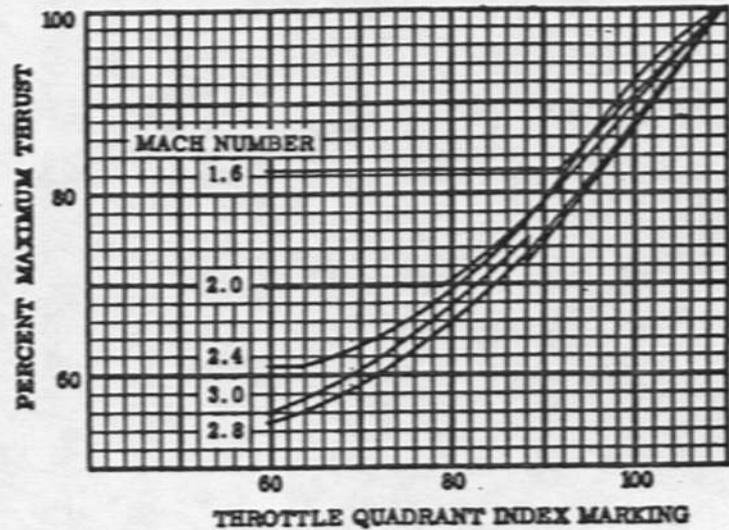
T. O. 1B-70(X)A-1A

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 65,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3



1-10-1-83-56A

Figure A6-21

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 70,000 FEET  
6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

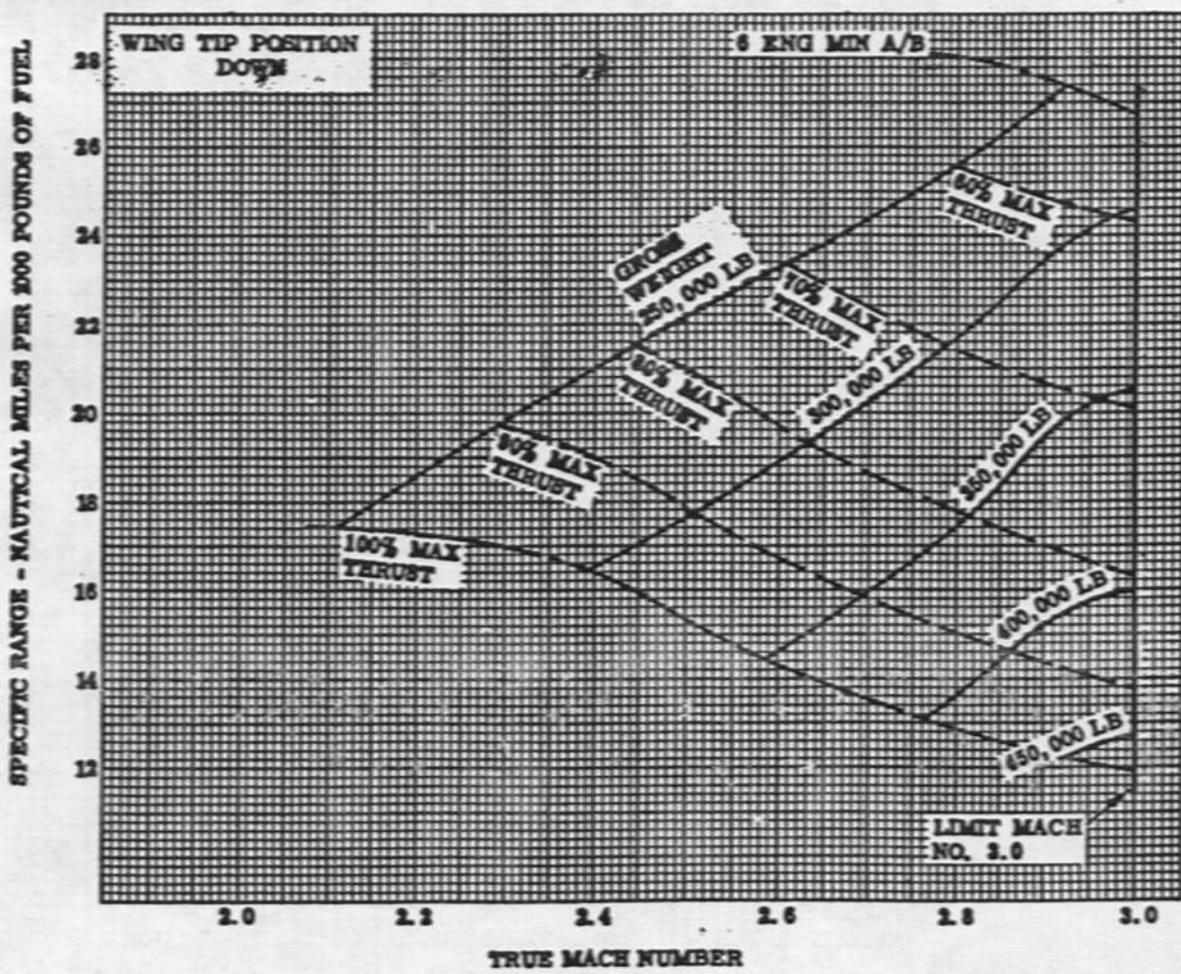
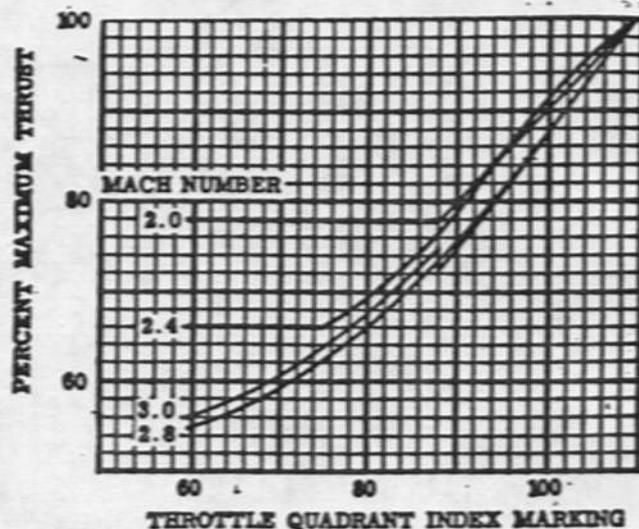


Figure A6-22

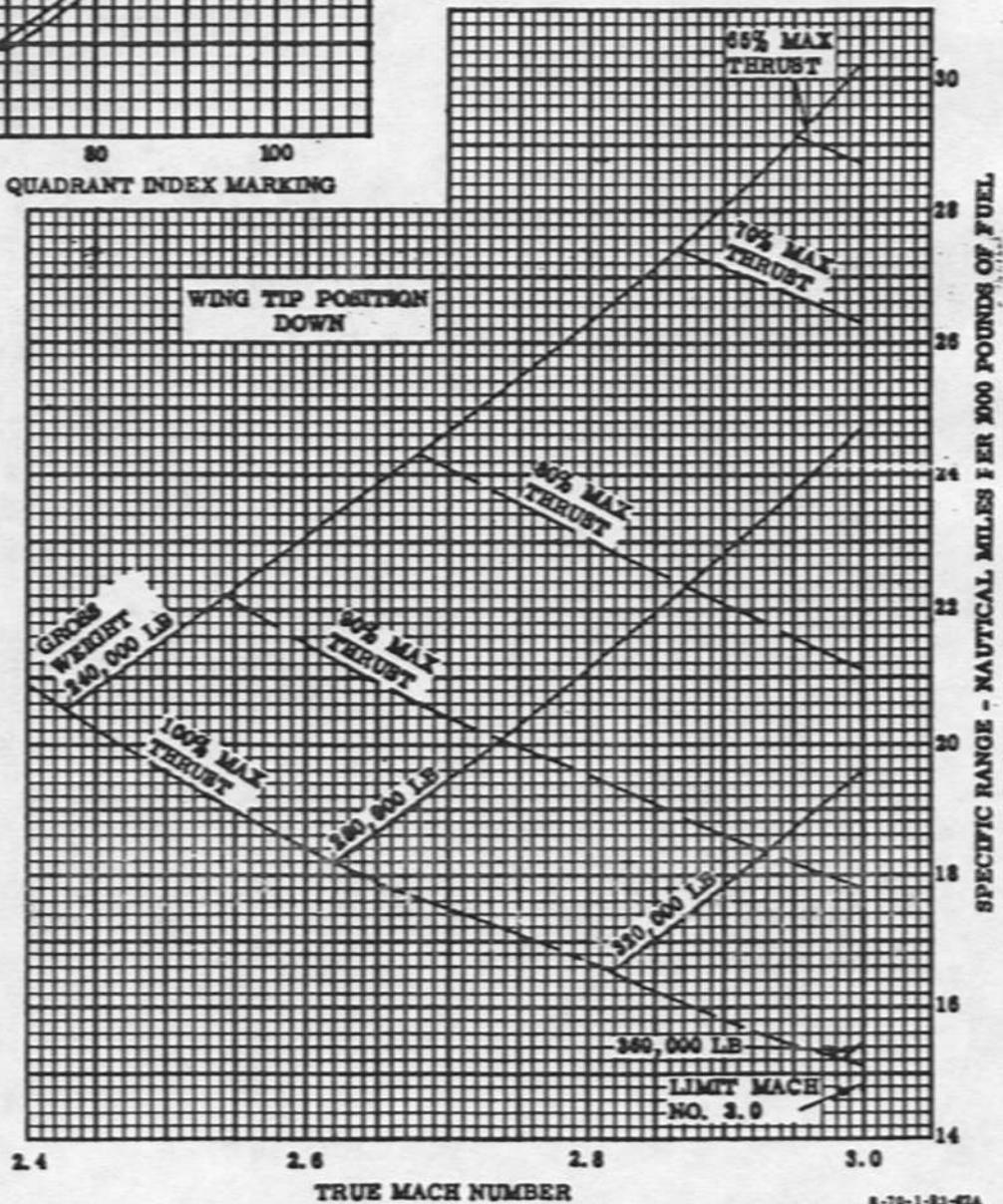
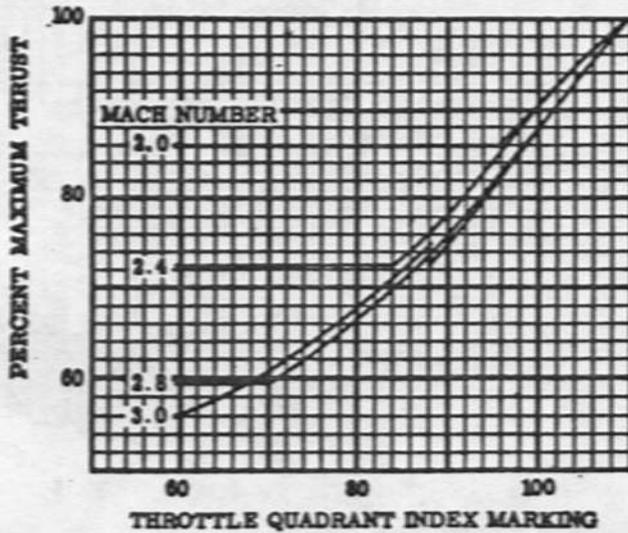
1-70-1-03-00A

# RANGE - SUPERSONIC

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

CONSTANT ALTITUDE CRUISE - 75,000 FEET  
 6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3



8-70-1-92-42A

Figure A6-23

# RANGE AT MACH 3.0 CRUISE

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES - UNIFORM THRUST

MODEL: XB-70A  
 ENGINES: YJ93-GE-3

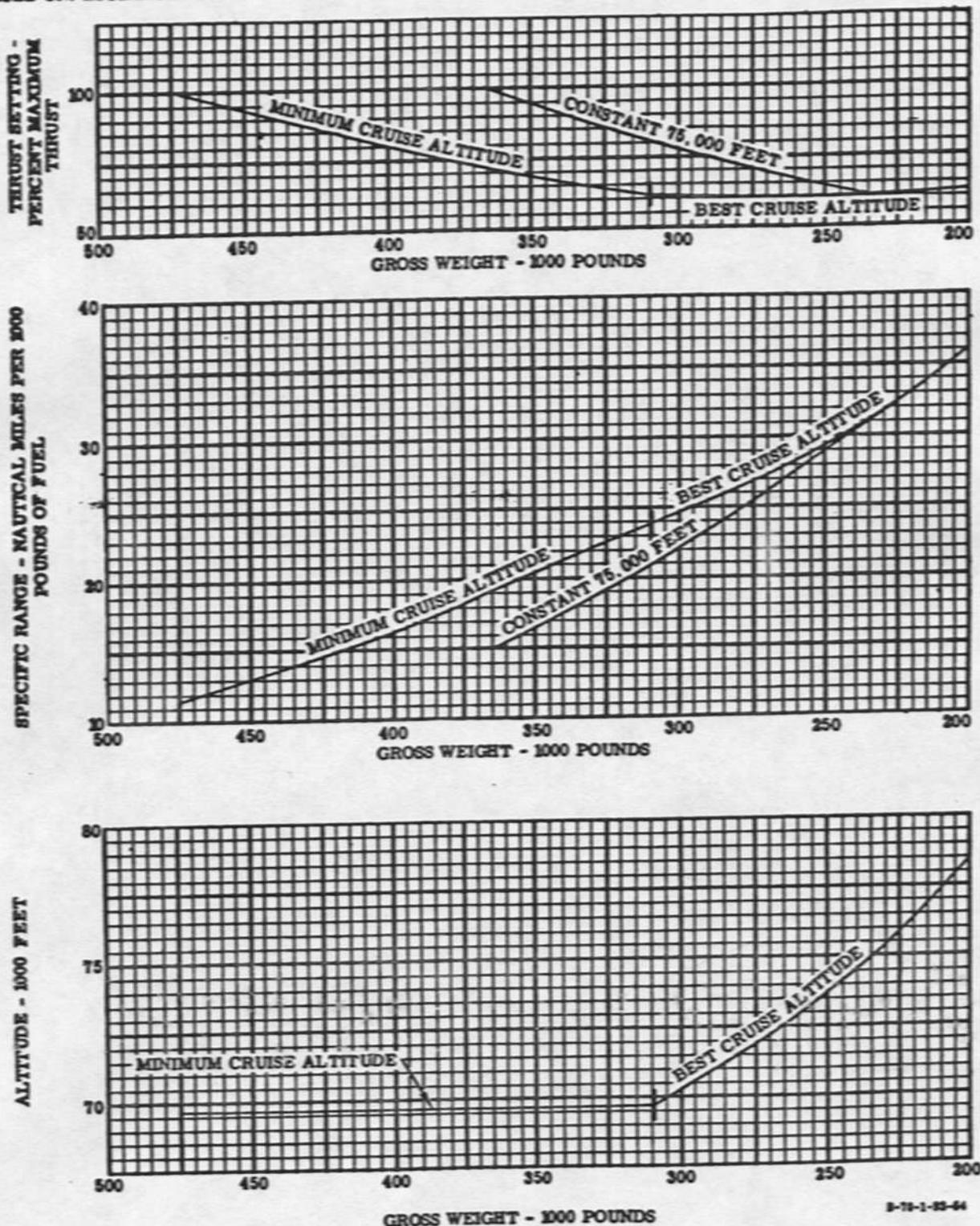


Figure A6-24

B-70-1-85-64

## PART 7

## ENDURANCE

Underlined page numbers denote charts.

TABLE OF CONTENTS	PAGE	PAGE
Description.....	A7-1	Endurance..... <u>A7-4</u>
Use of Charts.....	A7-1	

DESCRIPTION.

The information necessary to plan a maximum endurance (loiter) operation is shown in figure A7-2. In addition, the correction factors for inlet pressure recovery reduction and temperature effects must be applied where necessary. For any given gross weight there is an optimum altitude for maximum endurance. During loiter operations, the airplane weight decreases as fuel is used, and the optimum altitude increases resulting in a climbing flight path. At this optimum altitude, maximum endurance is attained at a constant Mach 0.90 for all gross weights. The endurance time for a given amount of fuel is obtained by dividing the amount of fuel to be used by the average fuel flow which is read from the chart at an average gross weight. Altitude variations of  $\pm 1000$  feet and airspeed variations of  $\pm 10$  knots will not appreciably affect the overall loiter plane. (For maximum range at a constant altitude refer to Part 6 in this appendix.) Mach number may be converted to CAS by using figure All-2.

The charts on figure A7-2 show fuel flow, altitude, and thrust setting as functions of gross weight. Curves representing the best loiter fuel flow, best loiter altitude, and best loiter thrust setting are superimposed on the charts. The fuel flow, endurance time, and thrust setting as read from the charts, must be corrected for both the inlet pressure recovery reduction and then for the temperature effects.

NOTE

- To correct chart values for inlet pressure recovery reduction, increase fuel flow by 0.6 percent

and thrust setting by 1 percent for each 1 percent reduction of inlet pressure recovery.

- To correct values for temperature, increase fuel flow .125 percent and thrust setting .25 percent for each degree F higher than ARDC Standard Day, or decrease fuel flow .12 percent and thrust setting .125 percent for each degree F lower than ARDC Standard Day. No temperature correction is required for endurance Mach and altitude change if within the  $\pm 1000$ -foot variation allowed.

USE OF CHARTS.SAMPLE PROBLEM.

## GIVEN:

- Initial gross weight.....300,000 pounds
- Allowable fuel for loiter.....40,000 pounds

## FIND:

- Average and final gross weights
- Average fuel flow
- Initial and final loiter altitudes
- Endurance (loiter) time
- Best thrust setting and throttle position.

**SOLUTION - AVERAGE AND FINAL GROSS WEIGHTS.**

Divide the allowable fuel for loiter by two, and subtract this amount from the initial gross weight. Thus, 40,000 pounds of fuel divided by two equals 20,000 pounds. Subtracting 20,000 pounds from the initial gross weight of 300,000 pounds gives the average gross weight of 280,000 pounds. To determine the final gross weight, subtract the amount of fuel to be used from the initial gross weight. Thus, 300,000 pounds minus 40,000 pounds equals 260,000 pounds, the final gross weight.

**SOLUTION - AVERAGE FUEL FLOW.**

Enter the charts on figure A7-1 at the average gross weight of 280,000 pounds (point A) and move up vertically to intercept the best loiter fuel flow curve (point B). Move horizontally left to the fuel flow scale and read the average fuel flow of 30,600 pounds per hour (point C), uncorrected for inlet pressure recovery and temperature.

**SOLUTION - INITIAL AND FINAL LOITER ALTITUDES.**

Enter the charts on figure A7-1 at the initial gross weight of 300,000 pounds (point D). Move up vertically to intercept the best loiter altitude curve (point E). Then move horizontally to the left to the altitude scale and read 33,300 feet (point F), the initial altitude. Because the airplane weight decreases as fuel is used, the final altitude will be greater than the initial altitude when holding a constant Mach number. Therefore, enter the same chart at the final gross weight of 260,000 pounds (point G), and move vertically to intercept the best loiter altitude curve (point H). Then move horizontally to the left to the altitude scale and read 36,100 feet (point J), the final altitude.

**NOTE**

To determine the best loiter altitude, regardless of the airspeed, enter the chart at the average gross weight, move up vertically to intercept the best loiter altitude

curve, then move horizontally to the left and read the best loiter altitude from the scale.

**SOLUTION - ENDURANCE (LOITER) TIME.**

To determine the endurance time, the following equation must be used:

$$\frac{\text{Loiter fuel (pounds)}}{\text{Average fuel flow (pph)}} = \frac{\text{endurance}}{\text{(hours)}}$$

Therefore, with 40,000 pounds of fuel available and an average fuel flow of 30,600 pounds per hour, the endurance time, uncorrected for inlet pressure recovery and temperature, is:

$$\frac{40,000}{30,600} = 1.307 \text{ hours or 1 hour, 18 minutes}$$

**SOLUTION - BEST THRUST SETTING AND THROTTLE POSITION.**

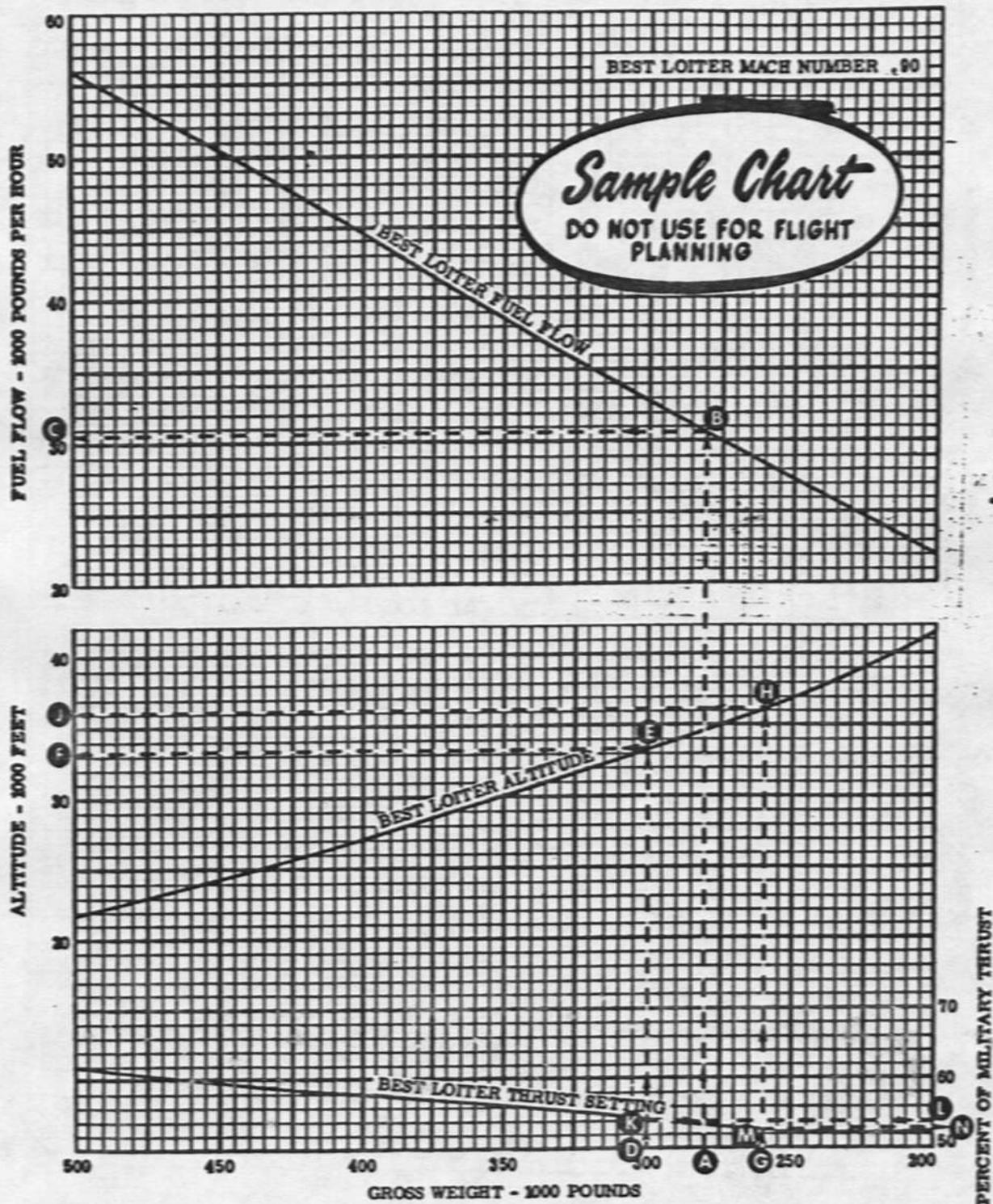
Thrust requirements decrease as the airplane weight decreases. Therefore, enter the lower chart on figure A7-1 at the initial gross weight of 300,000 pounds (point D) and move up vertically to intercept the best loiter thrust setting curve (point K). Then move horizontally to the right to the thrust setting scale and read the thrust setting as 54 percent of Military Thrust (point L), the best thrust setting to start loiter. As the airplane weight decreases, the thrust setting must be decreased until the loiter period is complete. To determine the final thrust setting, enter the same chart at the final gross weight of 260,000 pounds (point G) and move up vertically to intercept the best loiter thrust curve (point M). Then move horizontally to the right to the thrust setting scale, and read 52.5 percent of Military Thrust (point N), the best thrust setting at the end of the loiter period. The determined thrust settings are uncorrected for inlet pressure recovery reduction and temperature.

# ENDURANCE

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES

MODEL: XB-70A  
ENGINES: YJ93-GE-3



1-70-1-43-01

Figure A7-1

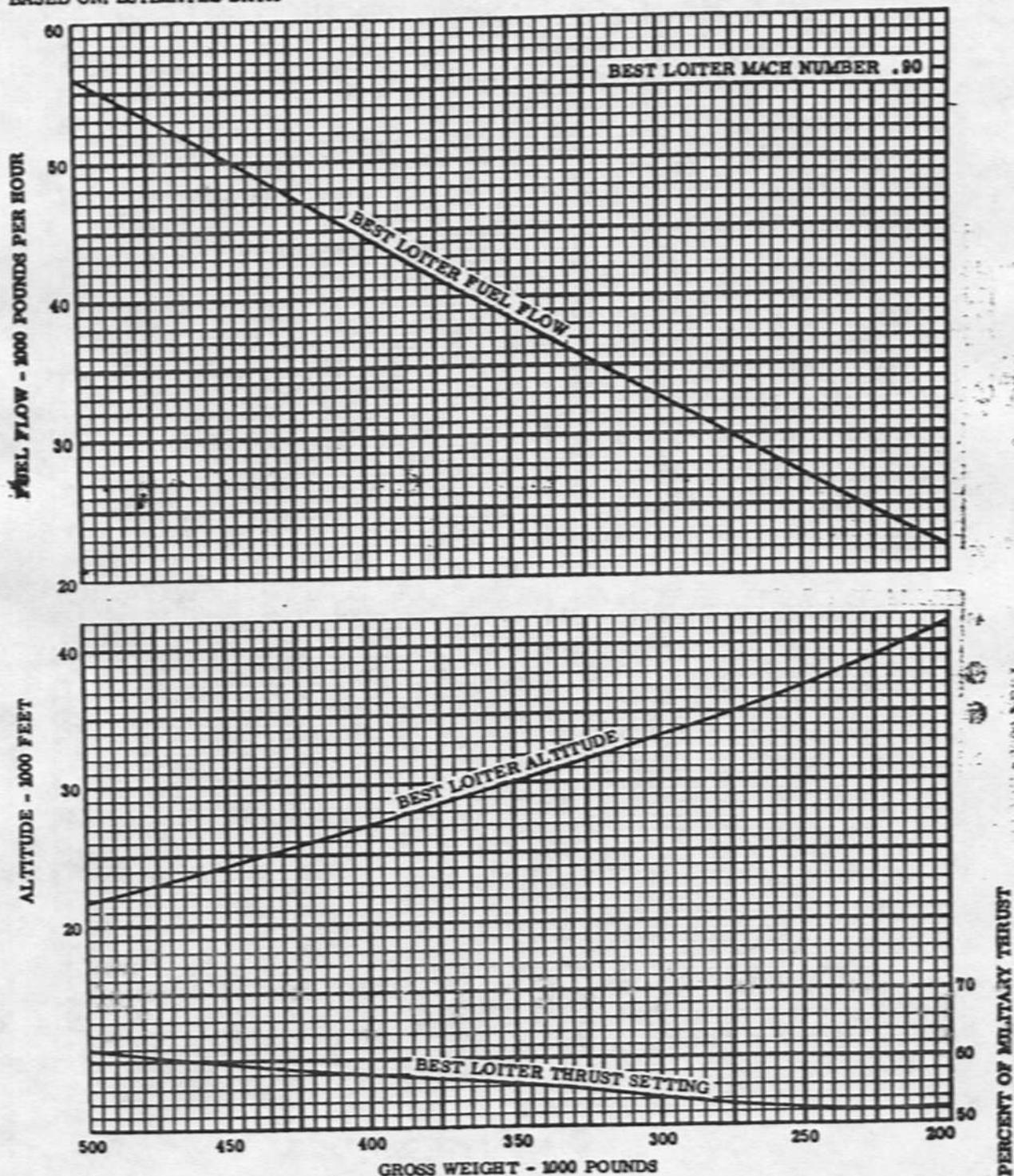
T. O. 1B-70(X)A-1A

# ENDURANCE

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES

MODEL: XB-70A  
ENGINES: YJ93-GE-3



1-70-1-43-26

Figure A7-3

To determine the approximate throttle position, use the throttle quadrant index marking chart on the range chart for the applicable altitude in Part 6. Enter the throttle quadrant index marking chart on figure A6-11 (subsonic range - 35,000 feet) at the percent of Military Thrust for the start of loiter, 54 percent. Move horizontally to the right to intersect the 0.9 Mach number line (best loiter Mach number for maximum endurance). Then move down vertically to the base of the chart and read the position of the throttle as the 29-degree index mark on the quadrant. Repeat this procedure for the percent of Military Thrust of 52.5, and read 28.5, the quadrant index mark for the throttle position at the end of loiter. The determined throttle positions are uncorrected for inlet pressure recovery reduction and temperature. Note that for this loiter period there is very little throttle movement.

NOTE

When the throttle positions at the start and end of loiter are close together ( $\pm 2$  degrees on the throttle quadrant), an average throttle position may be used.

PART 8

LEVEL FLIGHT DECELERATION

Underlined page numbers denote charts.

TABLE OF CONTENTS	PAGE	PAGE
Level Flight Deceleration.....	AB-1	Level Flight Deceleration (55,000 feet)..... <u>AB-5</u>
Description.....	AB-1	Level Flight Deceleration (65,000 feet)..... <u>AB-6</u>
Use of Charts.....	AB-1	Level Flight Deceleration (75,000 feet)..... <u>AB-7</u>
Level Flight Deceleration (45,000 feet).....	<u>AB-4</u>	

LEVEL FLIGHT DECELERATION.

All deceleration data in this section is predicated on the use of Military Thrust. Under reduced fuel flow conditions, fuel to the engines is supplementally cooled by a fuel-cooling heat exchanger (water boiler) in the cooling fuel loop. Therefore, to conserve the available water, deceleration is accomplished with the higher fuel flow inherent with Military Thrust.

DESCRIPTION.

Level flight deceleration charts for various constant altitudes are presented. Time, fuel, and distance are plotted against gross weight, with guide lines to show the weight reduction due to fuel used during deceleration. The charts start at the maximum allowable Mach number and end at the recommended descent Mach number, and may be used by interpolation for any true Mach number within these limits.

USE OF CHARTS.

To obtain the deceleration data desired, enter the proper chart at the gross weight and Mach number corresponding to the start of deceleration. Note the time, fuel, and distance at this point. From this initial point, trace a line parallel to the guide lines until it intersects the desired Mach number at the end of deceleration. Note the time,

fuel, and distance at this intersection point. The difference between initial and final values for time, fuel, and distance gives, respectively, the time required to decelerate, the fuel used during deceleration, and the distance traveled during the deceleration. The time, fuel, and distance are zero at the maximum allowable Mach number and therefore, the time required, the fuel used, and the distance traveled may be read directly for decelerations starting at this point. A linear interpolation may be used to obtain the desired data at intermediate altitudes between those shown. True Mach number may be converted to CAS using figure All-2.

The time, distance, and fuel used, as read from the charts, must be corrected for both the inlet pressure recovery reduction and then for the temperature effects. (See figure AB-6.)

NOTE

- For each degree F lower than ARDC Standard Day temperature, decrease the percent deceleration thrust as follows: 45,000 feet - .725 percent; 55,000 feet - .65 percent; 65,000 feet - .275 percent; and for 75,000 feet - no correction is required.
- For temperatures higher than ARDC Standard Day temperatures, decelerations are made at 100 percent Military Thrust.

SAMPLE PROBLEM.

GIVEN:

1. Initial gross weight.....310,000 pounds
2. Initial Mach number.....2.8
3. Initial altitude.....65,000 feet

FIND:

1. Fuel required during deceleration
2. Time required to decelerate to Mach 1.77, and distance traveled during deceleration.
3. Final gross weight

SOLUTION - FUEL REQUIRED DURING DECELERATION.

Enter the fuel versus gross weight chart on figure AB-1 with 310,000 pounds at Mach 2.8 (point A). Note the initial fuel reading of 475 pounds (point B). Move up from point A, parallel to the guide lines on the chart, to intersect the Mach 1.77 line (point C). Note the fuel reading of 6050 pounds (point D). Subtracting 475 pounds from 6050 pounds gives 5575 pounds, the amount of fuel required during deceleration, uncorrected for inlet pressure recovery reduction and temperature.

SOLUTION - TIME REQUIRED TO DECELERATE AND DISTANCE TRAVELED.

Enter the time/distance versus gross weight chart on figure AB-1 with 310,000 pounds at Mach 2.8 (point E). Note the time on the right scale as .65 minutes (point F) and distance on the left scale as 16 nautical miles (point G). Move up from point E, parallel to the guide lines on the chart, to intersect the Mach 1.77 line (point H). Note the time as 9.3 minutes (point J) and the distance as 214 nautical miles (point K). Subtracting .65 minutes from 9.3 minutes gives 8.65 minutes, the time required to decelerate to Mach 1.77, uncorrected for inlet pressure recovery reduction and temperature.

Subtracting 16 nautical miles from 214 nautical miles gives 198 nautical miles, the distance traveled during deceleration, uncorrected for inlet pressure recovery and temperature.

NOTE

If the initial Mach number is on the base line of the charts, the time required for deceleration, the fuel required, and the distance to travel can be read directly (using the guide lines) at the final gross weight/Mach intersection.

SOLUTION - FINAL GROSS WEIGHT.

Enter the fuel versus gross weight chart on figure AB-1 at point C (Mach 1.77) and move down vertically to the base of the chart and read 304,425 pounds (point L), the final gross weight, uncorrected for inlet pressure recovery reduction and temperature. The final gross weight also can be determined by subtracting the amount of fuel consumed from the initial gross weight (310,000 minus 5575 gives 304,425 pounds).

NOTE

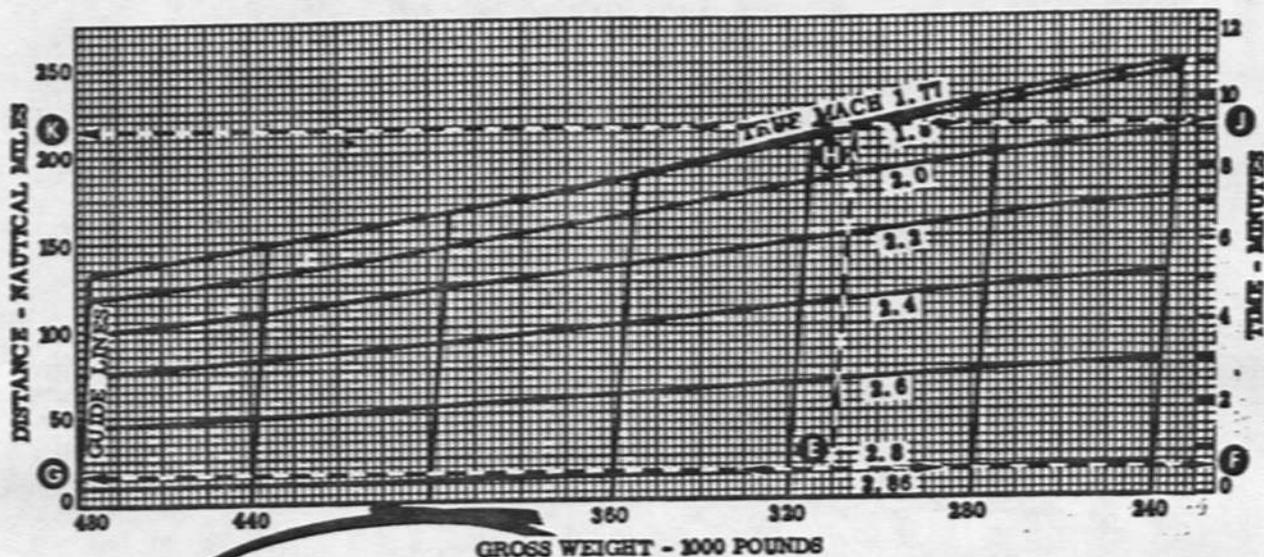
The weight difference between the initial and final gross weights is related directly to the amount of fuel consumed.

# LEVEL FLIGHT DECELERATION

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MILITARY THRUST  
 ALTITUDE - 65,000 FEET  
 LIMIT MACH NUMBER - 2.86  
 RECOMMENDED MINIMUM CAS - 342 KNOTS (1.77 TMN)

MODEL: XB-70A  
 ENGINES: YJ93-GE-3



*Sample Chart*  
 DO NOT USE FOR FLIGHT  
 PLANNING

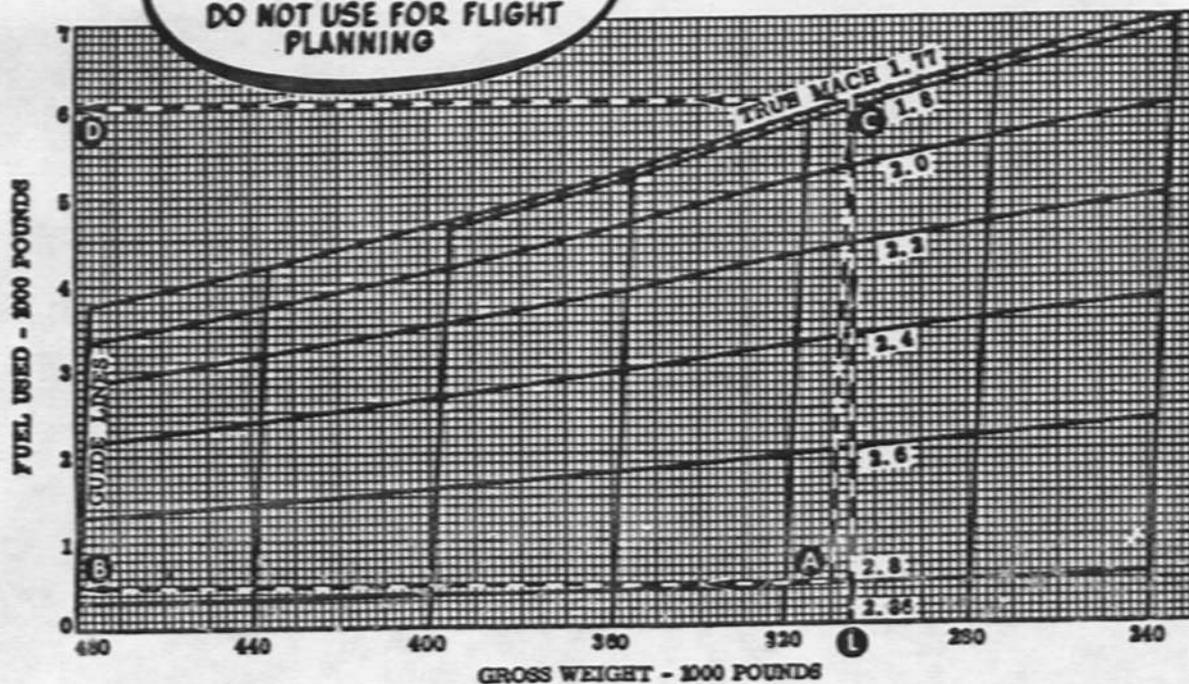


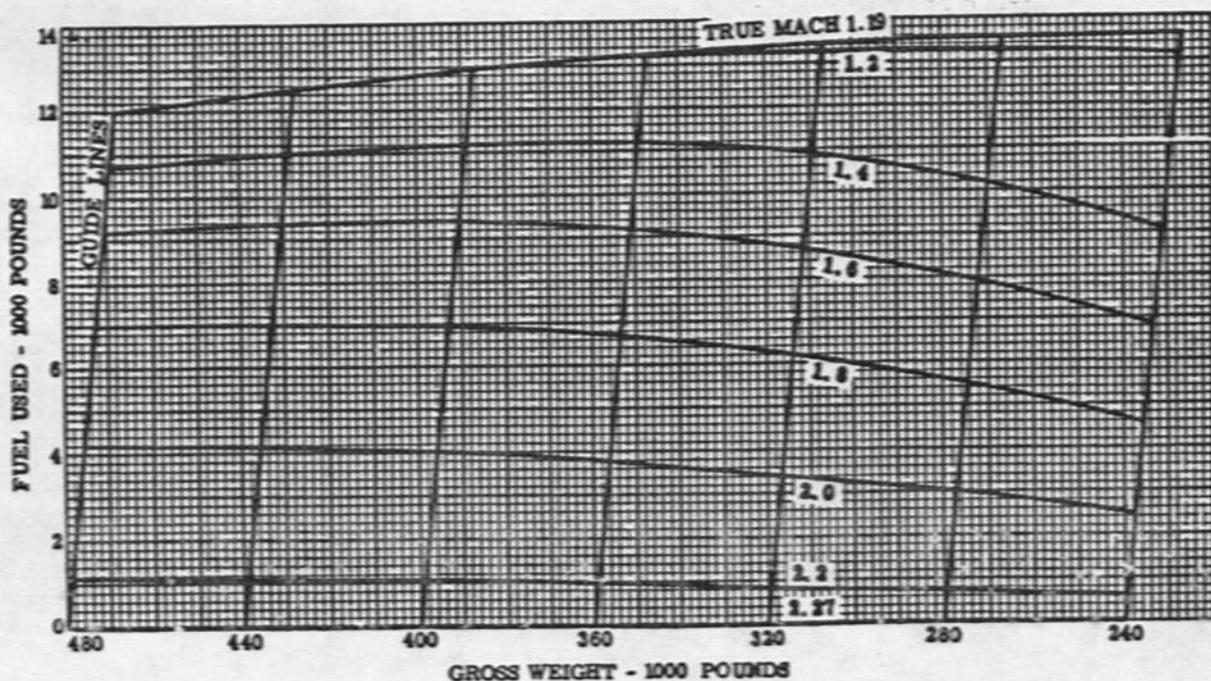
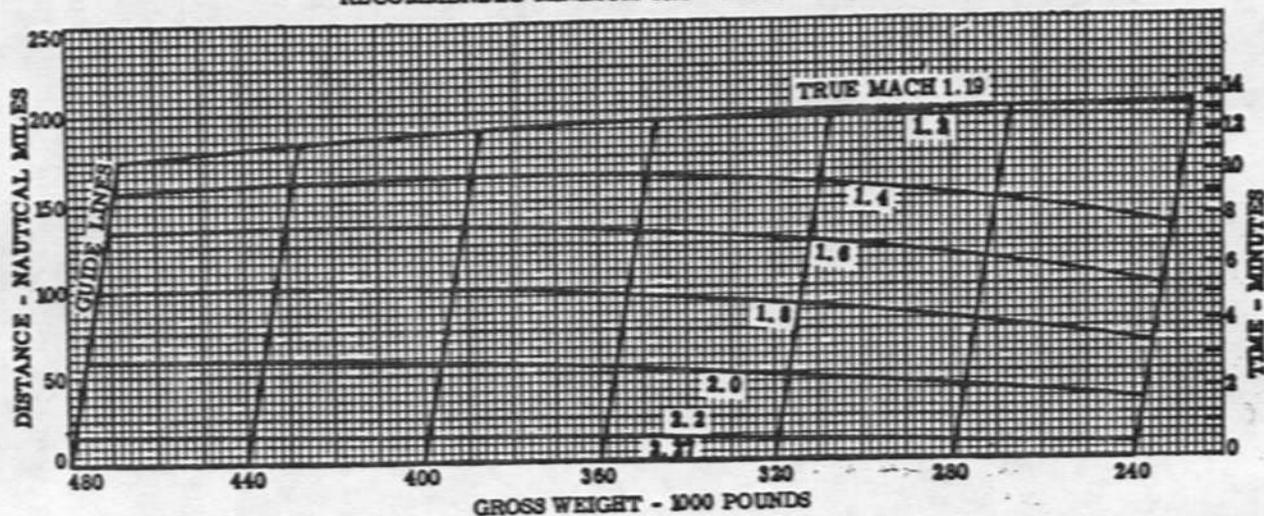
Figure A8-1

# LEVEL FLIGHT DECELERATION

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MILITARY THRUST  
 ALTITUDE - 45,000 FEET  
 LIMIT MACH NUMBER - 2.27  
 RECOMMENDED MINIMUM CAS - 342 KNOTS (1.19 TMN)

MODEL: XB-70A  
 ENGINE: YJ93-GE-3



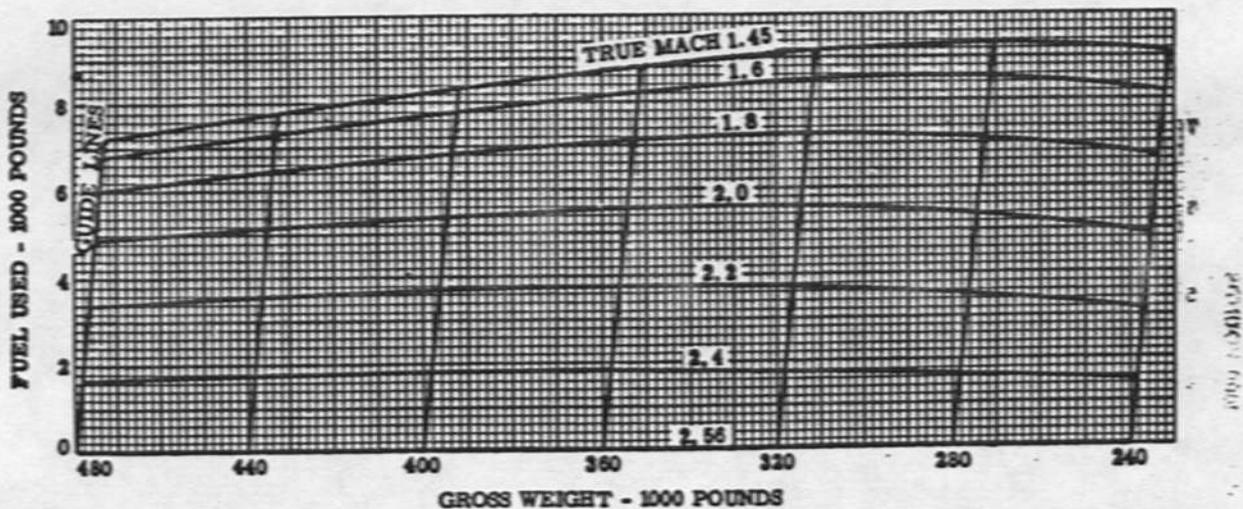
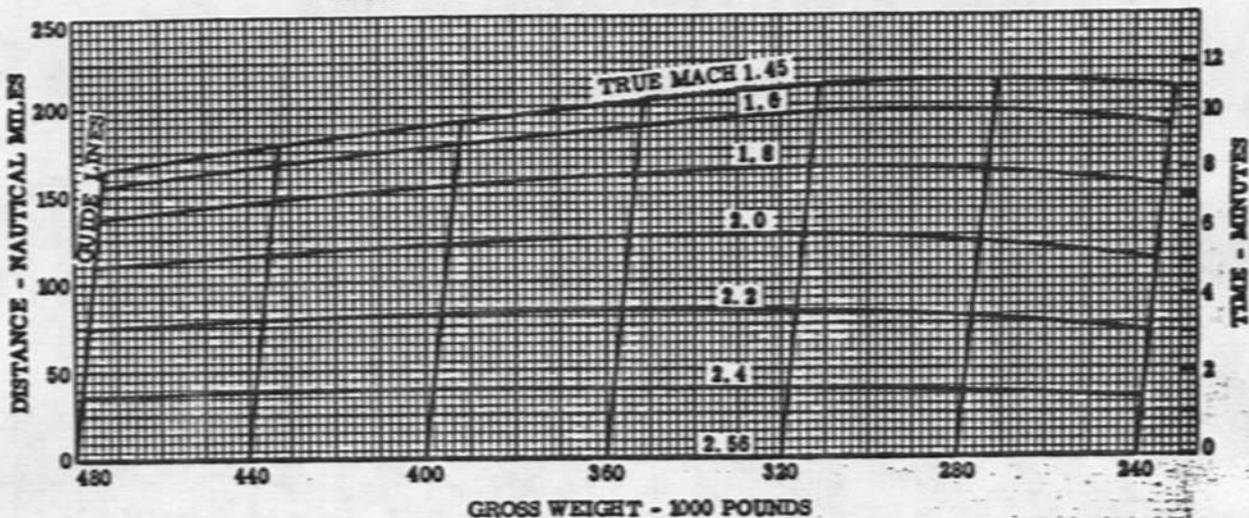
T. O. 1B-70(X)A-1A

# LEVEL FLIGHT DECELERATION

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MILITARY THRUST  
ALTITUDE - 55,000 FEET  
LIMIT MACH NUMBER - 2.56  
RECOMMENDED MINIMUM CAS - 342 KNOTS (1.45 TMN)

MODEL: XB-70A  
ENGINE: YJ93-GE-3



1-70-1-00-01

Figure A8-3

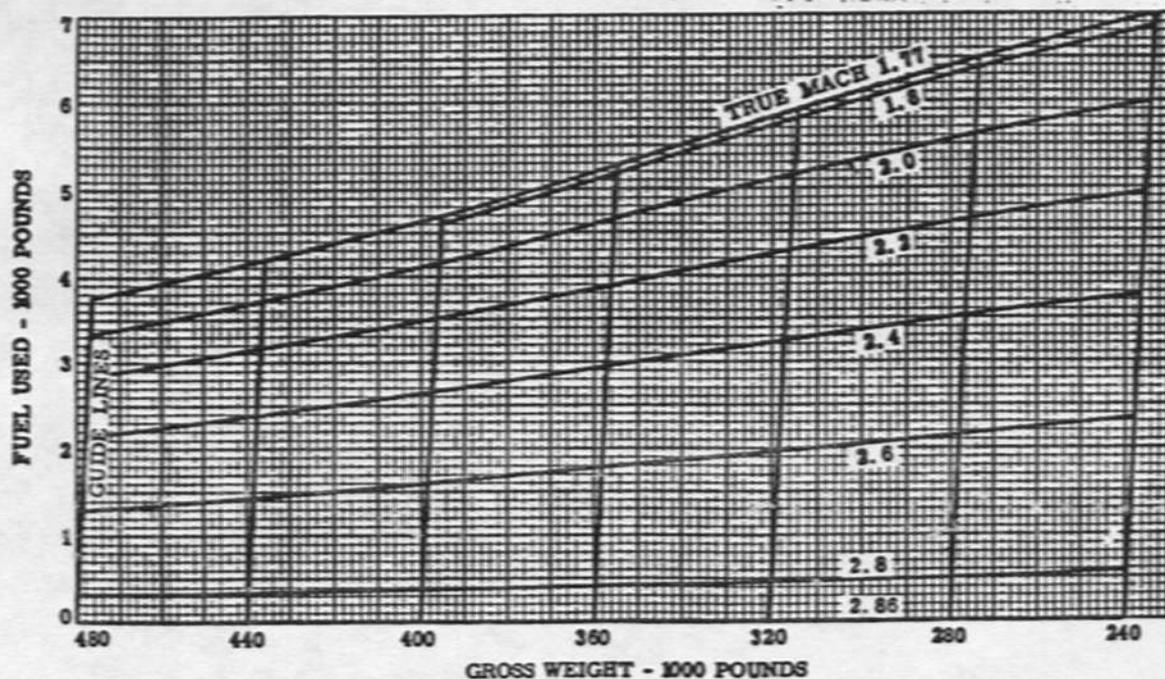
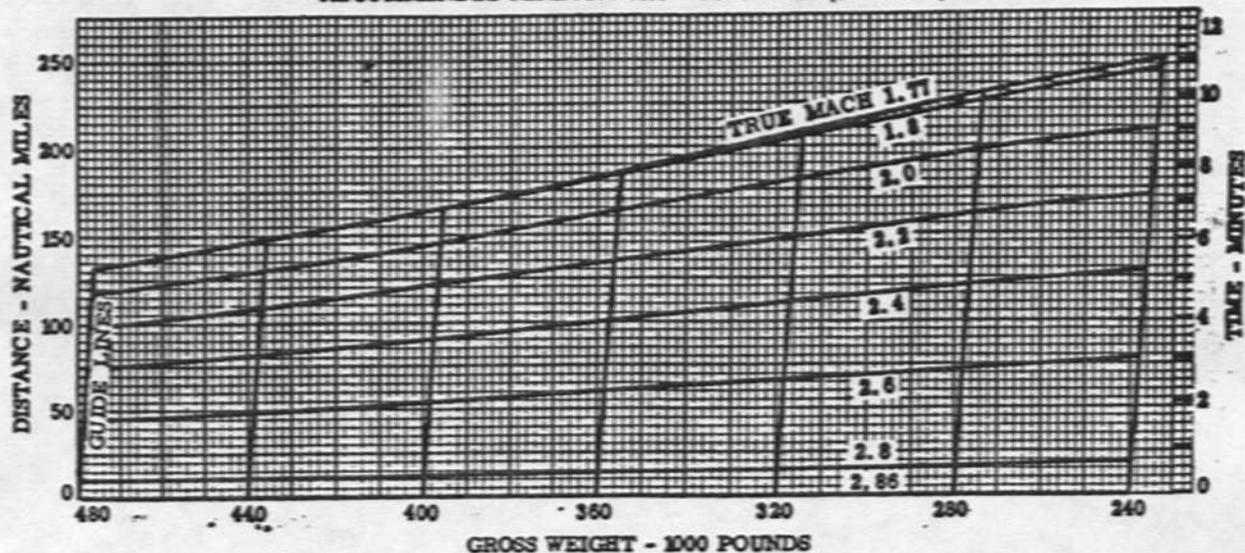
T.O. 1B-70(X)A-1A

## LEVEL FLIGHT DECELERATION

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, MILITARY THRUST  
ALTITUDE - 65,000 FEET  
LIMIT MACH NUMBER - 2.86  
RECOMMENDED MINIMUM CAS - 342 KNOTS (1.77 TAO)

MODEL: XB-70A  
ENGINE: YJ93-GE-3



# LEVEL FLIGHT DECELERATION

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

6 ENGINES, MILITARY THRUST  
 ALTITUDE - 75,000 FEET  
 LIMIT MACH NUMBER - 3.0

MODEL: XB-70A  
 ENGINE: YJ93-GE-3

RECOMMENDED MINIMUM CAS - 342 KNOTS (2.21 TMN)

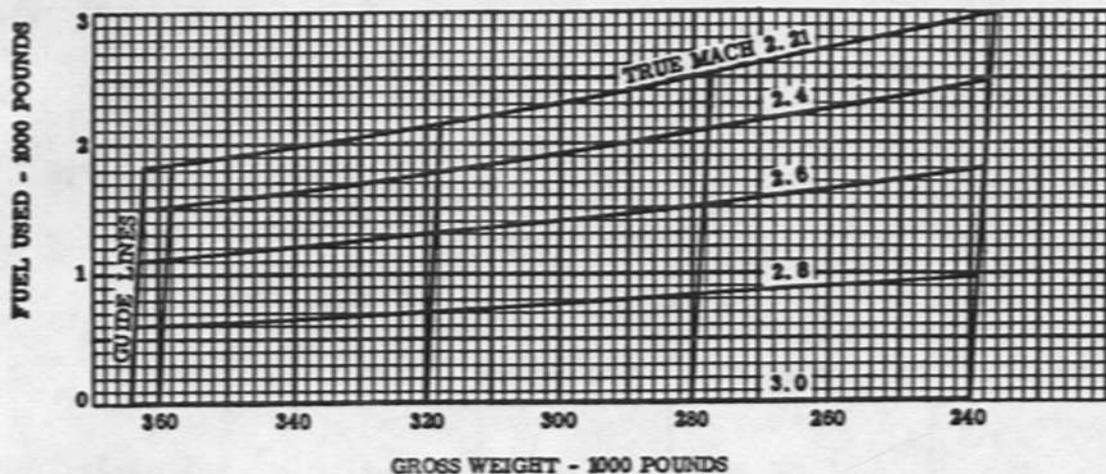
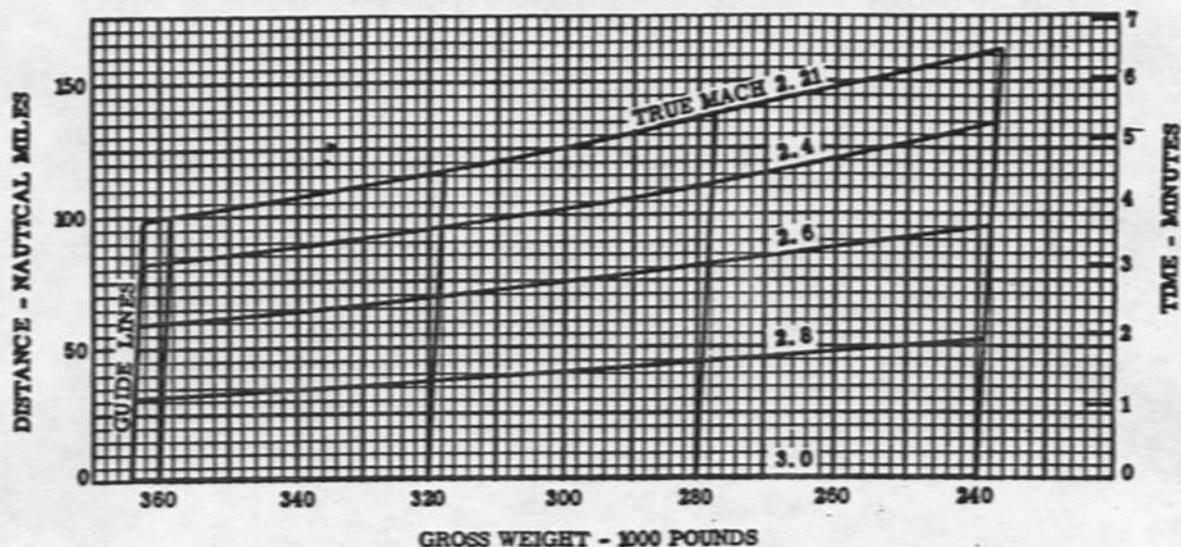


Figure A8-5

# CORRECTION FACTORS FOR INLET PRESSURE RECOVERY REDUCTION AND TEMPERATURE EFFECTS - LEVEL FLIGHT DECELERATION

To correct chart values for reduction in inlet pressure recovery, decrease time, distance, and fuel used, as follows:

DECELERATION ALTITUDE (FEET)	PERCENT DECREASE FOR EACH ONE PERCENT REDUCTION OF INLET PRESSURE RECOVERY	
	TIME AND DISTANCE	FUEL USED
45,000	4.5	5.5
55,000	3.5	4.5
65,000	2.5	3.5
75,000	1.5	2.5

To correct values for temperature effects after above corrections have been applied, correct time, distance, and fuel used, as follows:

DECELERATION ALTITUDE (FEET)	PERCENT INCREASE OR DECREASE FOR EACH DEGREE F CHANGE FROM ARDC STANDARD DAY TEMPERATURE *		
	TIME	DISTANCE	FUEL USED
45,000	0.85	0.85	1.25
55,000	0.75	0.65	1.10
65,000	0.52	0.49	0.95
75,000	0.30	—	0.625

- \* Increase time, distance, and fuel used for temperature higher than ARDC Standard Day.
- \* Decrease time, distance, and fuel used for temperature lower than ARDC Standard Day.

Figure A8-8

PART 9

DESCENT

Underlined page numbers denote charts.

TABLE OF CONTENTS	PAGE	PAGE
Descent.....	A9-1	Descent Speeds - Normal Descent..... <u>A9-7</u>
Description.....	A9-1	Effect of Inlet Pressure Recovery Correction Factors - Descent Performance (Normal Descent)..... <u>A9-8</u>
Use of Charts.....	A9-1	
Descent Performance - Normal Descent.....	<u>A9-6</u>	

DESCENT.

Descent procedures fall into two categories: normal end-of-mission descent and emergency descent as dictated by in-flight emergencies. The emergency descent procedure is described in Section III and, since detailed performance is of secondary importance and will vary with the emergency, only data for the normal descent is presented. The recommended descent speed schedule is shown for both true Mach number and CAS. For initial conditions at lower CAS, reduce altitude at a constant Mach number to intercept the recommended speed schedule. For initial conditions at higher CAS, maintain altitude and decelerate until the recommended speed is attained before starting descent. (Refer to Part 8 in this appendix.) The detailed performance data is valid only for the recommended speed schedule, and the initial condition is defined as the altitude at which this speed schedule is intercepted.

DESCRIPTION.

As illustrated on the descent speed schedule, certain gross weights require a level flight deceleration to be accomplished at 40,000 feet altitude to obtain the speed for maximum glide range at lower altitudes. Since engine thrust is maintained at Idle throughout the descent, this transition at 40,000 feet is accomplished merely by airplane angle-of-attack variation. The descent

chart for Idle Thrust descent from altitudes to sea level includes total of this transition and change in the proper gross weight. Time and distance are plotted against gross weight, with guide lines to show the weight reduction due to the fuel used during the descent. Mach 3.0 best cruise altitude is superimposed on the charts. The recommended descent speed schedule is shown for both true Mach number and CAS versus altitude for a range of gross weights.

USE OF CHARTS.

To obtain the descent data, enter the chart at the gross weight and altitude corresponding to the start of descent (point at which the speed schedule is intercepted). From this initial altitude point, trace a line parallel to the guide lines until it intersects the desired altitude at the end of descent. Note the time, distance, and gross weight at this intersection. The difference between initial and final values for time and distance gives, respectively, the time required to descend and the horizontal distance traveled during the descent. The difference

between initial and final values for gross weight gives the fuel used to descend. Since time and distance are zero for descents terminating at sea level, the time required and the distance traveled in descent to this altitude may be read directly. Fuel used, however, still must be determined by the difference in gross weights.

The time, distance, and fuel used must be corrected for inlet pressure recovery reduction for descents from above 50,000 feet to 50,000 feet or higher. Descents below 50,000 feet do not need to be corrected for inlet pressure recovery reduction.

**NOTE**

- To correct for inlet pressure recovery reduction, see figure A9-5 and refer to the following discussion.
- Time, distance, and fuel used do not need to be corrected for temperature.

To correct time and distance chart values for inlet pressure recovery reduction, enter figure A9-5 at the percent reduction in inlet pressure recovery. Move up vertically to the time and distance portion of the chart to the line for the initial weight at start of descent. From this point, move left horizontally and read the time and distance correction multiplying factor. Multiply the time and distance from A9-3 by this factor. This gives the time and distance required for the descent with the airplane operating at the given reduction in inlet pressure recovery from the design level.

To obtain the fuel used during descent, enter figure A9-5 at the same percent reduction in inlet pressure recovery. Move up vertically to the fuel portion of the chart to the line for the initial weight at the start of the descent. From this point, move left horizontally and read the total fuel used per 10,000 feet of descent. Then divide the loss of altitude by 10,000. Multiply this answer by the total fuel used per 10,000 feet. This is the total fuel used during the descent with the airplane operating at the given reduction in inlet pressure recovery.

For descents from an altitude above 50,000 feet to an altitude below 50,000 feet, first determine the time, distance, and fuel to 50,000 feet corrected for inlet pressure recovery reduction. Then using figure A9-3, with 50,000 feet as the initial altitude, determine time, distance, and fuel from 50,000 feet to the final altitude with no correction for inlet pressure recovery reduction. Add the two sets of values to obtain total time, distance, and fuel used from the altitude above 50,000 feet to the altitude below 50,000 feet.

**SAMPLE PROBLEM.**

**GIVEN:**

1. Initial gross weight.....340,000 pounds
2. Initial altitude.....60,000 feet
3. Final altitude.....20,000 feet

1. Horizontal distance traveled during descent, and the time required to descend to 20,000 feet.
2. Final gross weight.
3. Fuel required for descent.
4. CAS at end of descent.

**SOLUTION - HORIZONTAL DISTANCE TRAVELED AND TIME REQUIRED.**

Enter figure A9-1 with 340,000 pounds gross weight at an altitude of 60,000 feet (point A). Note the distance as 130 nautical miles on the inside scale (point B) and the time as 15.9 minutes

# DESCENT PERFORMANCE (Normal Descent)

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, IDLE THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

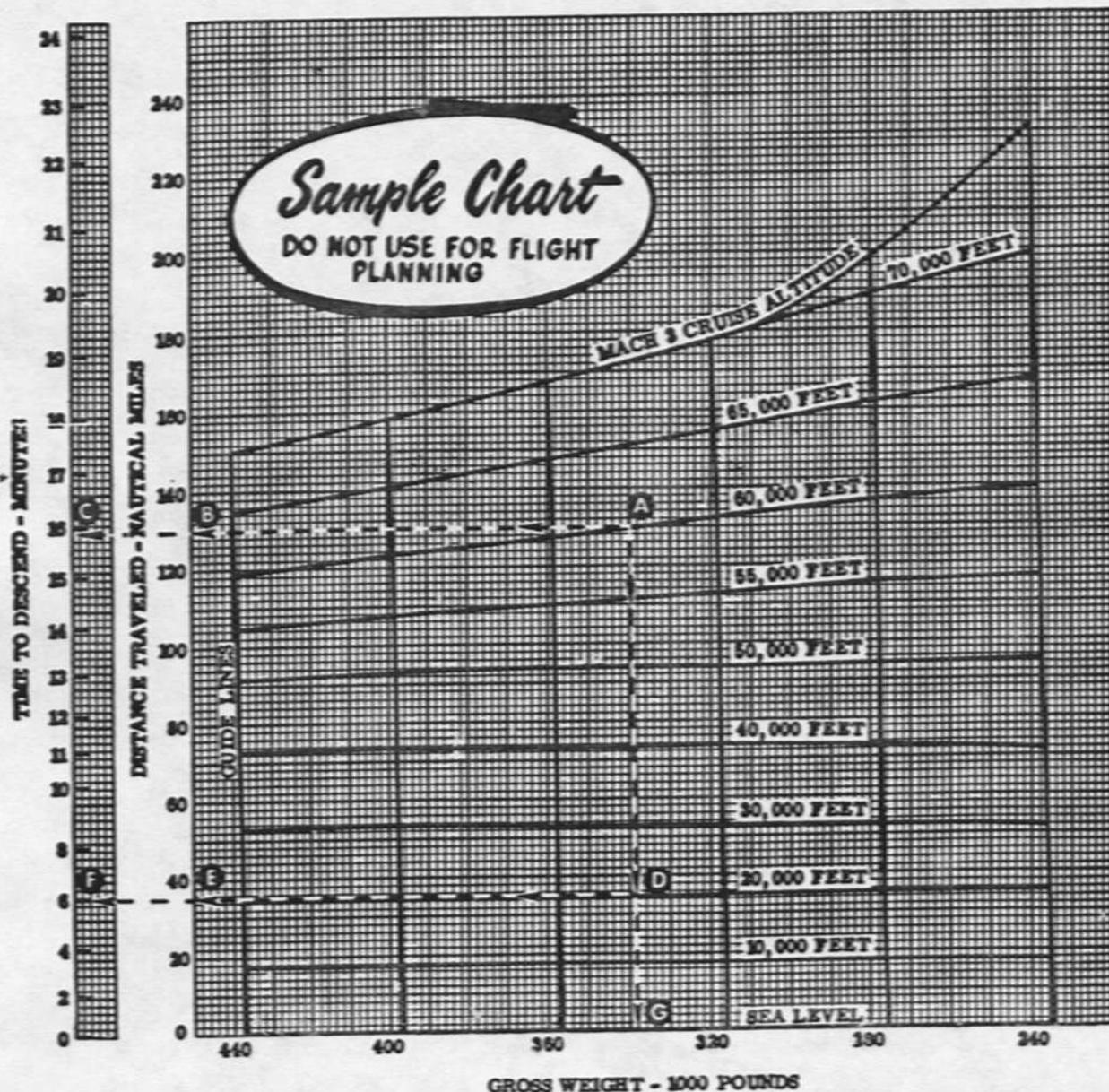


Figure A9-1

[REDACTED] 1A

on the outside scale (point C). Move down from point A, parallel to the guide lines, to intersect the 20,000 foot altitude line (point D). Note the distance as 35 nautical miles (point E) and the time as 6 minutes (point F). Subtracting 35 nautical miles from 130 nautical miles gives 95 nautical miles, the horizontal distance traveled during descent. Subtracting 6 minutes from 15.9 minutes gives 9.9 minutes, the time required to descend to 20,000 feet. These values for horizontal distance and time required are uncorrected for inlet pressure recovery reduction.

**SOLUTION-FINAL GROSS WEIGHT.**

Move down vertically from point D (20,000 feet) to the base of chart and read 338,000 pounds (point G), the final gross weight.

**SOLUTION - FUEL REQUIRED FOR DESCENT.**

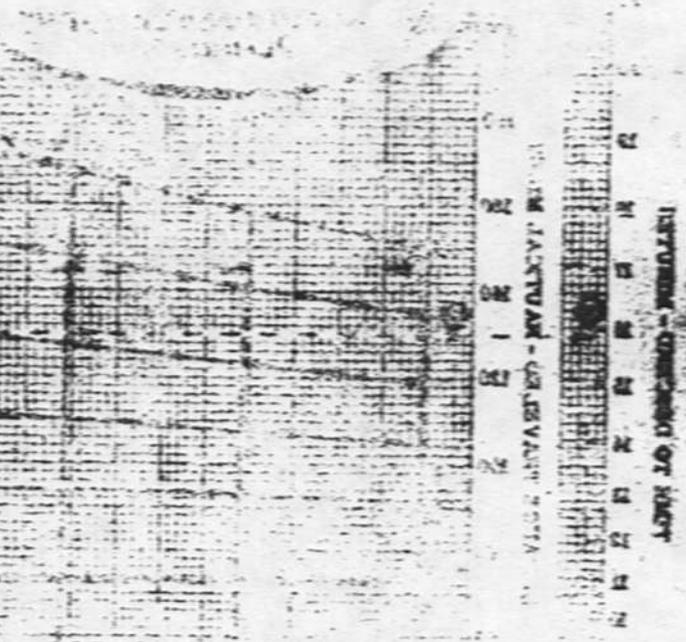
Because the weight difference between the initial and final gross weights is related directly to the amount of fuel consumed, subtracting the final gross weight of 338,000 pounds from the initial gross weight of 340,000 pounds gives 2,000 pounds, the amount of fuel required for the descent, uncorrected for inlet pressure recovery reduction.

**SOLUTION - CAS AT END OF DESCENT.**

Enter the CAS chart on figure A9-2 at the final gross weight of 338,000 pounds and final altitude of 20,000 feet (point A). Move down vertically to the base of the chart and read 320 knots (point B), the end-of-descent CAS.

**NOTE**

The procedure for determining end-of-descent true Mach number is the same except that the true Mach chart on figure A9-2 is used.



[REDACTED]

T. O. 1B-70(X)A-1A

# DESCENT SPEEDS (Normal Descent)

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1963  
BASED ON: ESTIMATED DATA

6 ENGINES, IDLE THRUST

MODEL: XB-70A  
ENGINES: YJ93-GZ-3

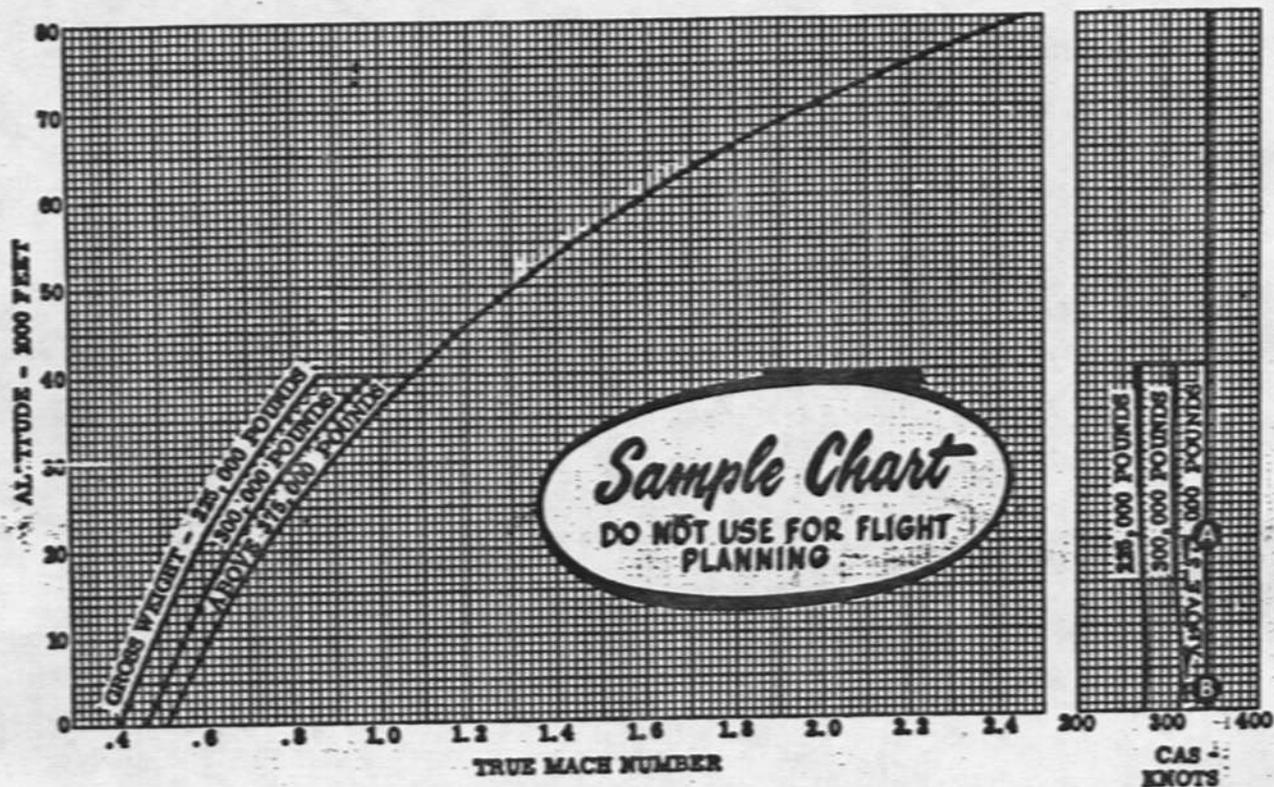


Figure A9-2

8-70-1-83-06

# DESCENT PERFORMANCE (Normal Descent)

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, IDLE THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3

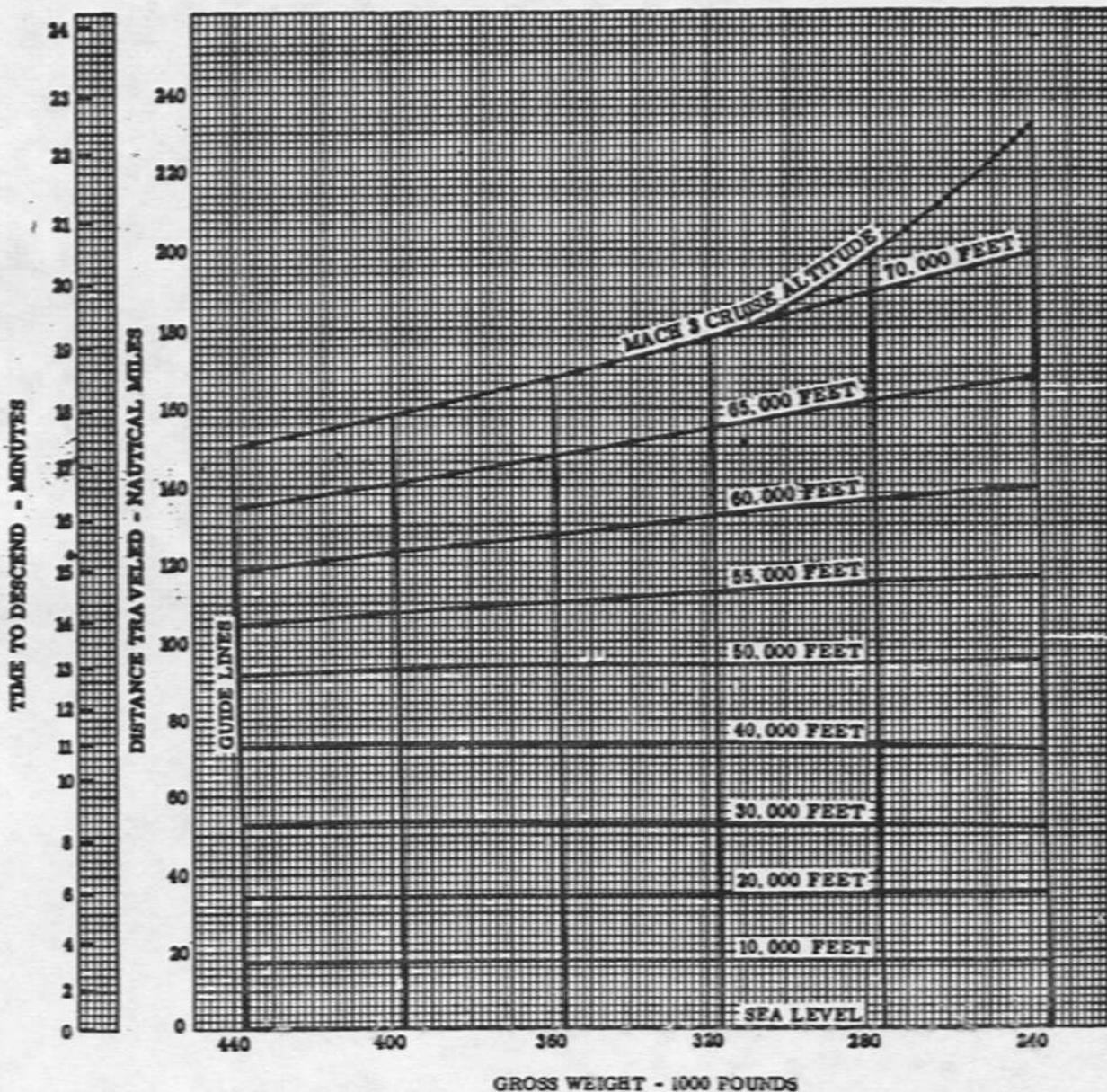


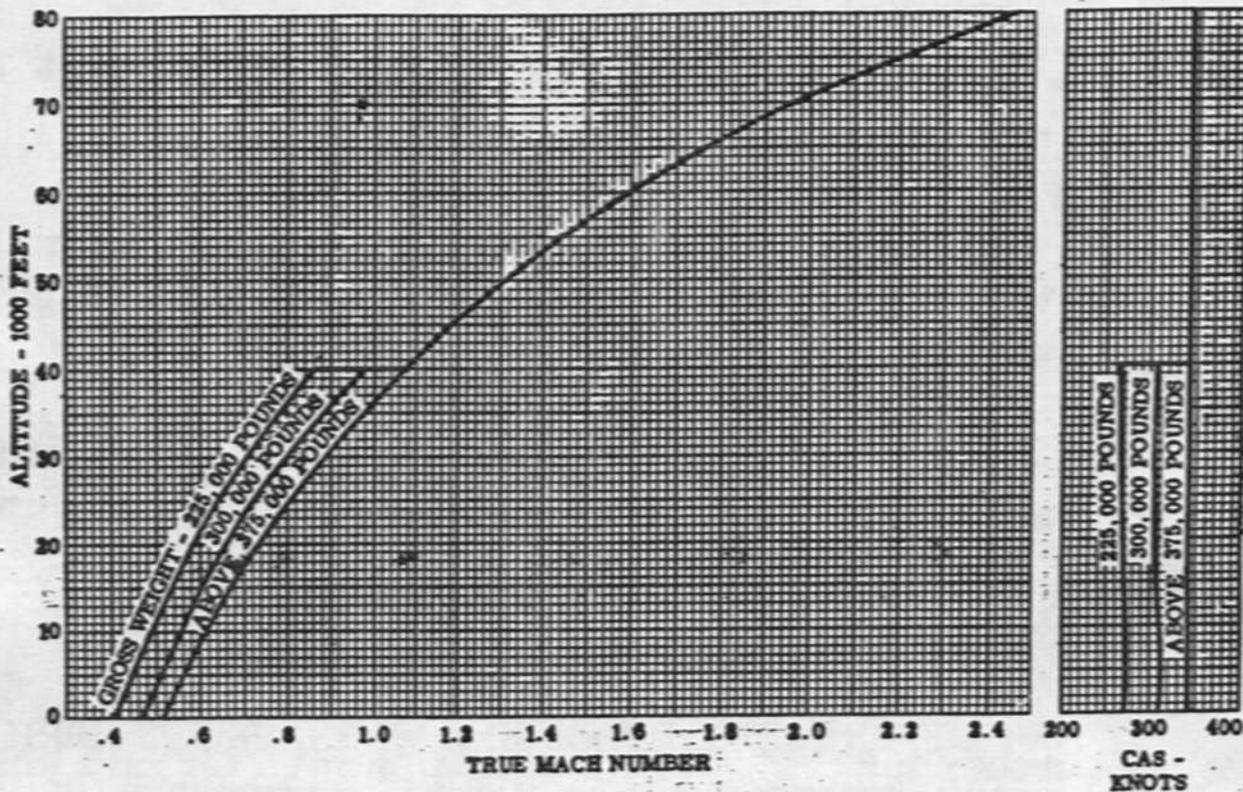
Figure A9-3

# DESCENT SPEEDS (Normal Descent)

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, IDLE THRUST

MODEL: XB-70A  
ENGINES: YJ93-GE-3



1-70-1-82-14

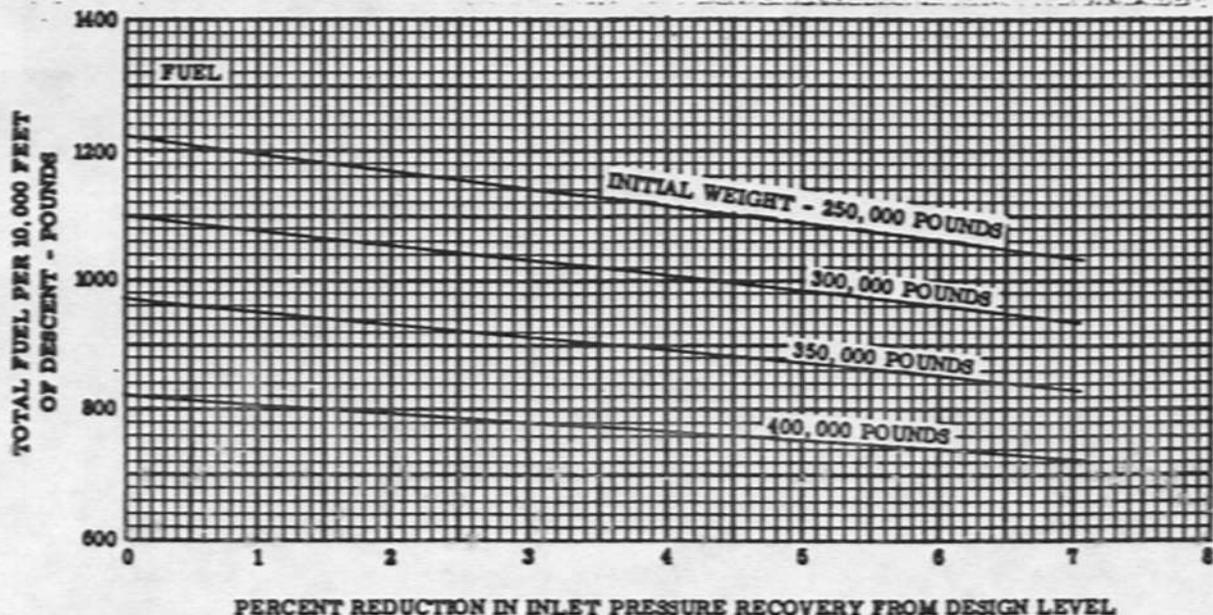
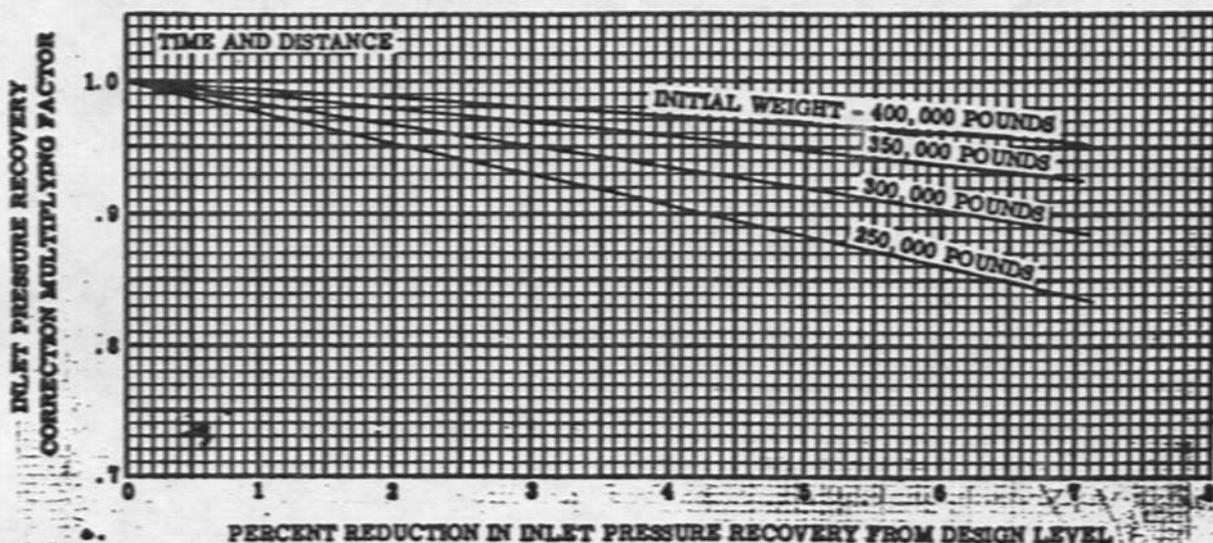
Figure A9-4

# EFFECT OF INLET PRESSURE RECOVERY ON DESCENT PERFORMANCE (Normal Descent)

ARDC STANDARD DAY  
DATA AS OF: 1 OCT 1962  
BASED ON: ESTIMATED DATA

6 ENGINES, IDLE THRUST  
DESCENT BETWEEN ALTITUDES ABOVE 50,000 FEET  
(NO CORRECTIONS APPLIED BELOW 50,000 FEET)

MODEL: XB-70A  
ENGINES: Y793-GE-3



PART 11

MISCELLANEOUS CHARTS

Underlined page numbers denote charts.

TABLE OF CONTENTS	PAGE	PAGE
Description.....	All-1	<u>Inlet Pressure Recovery Chart.....All-2</u>

All Part 11 information is in the unclassified Flight Manual, T.O. 1B-70(X)A-1, except the following:

DESCRIPTION.

Figure All-4 shows three inlet pressure recovery curves: one is the design level curve representing the original design concept of the fully automatic high recovery inlet; the second curve represents the automatic inlet control installed in Airplane AF62-207; and the third curve is for the interim manual inlet control installed in Airplane AF62-001. These curves represent the normal level of inlet recovery which allows a certain amount of variation in airplane angle of attack and yaw angle during transient flight such as climb, acceleration, etc. (Refer to "Inlet Limitations" in Section V of the unclassified Flight Manual, T.O. 1B-70(X)A-1.) For Airplane AF62-001, the normal performance schedule is defined as the pressure recovery attained with the throat on schedule and the bypass doors operated to maintain the shock wave position indicator at the bottom of the green arc. For Airplane AF62-207, the normal performance schedule is defined as the pressure recovery attained with the AICS mode switches at AUTO and the duct performance switch at NORM.

During Mach 3.0 stabilized cruise flight, the inlet recovery may be increased to the high performance schedule (as indicated on figure All-4 for 70,000-foot cruise altitude) by reducing the

allowable variation in airplane angle of attack and yaw angle. (Refer to "Inlet Limitations" in Section V of the unclassified Flight Manual, T.O. 1B-70(X)A-1, for the allowable variations.) For Airplane AF62-001, the high performance schedule is representative of the pressure recovery attained with the throat on schedule and the shock wave position indicator near the top of the green arc. Airplane AF62-207 attains the high performance pressure recovery with the AICS mode switches at AUTO and the duct performance switch at NORM.

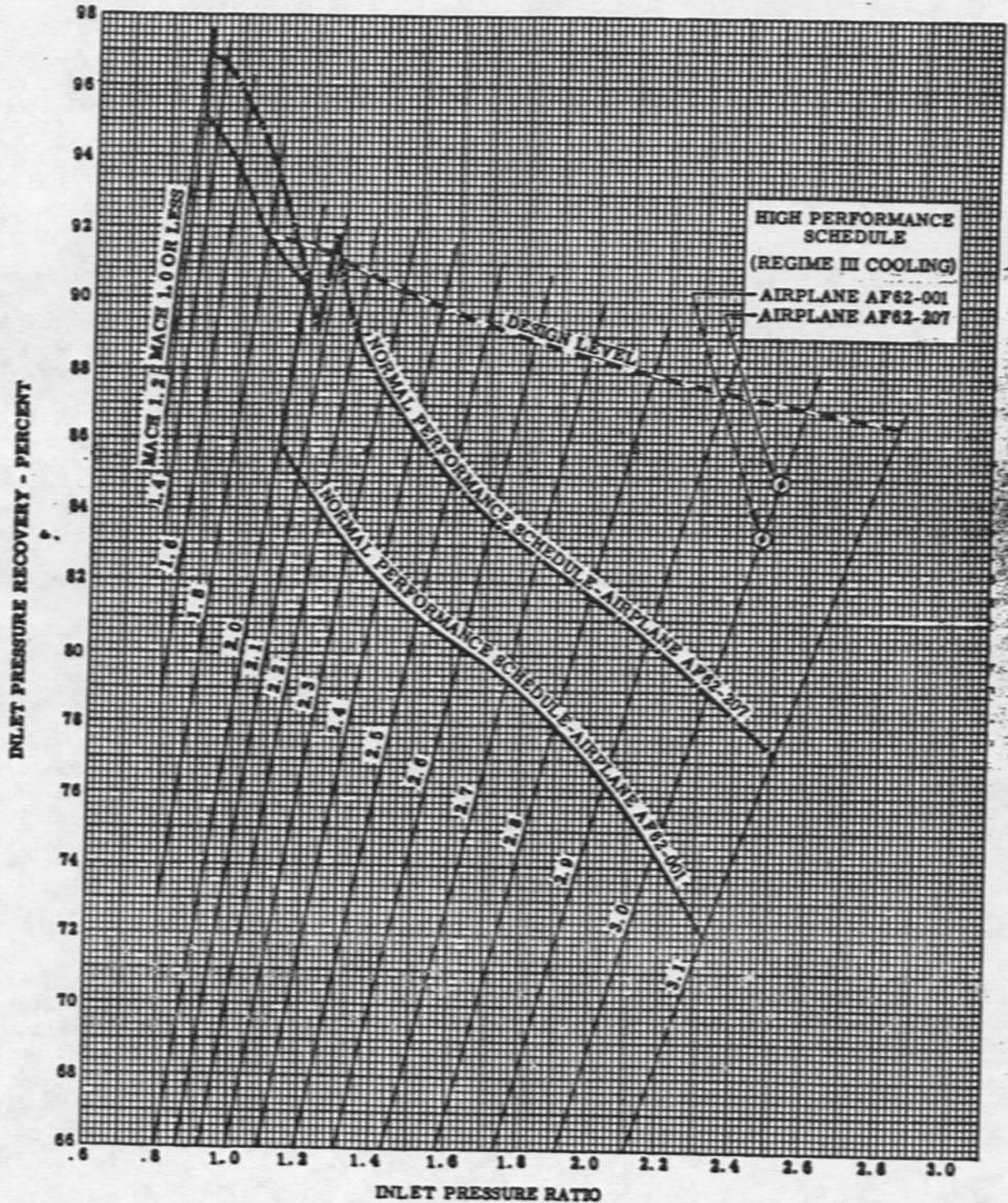
For flight planning purposes, use figure All-4 to determine the difference in total pressure recovery between the design level and the applicable normal performance schedule. At the same Mach number, read the pressure recovery (on the scale at the left side) corresponding to each condition and take the numerical difference. This percentage difference then is applied, where necessary, to the performance charts throughout Appendix I.

To correct inflight performance, use the airplane indicated Mach number and the reading from the inlet pressure ratio gage to obtain the percent recovery to be subtracted from the design level and thus determine the percent of inlet pressure recovery reduction.

# INLET PRESSURE RECOVERY CHART

ARDC STANDARD DAY  
 DATA AS OF: 1 OCT 1962  
 BASED ON: ESTIMATED DATA

MODEL: XB-70A  
 ENGINES: YJ93-GE-3



8-70-1-93-125A

•• AII-4