MILITARY SPECIFICATION

PERFORMANCE DATA REPORT FOR STANDARD AIRCRAFT CHARACTERISTICS CHARTS FOR PILOTED AIRCRAFT

This specification has been approved by the Bureau of Aeronautics, Department of the Navy

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1. SCOPE

1.1 SCOPE.-This specification governs the definitions of the requirements for, and methods of presenting, the substantiating Performance Data Report for the Standard Aircraft Characteristics (SAC) charts required by Specification MIL-D-8706 (Aer) and by addenda thereto. The Standard Aircraft Characteristics charts, which are distributed throughout the Department of Defense and to other interested agencies, are the official means of delineating the performance of naval aircraft, and as such must contain accurate and realistic information. The Performance Data Report, substantiating the information given in the Standard Aircraft Characteristics charts must be sufficiently complete to expedite a prompt investigation and review of the derived performance and to permit additional calculations to be made by personnel of the Bureau of Aeronautics as required.

1.2 APPLICATION.- The characteristics charts and reports described herein are based on the Standard Aircraft Characteristics charts governed by the coordinated Specification MIL-D-5011A for piloted aircraft. This specification details that portion of MIL-C-5011A which governs the submittal of the substantiating Performance Data Reports and pertinent graphs associated with these reports.

1.3 CLASSIFICATION.- Performance Data Reports are to be presented in the manner prescribed in this specification. Unauthorized reproduction of such reports is prohibited.

2. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

2.1 This specification implements, amplifies, or invokes the following publications, of latest issue date in effect.

SPECIFICATIONS
MILITARY

MIL-C-5011A	Charts; Standard Aircraft Characteristics and Performance, Piloted Aircraft
MIL-D-8706(Aer)	Data, Design; Contract Requirements for Aircraft
MIL-D-7822	Drawings; For Standard Aircraft Characteristics and Performance charts, Piloted Aircraft

(When requesting specifications, standards, drawings, and publications refer to both title and number. Copies of this specification and applicable specification may be obtained upon application to the Commanding Officer, Naval Aviation Supply Depot, Philadelphia 20, Pennsylvania, Attention Code CDPT).

3. REQUIREMENTS

3.1 GENERAL REQUIREMENTS.- The Performance Data Report, substantiating the information given in the Standard Aircraft Characteristics charts must be sufficiently complete to expedite a prompt investigation and review of the derived performance and to permit additional calculations to be made by BuAer personnel as required.

3.1.1 BASIC DATA.- Prior to proceeding with the initial performance calculations for the Standard Aircraft Characteristics charts the following basic data including all calculations and material necessary to substantiate these data, shall be submitted to the Bureau of Aeronautics (Attention AD-33) for acceptance not later than 30 days following the first official notice of BuAer's intent to negotiate a contract. Prior to subsequent performance calculations, these basic data shall be submitted only when different from the original basic data:

(1) Low speed drag data itemized according to various aircraft components (wings, fuselage, rotor hub, etc.)

(2) Plot of parasite drag coefficient, C_D , and trimmed airplane efficiency factor e, versus Mach Number for various values of lift coefficient as applicable.

(3) Net thrust - or horsepower - available data with all losses (duct, propeller efficiencies and other applicable items) indicated.

(4) Aircraft lift coefficient (trimmed) with take-off power, approach power, and without power plotted against angle of attack with and without high lift devices, with and without ground-effect.

(5) Rotor blade stall and compressibility limits (helicopter only)

Data not accepted by BuAer shall be replaced after conference with Contractor by similar data to be designated by BuAer.

3.1.2 PERFORMANCE DATA REPORT.- All data presented on the charts are to be substantiated by reports to be submitted with the charts. The report may be in legible, rough draft form, utilizing contractor's work sheet copy, but is to be complete and contain adequate list of references, and justification for all data used. Contractors are free to use calculation methods of their own selection, but such methods are to be fully explained, and sample calculations are to be given. Calculations are to be presented in sufficient details to permit ready review and check of conclusions, and to enable additional calculations to be made by reviewing personnel as required.

3.1.2.1 TEXT.- The substantiating data report, outlined in paragraph 3.1.1.1 of MIL-C-5011A, is to be detailed and arranged as follows.

3.1.2.1.1 INTRODUCTION.- Include pertinent background information regarding data upon which performance calculations are based, approved aircraft configuration changes, similarity of the aircraft model to other aircraft of the series, general discription of the model including armament, radar, major and special equipment and controls, essential comments on mission capabilities, general basis of performance calculations of the airplane and engine, indication of consistency of presented performance data with the Flight Manual Operating Data if the latter are available, and any further special considerations useful in the evaluation of the aircraft.

3.1.2.1.2 TABULATED DATA.- Tabulate all data important in the computation of performance and establishment of operational limitations, such as:

(1) Aircraft Dimensional data

(2) Derivation of weights, with reference to latest applicable weight report; operational weight limitation; maximum allowable load factors at take-off, combat and design weights, etc.

(3) Power plant sea level static thrust or power ratings, specific fuel consumption ratings and include source of ratings (applicable engine specification).

3.1.2.1.3 AERODYNAMIC DATA.- Present an analysis leading to the establishment of all lift and drag values used in the calculations including any corrections made to obtain trimmed lift and drag. Incremental drag for speedbrakes, feathered propeller, windmilling propeller, cowl flaps, and in operative engine (both jet and reciprocating), as applicable, shall be shown. Included also shall be the following graphs:

(1) Drag polars for the airplane trimmed in the clean, take-off, and landing configurations (out of ground effect) as shown in Figure 1 and 3. The variation of maximum lift coefficient and lift coefficients for onset and limit buffet with Mach number shall also be included as applicable.

(2) Installed drag of droppable external stores or bombs as shown in Figure 2.

(3) Trimmed lift curves for clean configuration, and for the various high lift configurations (take-off and landing configurations) as shown in Figure 4.

If above aerodynamic data are affected by variations in the position of the center of gravity, such shall be indicated on Figures 1, 3, and 4.

3.1.2.1.4 THRUST REQUIRED.- State method of computing thrust (or power) required and plot thrust (or power) required curves versus true airspeed from stall speed to maximum speed throughout the altitude range of the aircraft. A sample of primary-mission-configuration power required and available curves are shown in Figure 5. These curves should bracket the expected operating weights of the aircraft and the expected extremes of external configurations.

3.1.2.1.5 THRUST AVAILABLE.- State the method of establishing thrust (or power) available, including discussion of losses and efficiencies associated with any computations. For turbo-jet and turbo-prop engines the following curves are required:

(1) For jet engines plot total installation losses in net thrust and fuel flow versus true airspeed. For turbo-prop engines plot installation losses in net shaft horsepower and net jet thrust versus true airspeed. Losses should be shown for. Maximum Military normal are various per cents of. Normal engine ratings at various allitude consistent with the applicable engine specification as shown in fig. 6 and 7.

(2) Plot net thrust (for fet engines), SHP and net jet thrust (for turbo prop engines) and fuel flow corrected for, installation losses versus true airspeed for maximum military and normal engine ratings at altitudes for which engine data are presented in the applicable engine specification. Examples are shown in fig. 8 and 9.

(3) Plot jet engine net thrust versus specific rang at various true airspeed and engine RPMs at altitudes for which engine data are presented in the applicable engine specification. Example is shown in Figure 10.

(4) Include sample calculations to illustrate determination of propeller-efficiencies, if applicable.

For reciprocating engines plot net thrust horsepower available at each 5000 ft. increment in altitude from sea level to maximum altitude.

3.1.2.1.6 PERFORMANCE.- Indicate derivations of equations used for determination of all performance characteristics. Fuel quantities required, time and distance in each of the operational sequences involved in the combat range and combat radius problems shall be shown. The following graphs are required:

(1) Maximum true airspeed vs gross weight at various altitudes at military and maximum thrust (or power). Example is shown in Figure 11.

(2) Rate-of-climb vs gross weight at various altitudes at military and maximum thrust (or power). Example is shown in Figure 12.

(3) Service and combat ceilings at military and maximum thrust (or power), cruise ceiling and optimum cruise altitude vs gross weight. Example is shown in Figure 13.

(4) Distance covered and fuel used in climb, time-to-climb and true airspeed for climb to various altitudes vs gross weight at military and maximum thrust (or power). Example is shown in Figure 14.

(5) For turbo-jet and turbo-prop aircraft, specific range vs true airspeed at various gross weights and at altitudes for which data are presented in the applicable engine specification. For reciprocating engine aircraft present these data at each 5,000 foot increment in altitude from sea level to maximum altitude. Example is shown in Figure 15.

(6) For turbo-jet and turbo-prop aircraft, maximum specific range and endurance vs gross weight at altitudes for which engine data are presented in the applicable engine specification. For reciprocating engine aircraft present these data at each 5,000 foot increment in altitude from sea level to maximum altitude. Example is shown in Figure 16.

(7) True airspeed for maximum specific range and endurance vs gross weight at altitudes for which maximum specific range is presented. Example is shown in Figure 17.

(8) True airspeed for stall or minimum usable flying speed, as applicable vs gross weight for the following configurations and power settings:

(a) Clean configuration without power
(b) Landing configuration without power
(c) Landing configuration with approach power
(d) Take-off configuration with take-off power
Example is shown in Figure 18

(9) Take-off distance vs gross weight for both ground run and distance over 50 foot obstacle at sea level on standard day in calm air for land and carrier based aircraft. In the absence of flight test data, take-off distance for turbo-jet aircraft shall be based on take-off speed which is not less than 1.2 times power-off stall speed in take-off configuration and shall be shown for military and maximum thrusts. For seaplanes, plot take-off time vs take-off weight at sea level on standard day under calm wind and water conditions. Example is shown in Figure 19.

(10) Landing distance vs weight for both ground run and distance over 50 foot obstacle at sea level on standard day in calm. In the absence of flight test data, landing distance shall be based on touch down speed which is not less than 1.2 times power-off stall speed in landing configuration.

(11) Normal acceleration vs true airspeed for various rates of longitudinal acceleration for turbo-jet powered aircraft at 35,000 feet altitude and two higher altitudes. Example is shown in Figure 20.

(12) Level flight longitudinal acceleration vs true airspeed for take-off configuration at ambient temperatures of 59°F and 89°F at normal and maximum allowable take-off gross weights. Example is shown in Figure 21.

(13) For aircraft having more than one external configuration, effects of drag at various weights are desired. Examples are shown in Figures 22 to 26 inclusive.

For all calculations involving fuel flow, engine specification fuel consumption data shall be increased by 5% for service use. Flight test fuel consumption data shall not be increased, however. All graphs presenting fuel flow or range data shall reference source of fuel consumption data and whether increased by 5%.

Rate-of-climb data shall be corrected for accelerating or decelerating effects of varying climb airspeeds with altitude.

3.1.2.1.7 CARRIER SUITABILITY.- For carrier based aircraft, a detailed analysis of airplane launching characteristics that are in agreement with the minimum wind requirements of paragraph 3.4.2.1(a) of MIL-C-5011A should be submitted in a separate report. This procedure is intended to avoid delay in the submittal of the substantiating data for the SAC charts.

3.1.2.1.8 IN-FLIGHT REFUELING.- It is required that SAC chart submittals for receiver aircraft having in-flight refueling (IFR) capabilities include IFR radii for both rendezvous missions with tanker and/or Buddy type refueling. Information concerning tanker radius and fuel available for transfer may be obtained from BuAer (AD-33).

3.1.2.1.9 REFERENCE MATERIAL.- All reference material concerning the preparation of the substantiating data report should be tabulated and any specific material prepared by the Contractor and not previously submitted, should be included as an appendix to the substantiating Performance Data Report.

3.2 MISSIONS.- Combat radius and endurance problems for combat air patrol, low- and high-altitude photographic, special store delivery (sea level and 15,000 feet altitude) and in-flight refueling missions of jet aircraft are contained in Appendix I of this Specification. These problems are intended for use in preparation of SAC charts and supplement the problems of Table I of MIL-C-5011A.

4. QUALITY ASSURANCE PROVISIONS

4.1 INSPECTION AND ACCEPTANCE.- The Performance Data Report will be subject to final inspection and approval of the BUAER as required by MIL-D-8706. All data contained in this report are subject to review and analysis and shall be closely coordinated with BUAER (AD-33).

5. PREPARATION FOR DELIVERY

5.1 PACKING.- Reproduction copy shall be packed separately and in such manner that contents will not be damaged during shipment. Reproduction copy shall not be folded. All shipping containers containing reproduction copy shall also contain a copy of the applicable letter of transmittal.

5.2 MARKING AND LABELING.- All shipping containers shall be addressed to:

Bureau of Aeronautics
Department of the Navy
Washington 25, D. C.
Attn: AD-33

5.2.1 The following information shall appear on all shipping containers for reproduction copy:

"Reproduction Copy"
"Government Order No. (or Contract No.)"

6. NOTES

6.1 INTERPRETATION.- Interpretations of the technical requirements of this document may be obtained from BUAER.

NOTICE:

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented inventions that may in any way be related thereto.

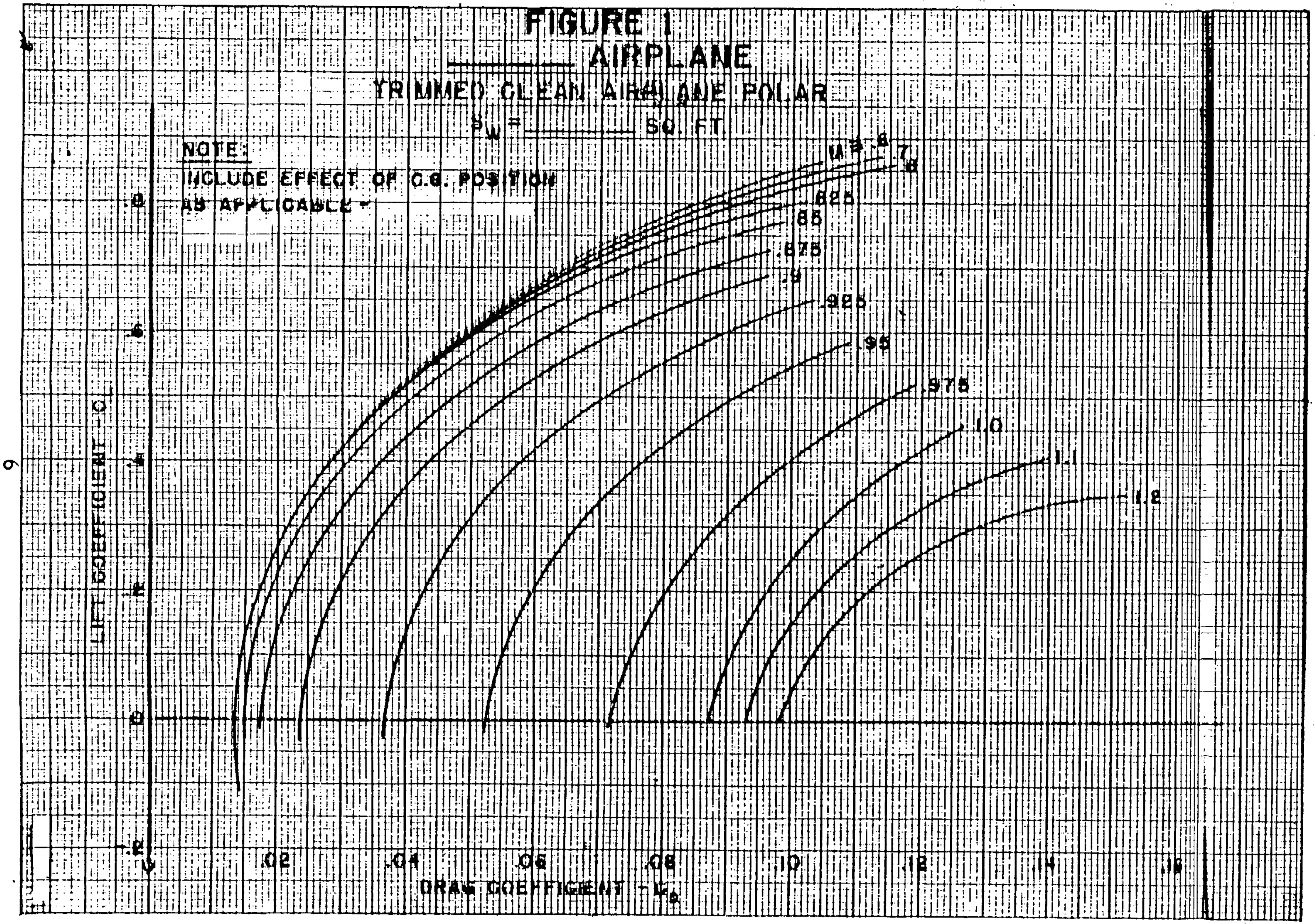


FIGURE 1

_______ AIRPLANE

TRIMMED CLEAN AIRPLANE POLAR

S_W = _______ SQ FT

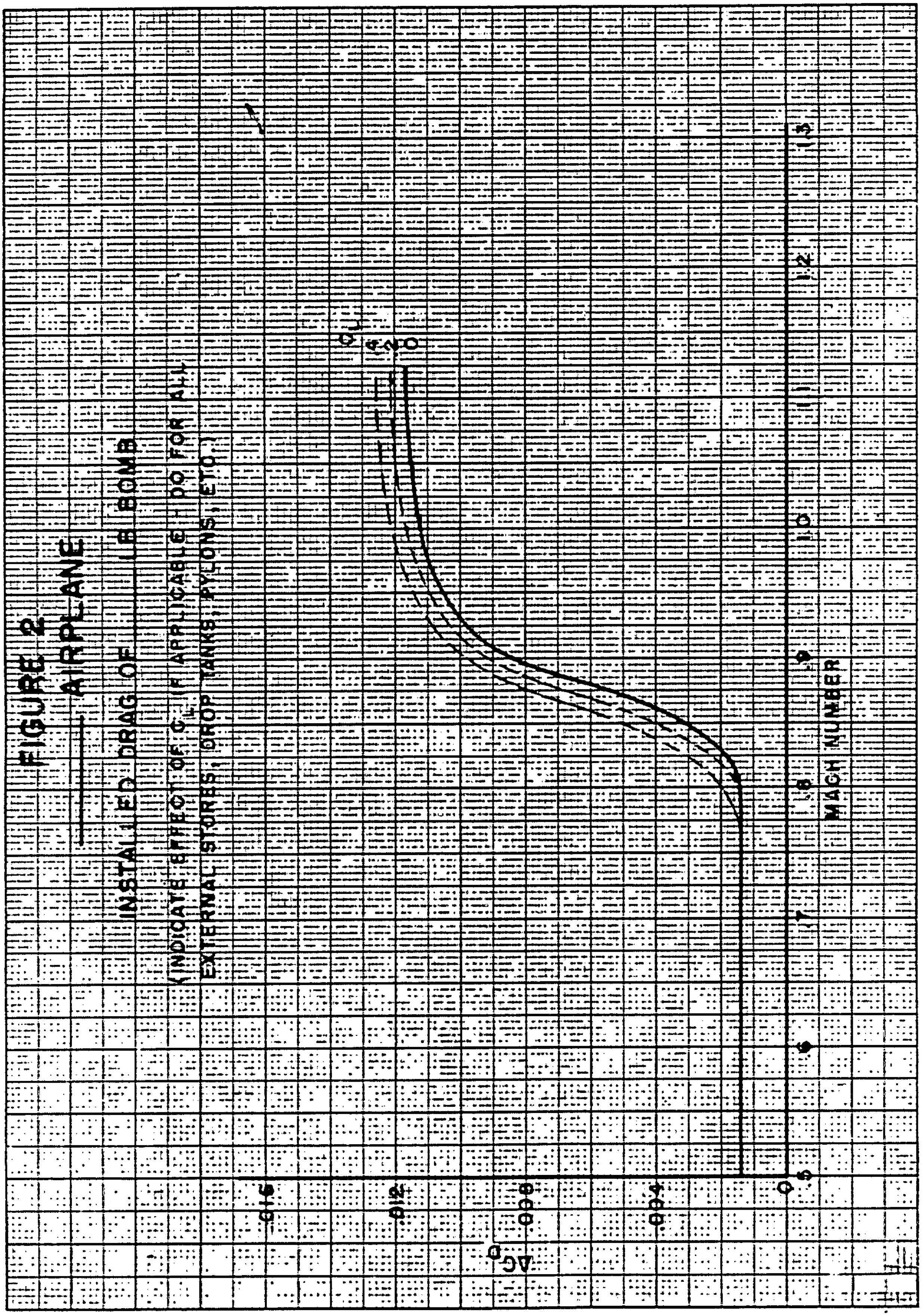


FIGURE 2
_____ AIRPLANE
INSTALLED DRAG OF ___ LB BOMB

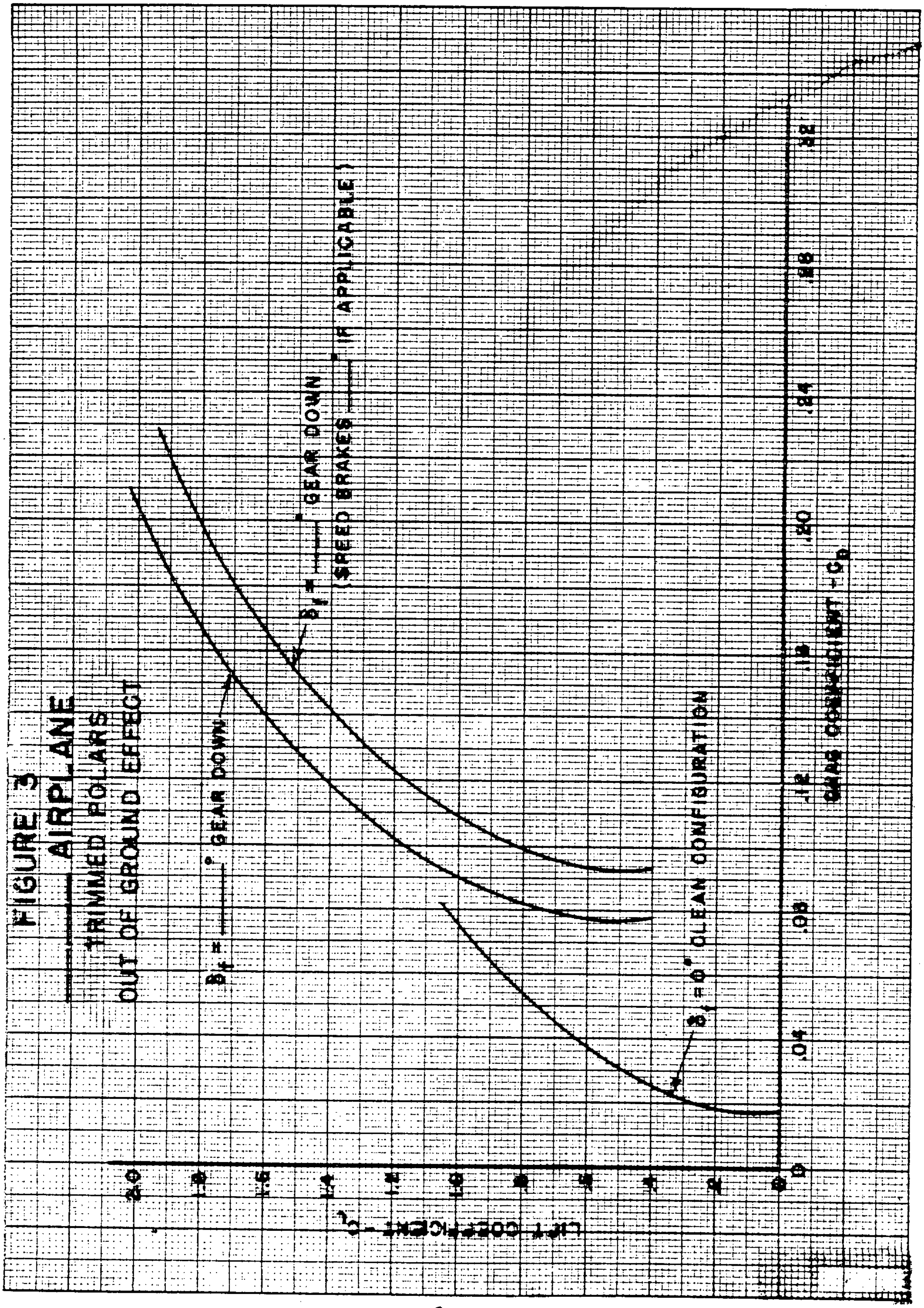


FIGURE 3
______ AIRPLANE
TRIMMED POLARS
OUT OF GROUND EFFECT
δf = ____° GEAR DOWN
δf = ____° GEAR DOWN
(SPEED BRAKES ____° IF APPLICABLE)
δf = 0° CLEAN CONFIGURATION
0
.04
.08
.12
.16
.20
.24
.28
.32
DRAG COEFFICIENT - CD
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
2.0
LIFT COEFFICIENT - CL

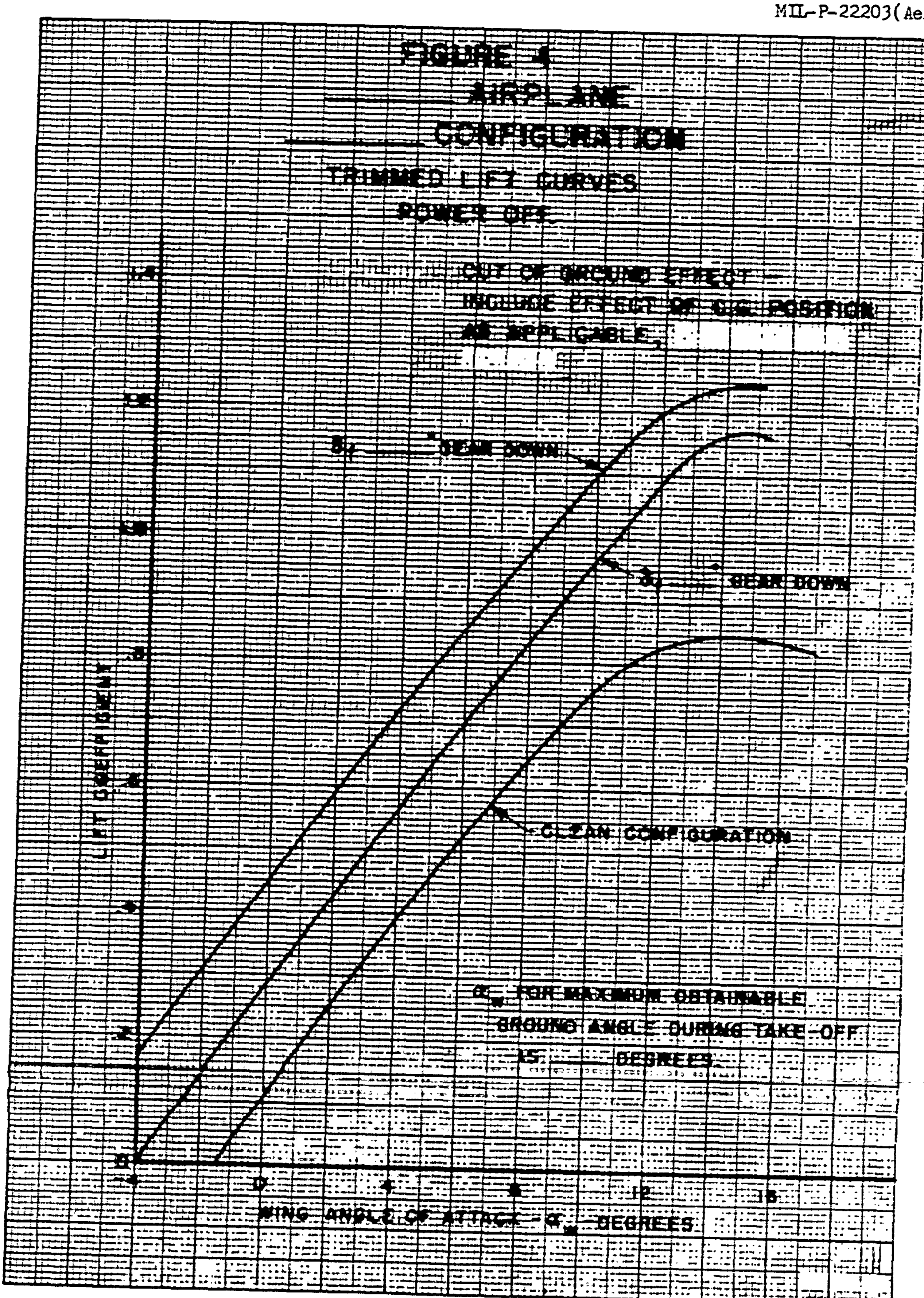


FIGURE 4
AIRPLANE
CONFIGURATION
TRIMMED LIFT CURVES
POWER OFF
OUT OF GROUND EFFECT —
INCLUDE EFFECT OF C.G. POSITION
AS APPLICABLE.
GEAR DOWN
GEAR DOWN
CLEAN CONFIGURATION
FOR MAXIMUM OBTAINABLE
GROUND ANGLE DURING TAKE-OFF
DEGREES
1.4
0
12
16
WING ANGLE OF ATTACK
DEGREES

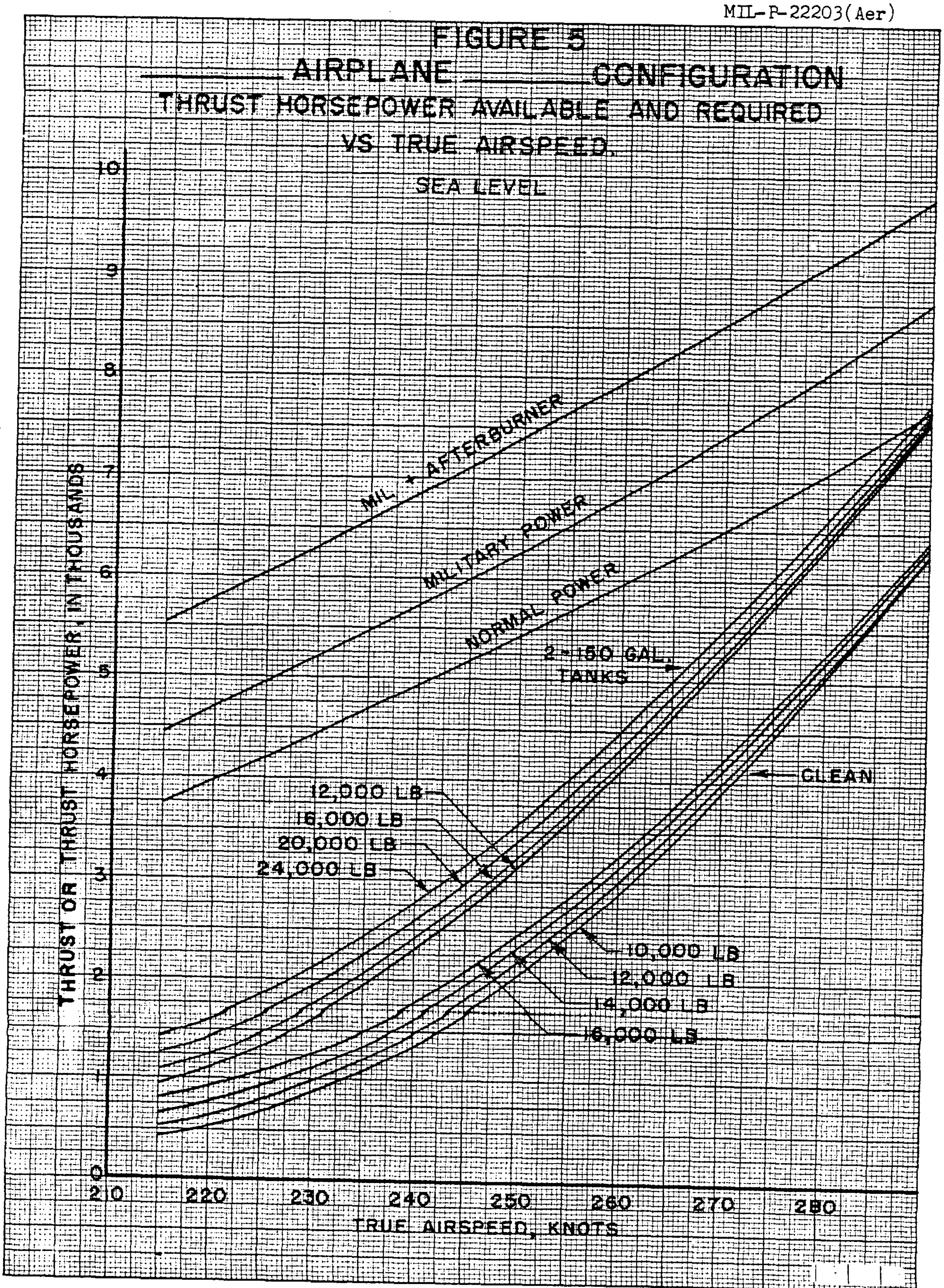


FIGURE 5
AIRPLANE CONFIGURATION
THRUST HORSEPOWER AVAILABLE AND REQUIRED
VS TRUE AIRSPEED.
SEA LEVEL
MIL + AFTERBURNER
MILITARY POWER
NORMAL POWER
2 - 150 GAL. TANKS
CLEAN
12,000 LB
16,000 LB
20,000 LB
24,000 LB
10,000 LB
12,000 LB
14,000 LB
16,000 LB
THRUST OR THRUST HORSEPOWER, IN THOUSANDS
0
1
2
3
4
5
6
7
8
9
10
210
220
230
240
250
260
270
280
TRUE AIRSPEED, KNOTS

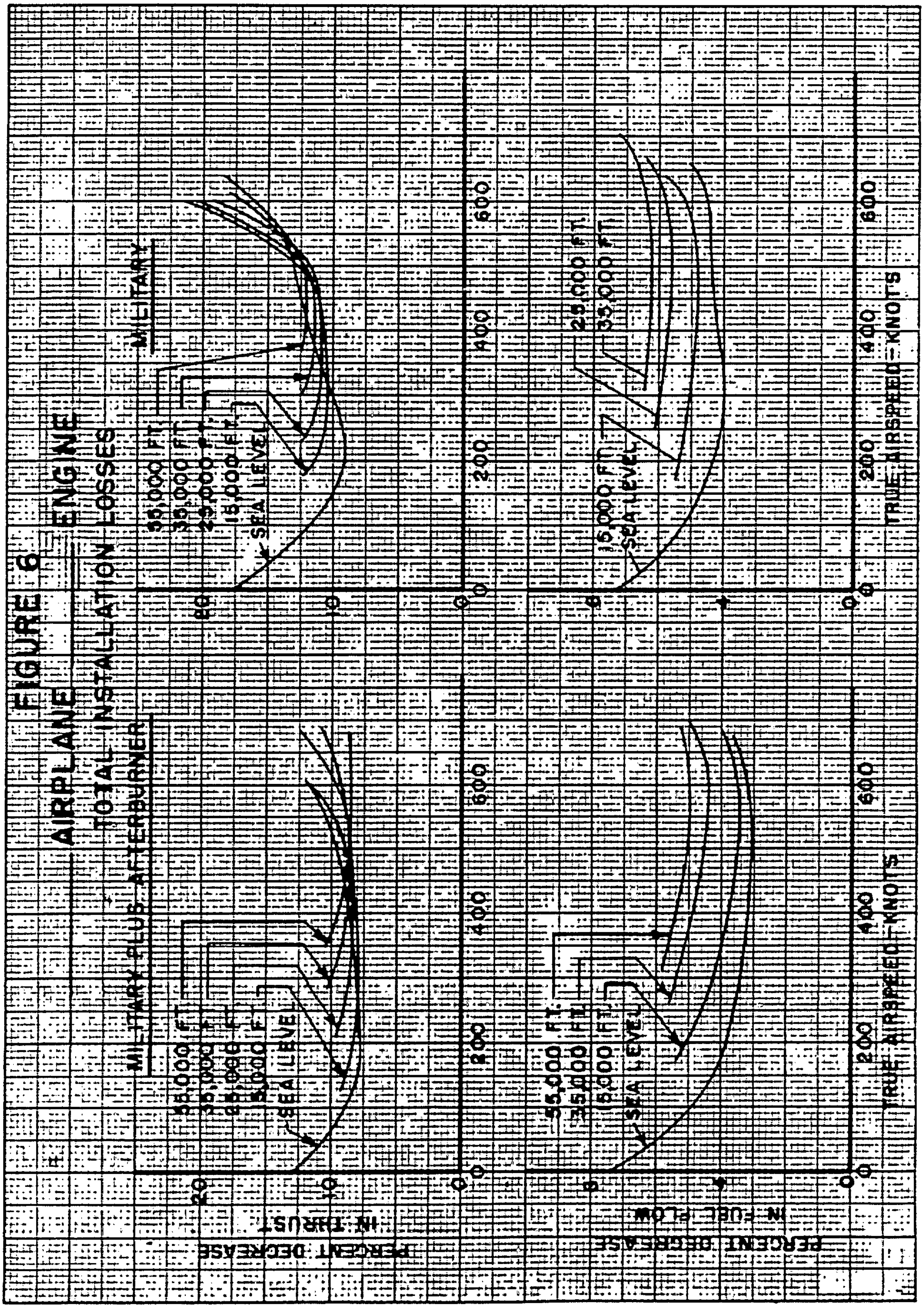


FIGURE 6
AIRPLANE — ENGINE
TOTAL INSTALLATION LOSSES
MILITARY PLUS AFTERBURNER
MILITARY
55,000 FT.
35,000 FT.
25,000 FT.
15,000 FT.
SEA LEVEL
PERCENT DECREASE IN THRUST
PERCENT DECREASE IN FUEL FLOW
TRUE AIRSPEED - KNOTS

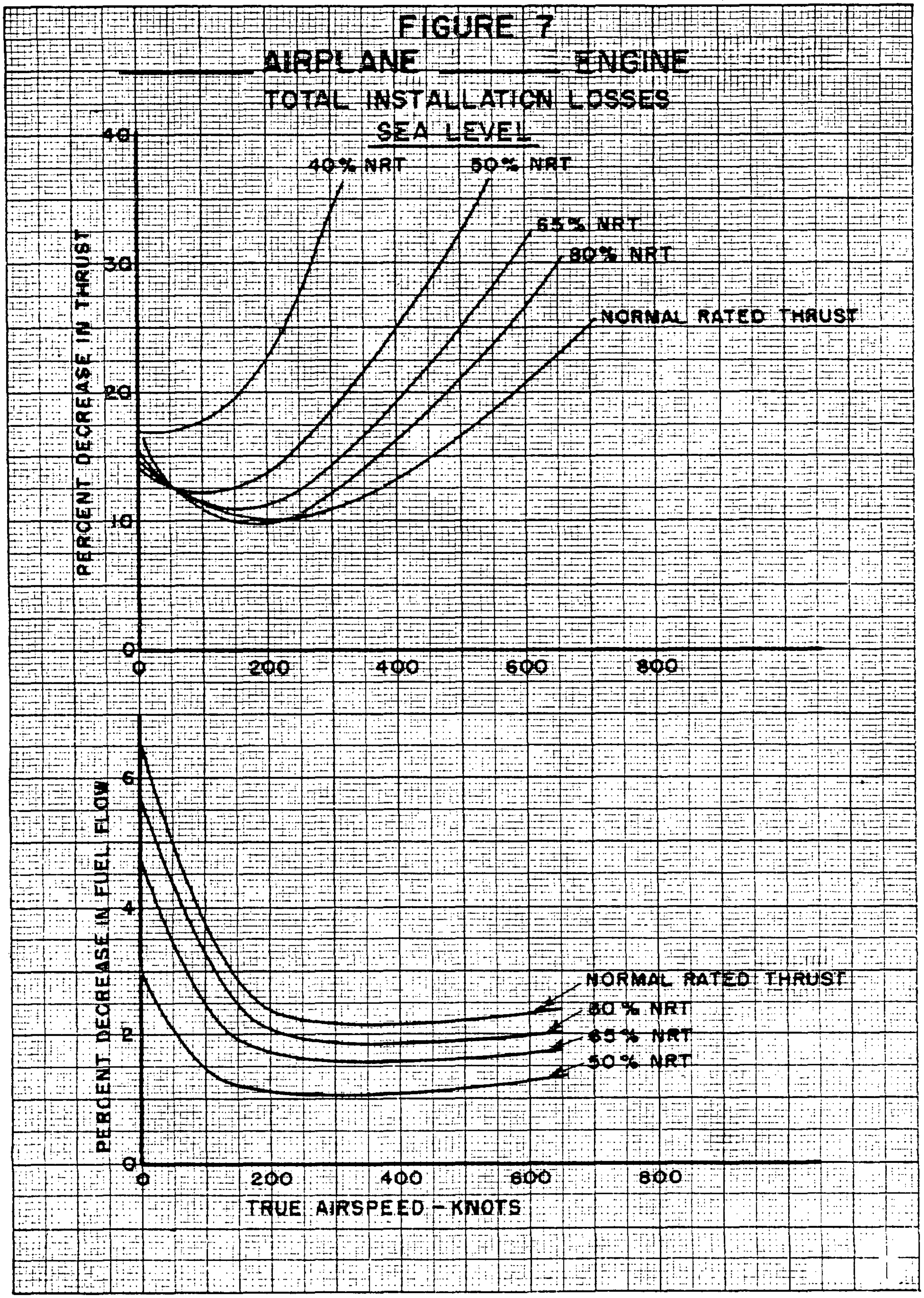


FIGURE 7
AIRPLANE
ENGINE
TOTAL INSTALLATION LOSSES
SEA LEVEL
40% NRT
50% NRT
65% NRT
80% NRT
NORMAL RATED THRUST
PERCENT DECREASE IN THRUST
40
30
20
10
0
0
200
400
600
800
PERCENT DECREASE IN FUEL FLOW
6
4
2
0
NORMAL RATED THRUST
80 % NRT
65 % NRT
50 % NRT
0
200
400
600
800
TRUE AIRSPEED – KNOTS

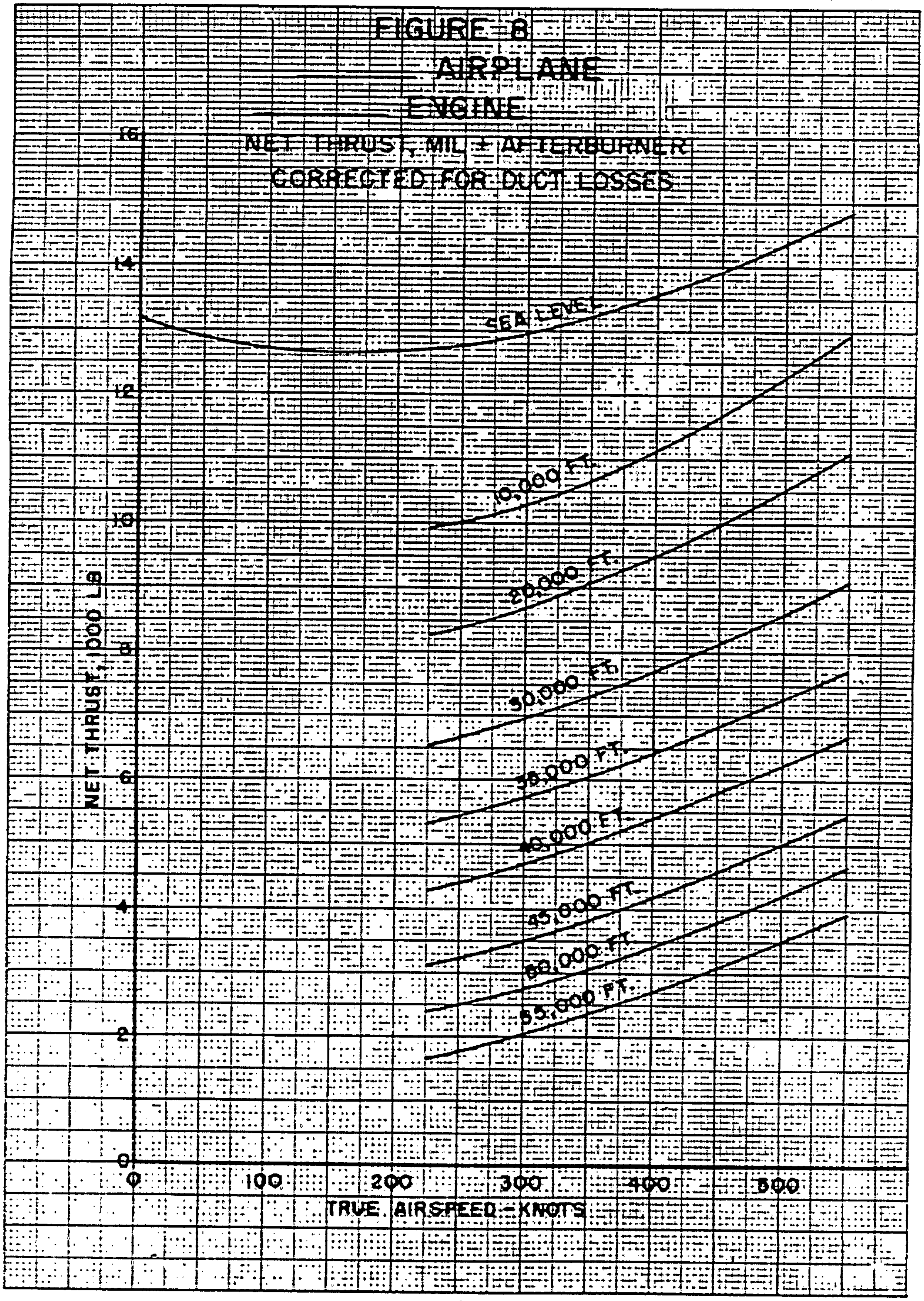


FIGURE 8
AIRPLANE
ENGINE
NET THRUST, MIL + AFTERBURNER
CORRECTED FOR DUCT LOSSES
SEA LEVEL
10,000 FT.
20,000 FT.
30,000 FT.
35,000 FT.
40,000 FT.
45,000 FT.
50,000 FT.
55,000 FT.
NET THRUST, 1000 LB
TRUE AIRSPEED - KNOTS
0
2
4
6
8
10
12
14
16
100
200
300
400
500

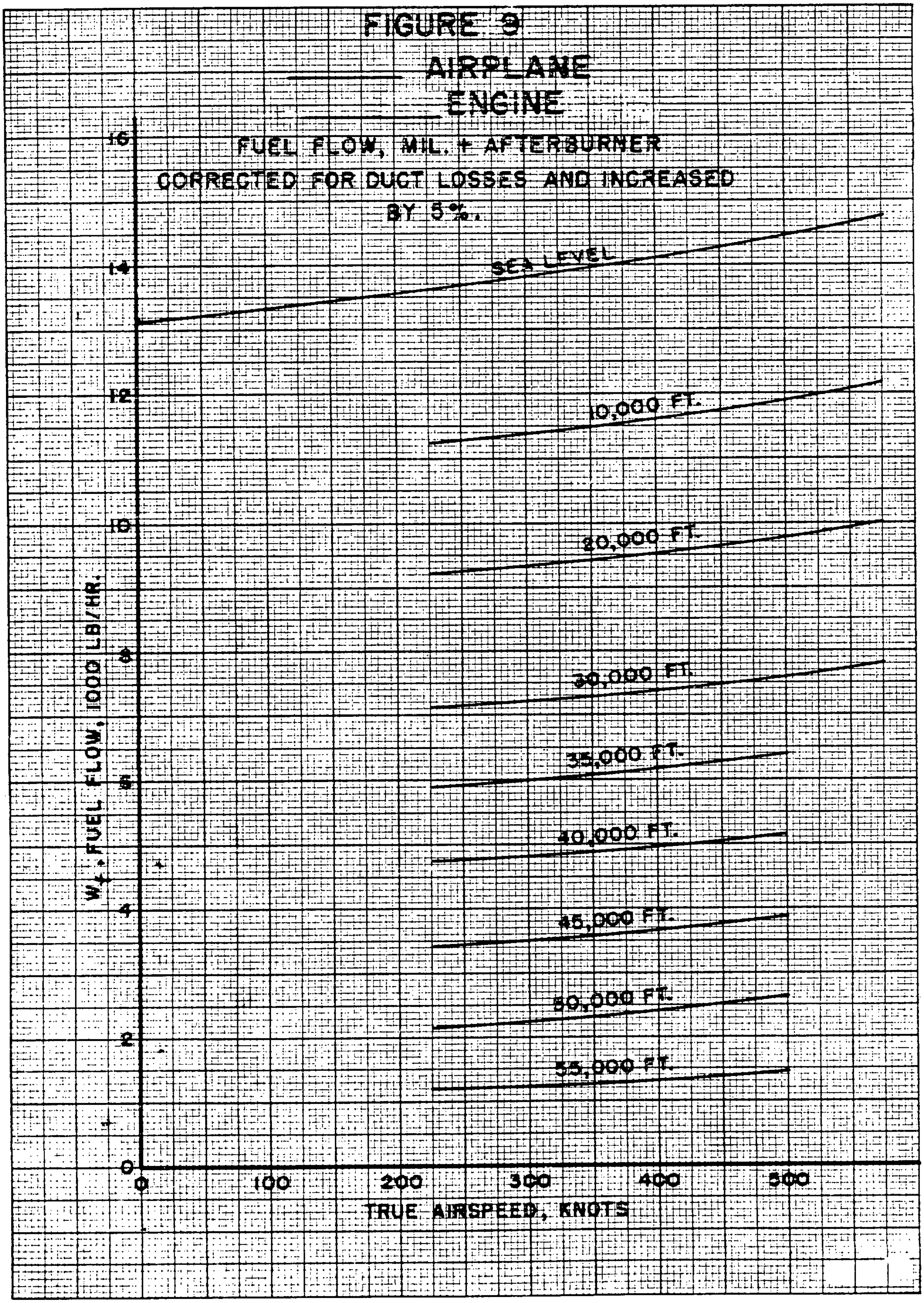


FIGURE 9
AIRPLANE
ENGINE
FUEL FLOW, MIL. + AFTERBURNER
CORRECTED FOR DUCT LOSSES AND INCREASED
BY 5%.
SEA LEVEL
10,000 FT.
20,000 FT.
30,000 FT.
35,000 FT.
40,000 FT.
45,000 FT.
50,000 FT.
55,000 FT.
W_f, FUEL FLOW, 1000 LB/HR.
0
2
4
6
8
10
12
14
16
0
100
200
300
400
500
TRUE AIRSPEED, KNOTS

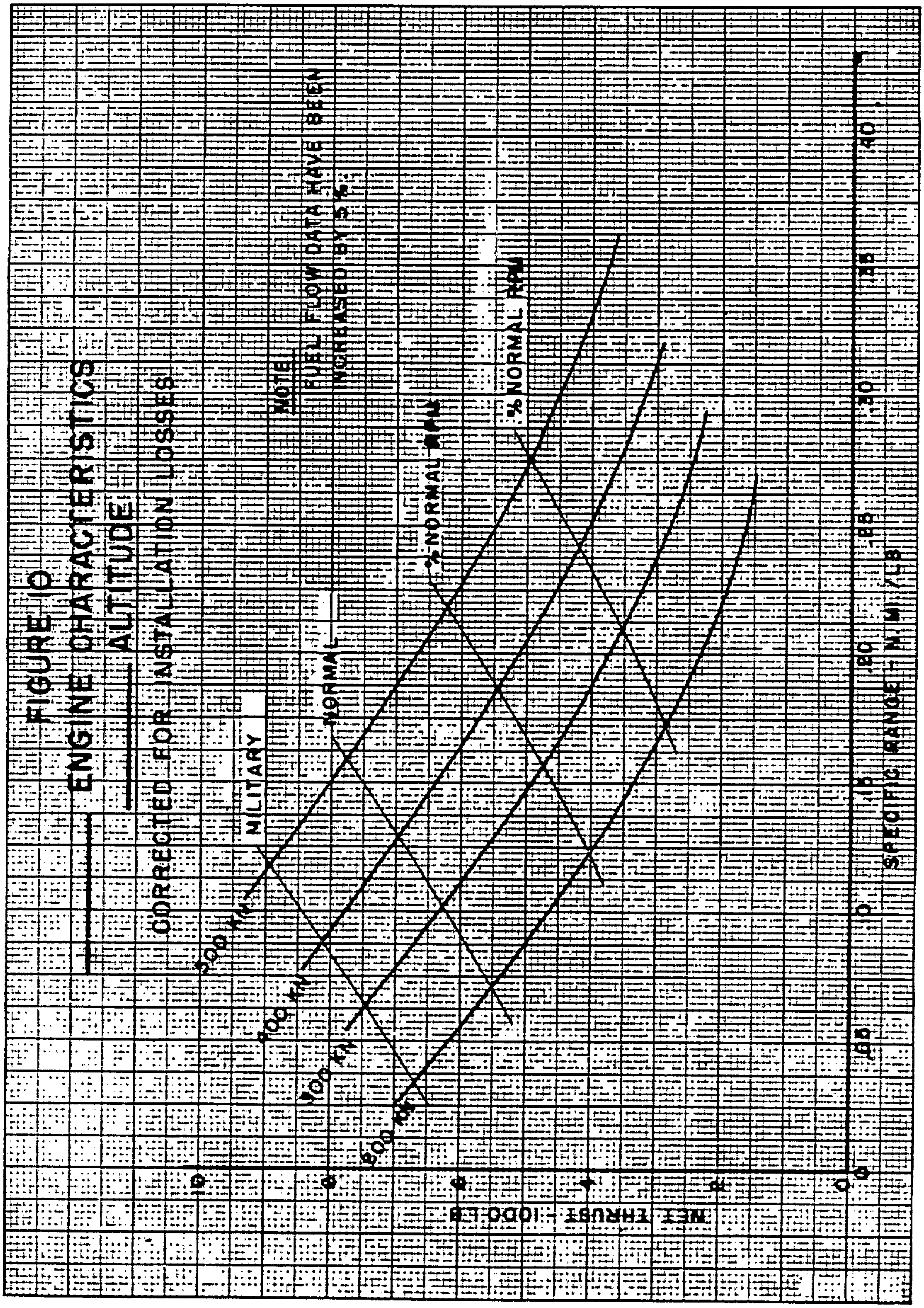


FIGURE 10
ENGINE CHARACTERISTICS
ALTITUDE
CORRECTED FOR INSTALLATION LOSSES
MILITARY
NORMAL
NOTE:
FUEL FLOW DATA HAVE BEEN
INCREASED BY 5%.
% NORMAL
% NORMAL
500 KN
400 KN
300 KN
200 KN
SPECIFIC RANGE - N.MI./LB
NET THRUST - 1000 LB

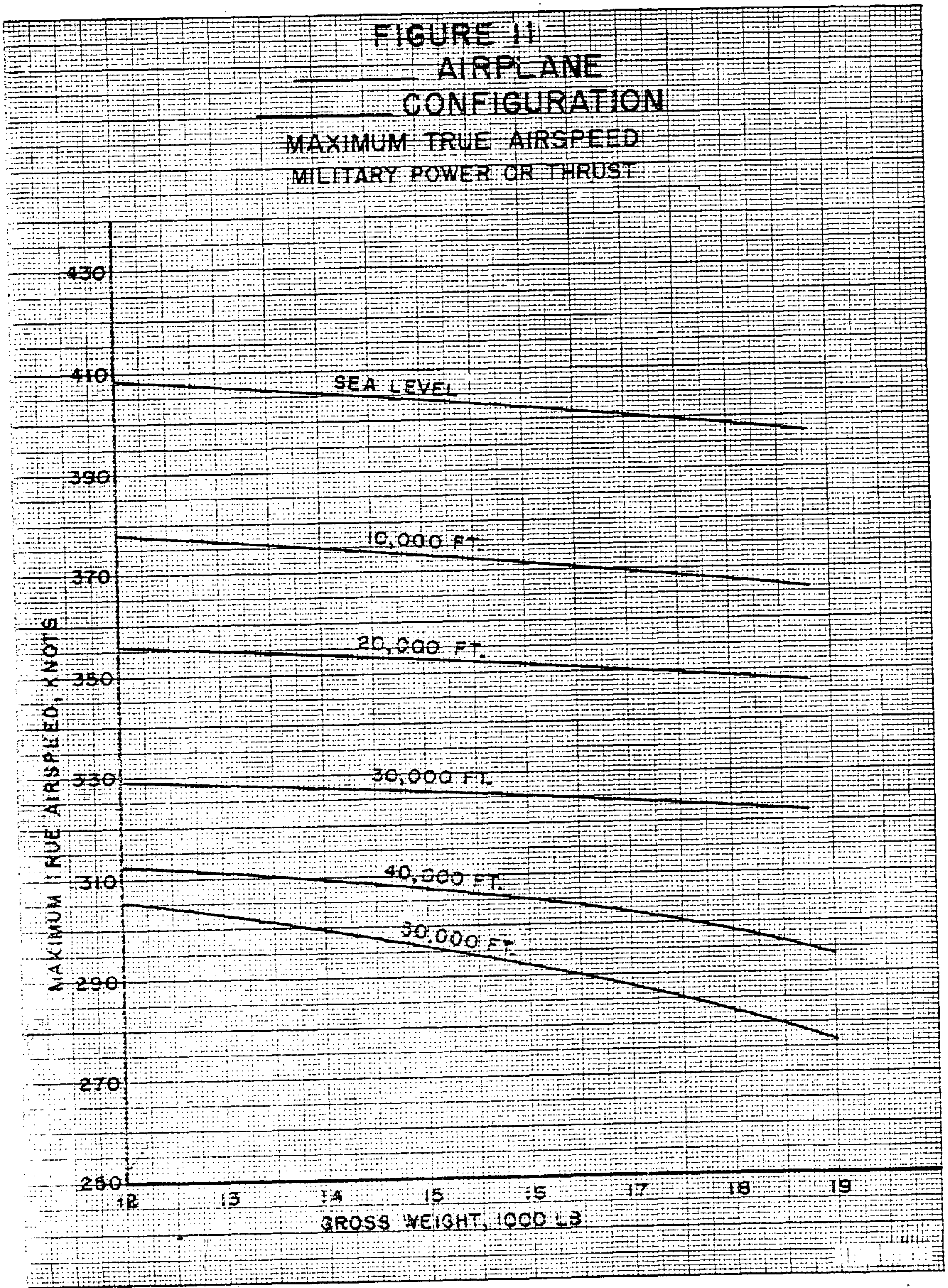


FIGURE 11
______ AIRPLANE
______ CONFIGURATION
MAXIMUM TRUE AIRSPEED
MILITARY POWER OR THRUST
SEA LEVEL
10,000 FT.
20,000 FT.
30,000 FT.
40,000 FT.
50,000 FT.
MAXIMUM TRUE AIRSPEED, KNOTS
430
410
390
370
350
330
310
290
270
250
12
13
14
15
16
17
18
19
GROSS WEIGHT, 1000 LB

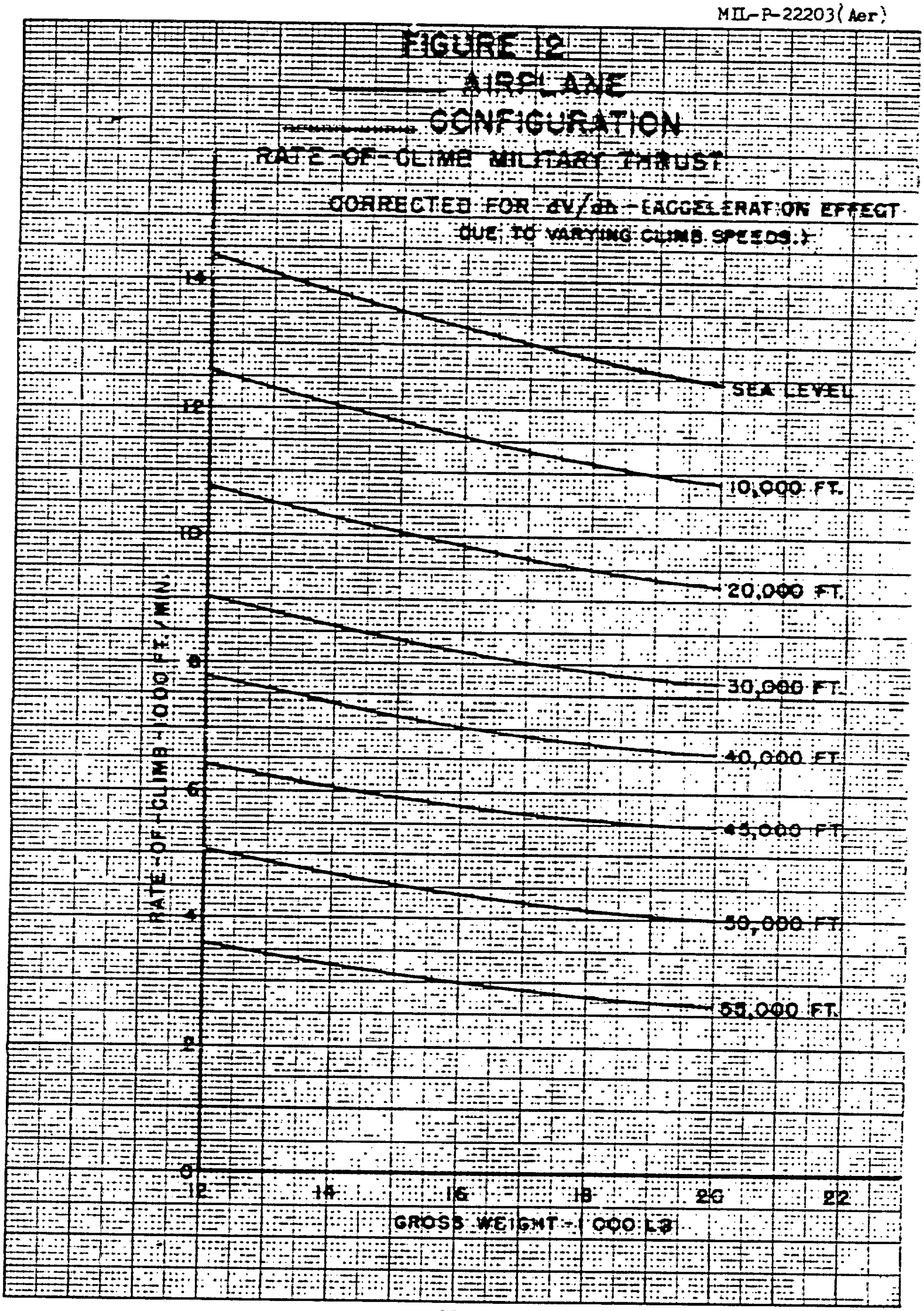


FIGURE 12
AIRPLANE
CONFIGURATION
RATE-OF-CLIMB MILITARY THRUST
CORRECTED FOR dV/dh (ACCELERATION EFFECT DUE TO VARYING CLIMB SPEEDS.)
SEA LEVEL
10,000 FT.
20,000 FT.
30,000 FT.
40,000 FT.
45,000 FT.
50,000 FT.
55,000 FT.
RATE-OF-CLIMB-1000 FT./MIN.
0
2
4
6
8
10
12
14
12
14
16
18
20
22
GROSS WEIGHT-1000 LB

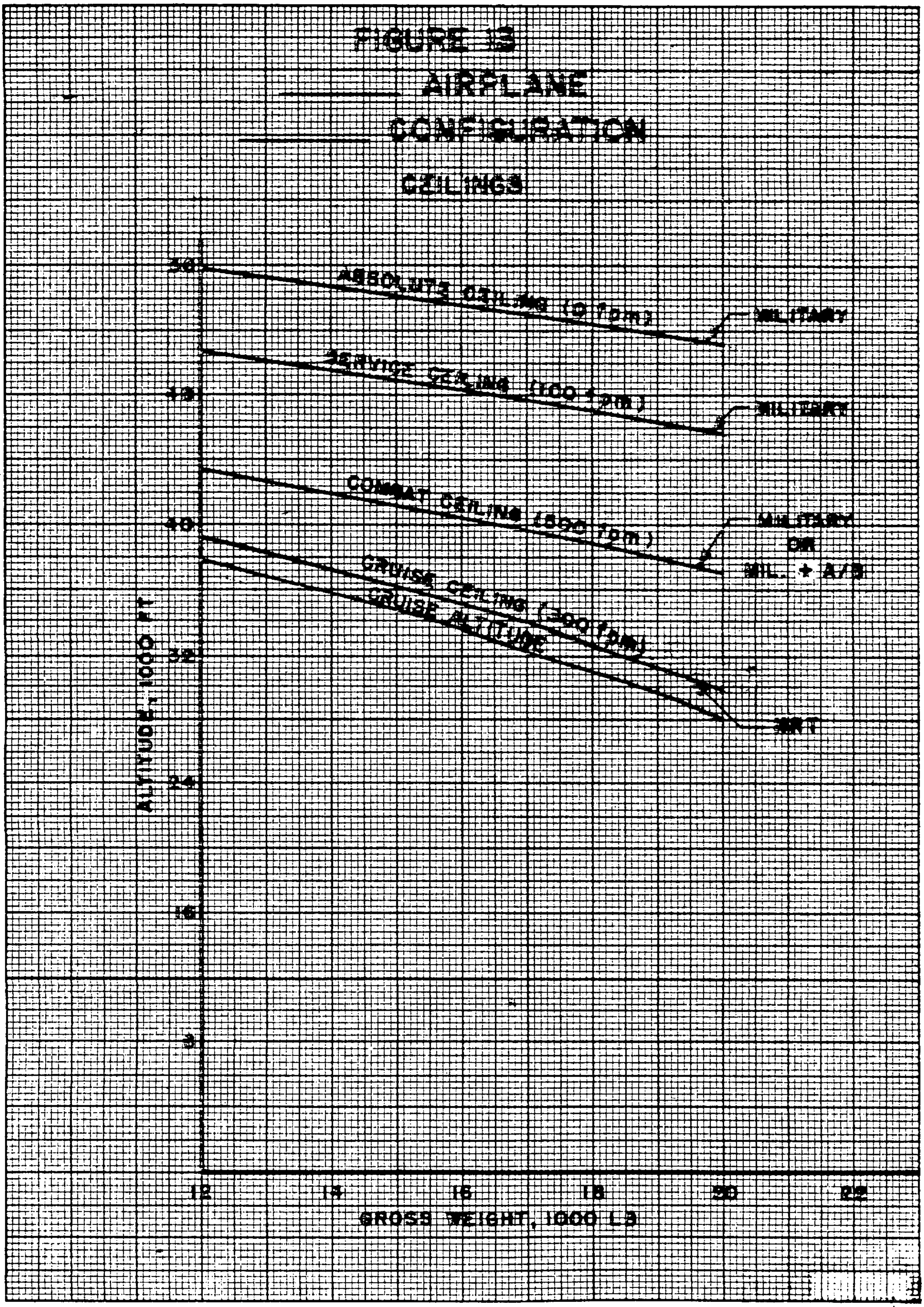


FIGURE 13
_______ AIRPLANE
_______ CONFIGURATION
CEILINGS
ABSOLUTE CEILING (0 fpm)
MILITARY
SERVICE CEILING (100 fpm)
MILITARY
COMBAT CEILING (500 fpm)
MILITARY
OR
MIL. + A/B
CRUISE CEILING (300 fpm)
CRUISE ALTITUDE
NRT
ALTITUDE, 1000 FT
GROSS WEIGHT, 1000 LB
12
14
16
18
20
22
16
24
32
40
48

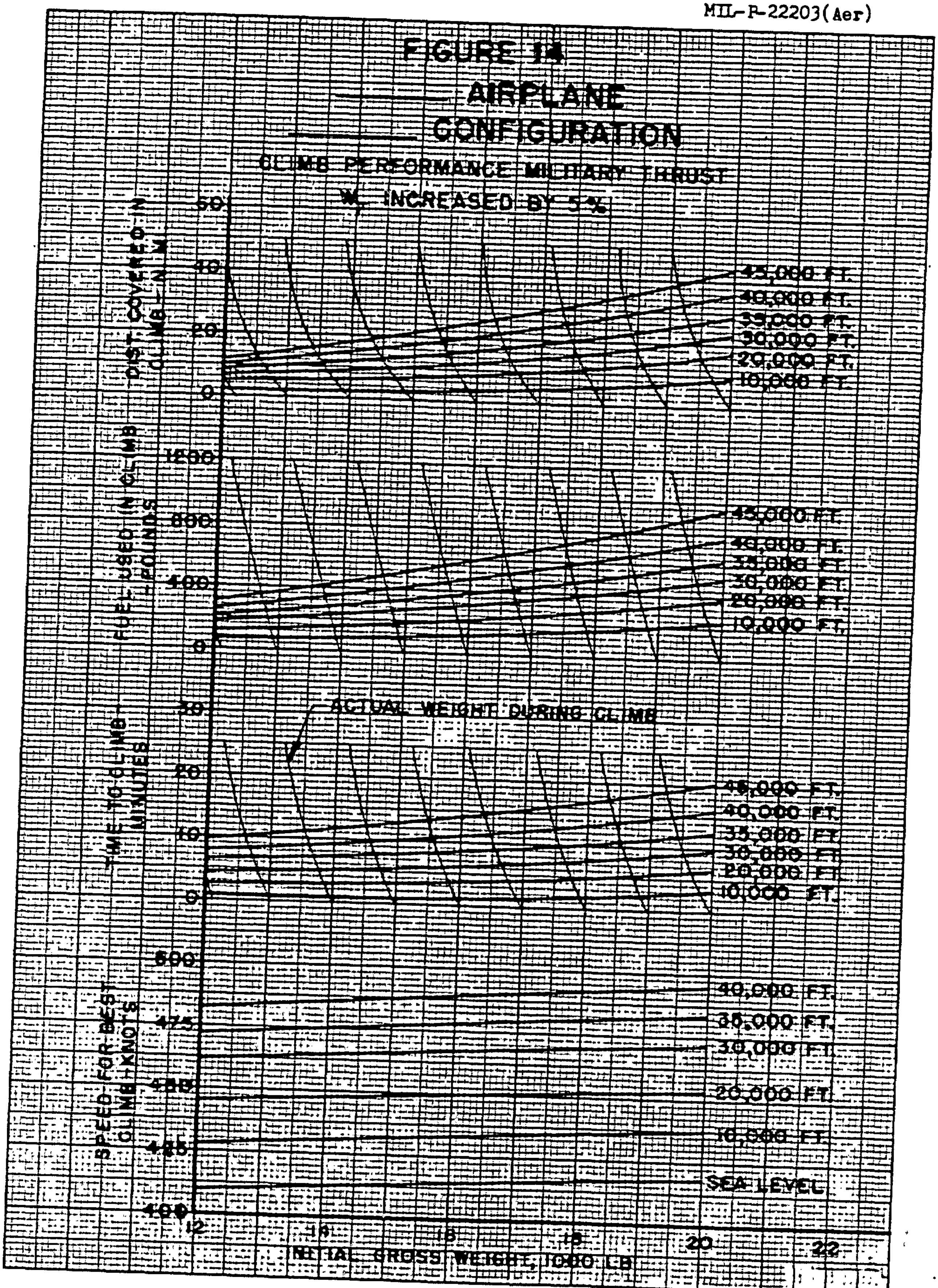


FIGURE 14
AIRPLANE
CONFIGURATION
CLIMB PERFORMANCE MILITARY THRUST
INCREASED BY 5%
DIST COVERED IN CLIMB N.M.
FUEL USED IN CLIMB POUNDS
TIME TO CLIMB MINUTES
SPEED FOR BEST CLIMB KNOTS
45,000 FT.
40,000 FT.
35,000 FT.
30,000 FT.
20,000 FT.
10,000 FT.
SEA LEVEL
ACTUAL WEIGHT DURING CLIMB
INITIAL GROSS WEIGHT, 1000 LB

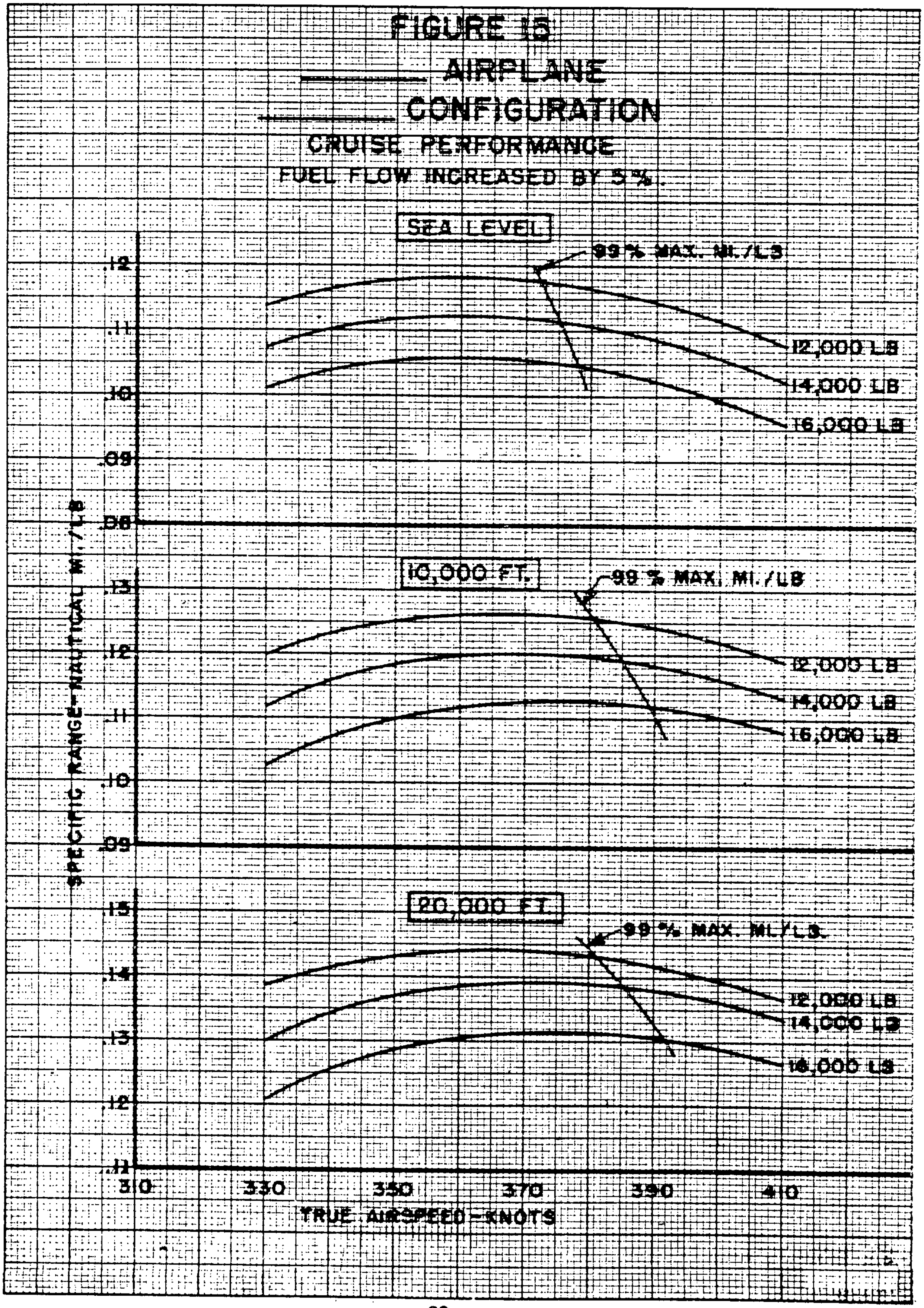


FIGURE 15
AIRPLANE
CONFIGURATION
CRUISE PERFORMANCE
FUEL FLOW INCREASED BY 5 %.
SEA LEVEL
99 % MAX. MI./LB
12,000 LB
14,000 LB
16,000 LB
10,000 FT.
99 % MAX. MI./LB
12,000 LB
14,000 LB
16,000 LB
20,000 FT.
99 % MAX. MI./LB.
12,000 LB
14,000 LB
16,000 LB
SPECIFIC RANGE-NAUTICAL MI./LB
.12
.11
.10
.09
.08
.13
.12
.11
.10
.09
.15
.14
.13
.12
.11
310
330
350
370
390
410
TRUE AIRSPEED-KNOTS

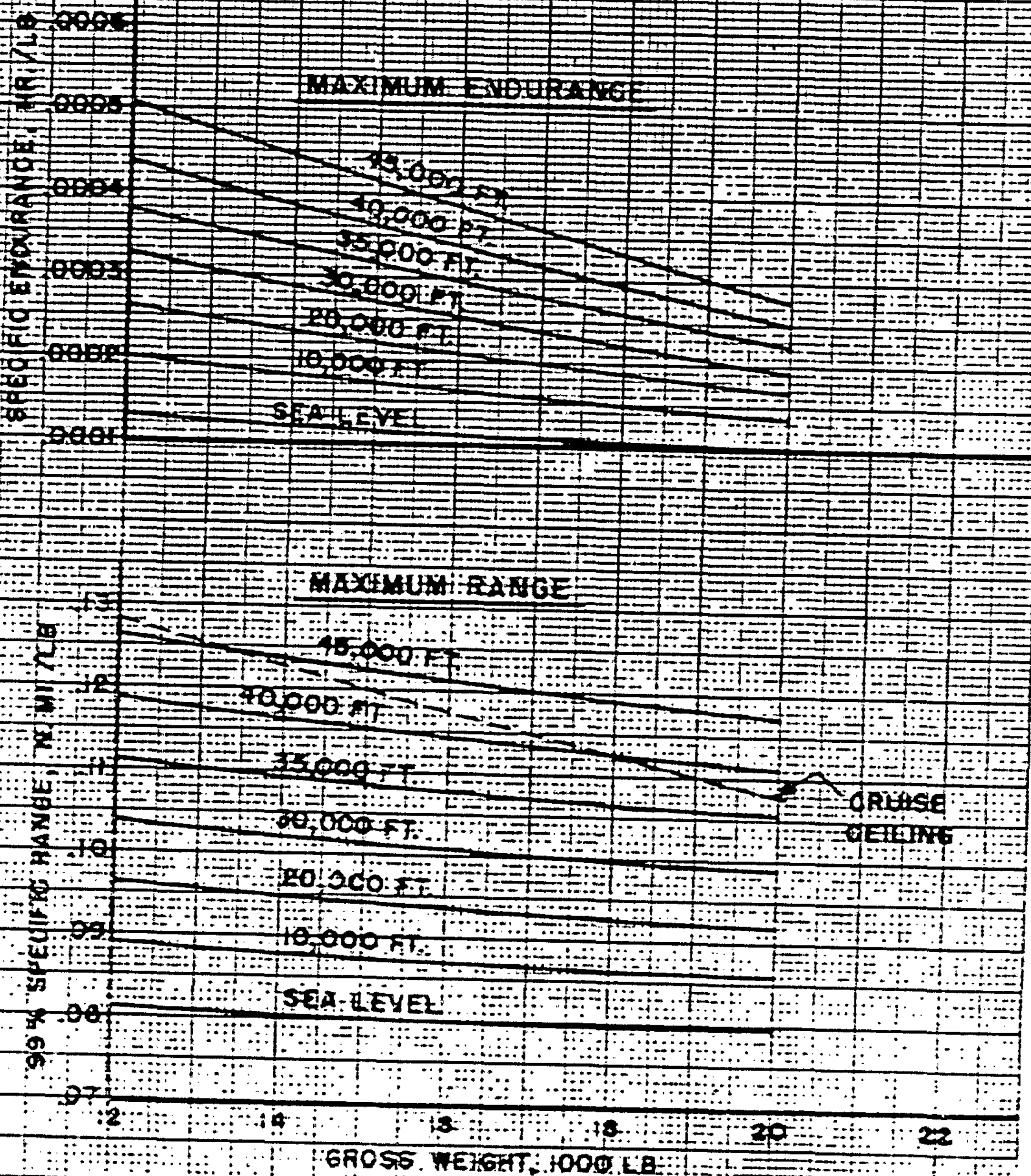
FIGURE 16

______ AIRPLANE

______ CONFIGURATION

RANGE AND ENDURANCE

FUEL FLOW INCR 5%



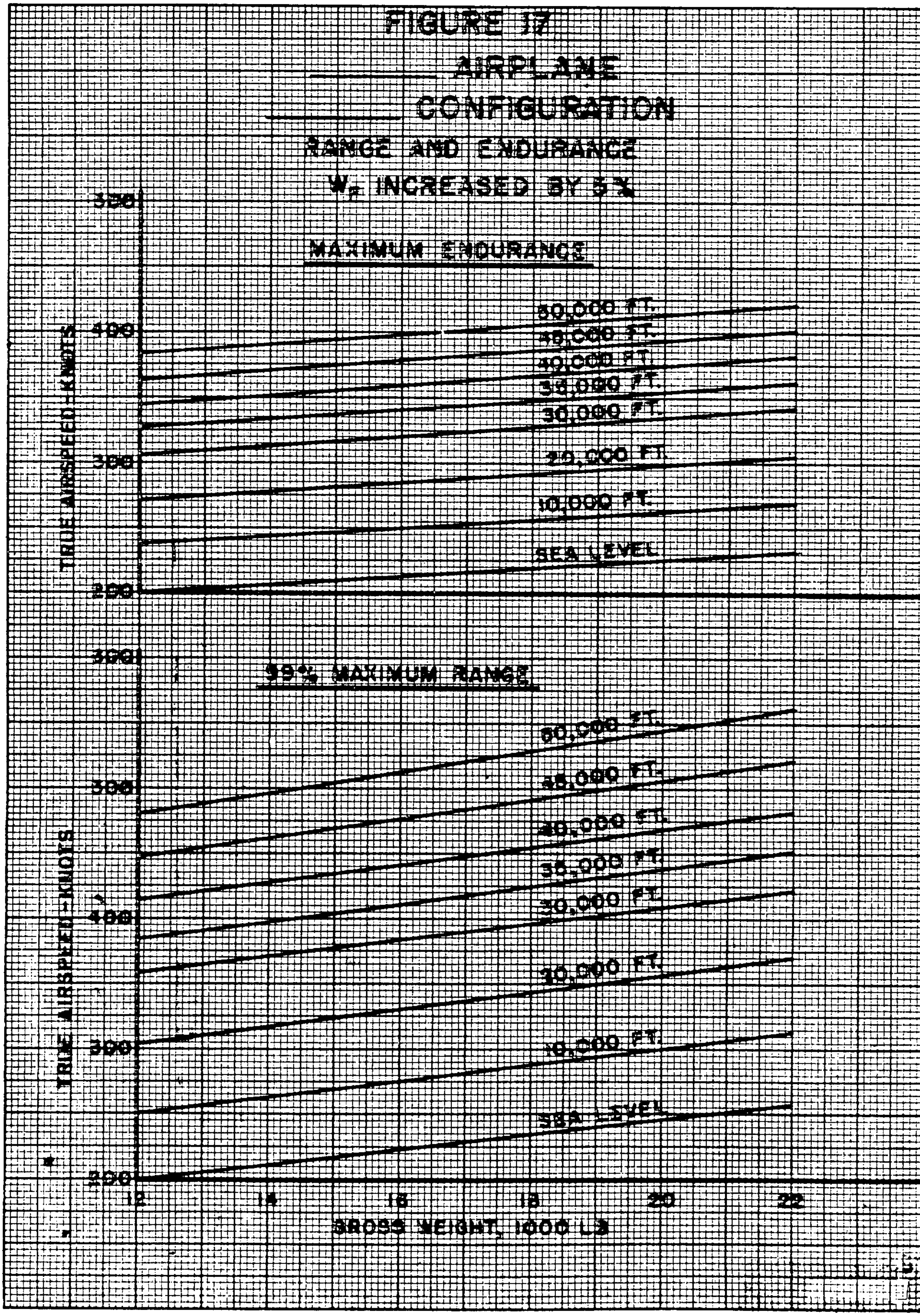
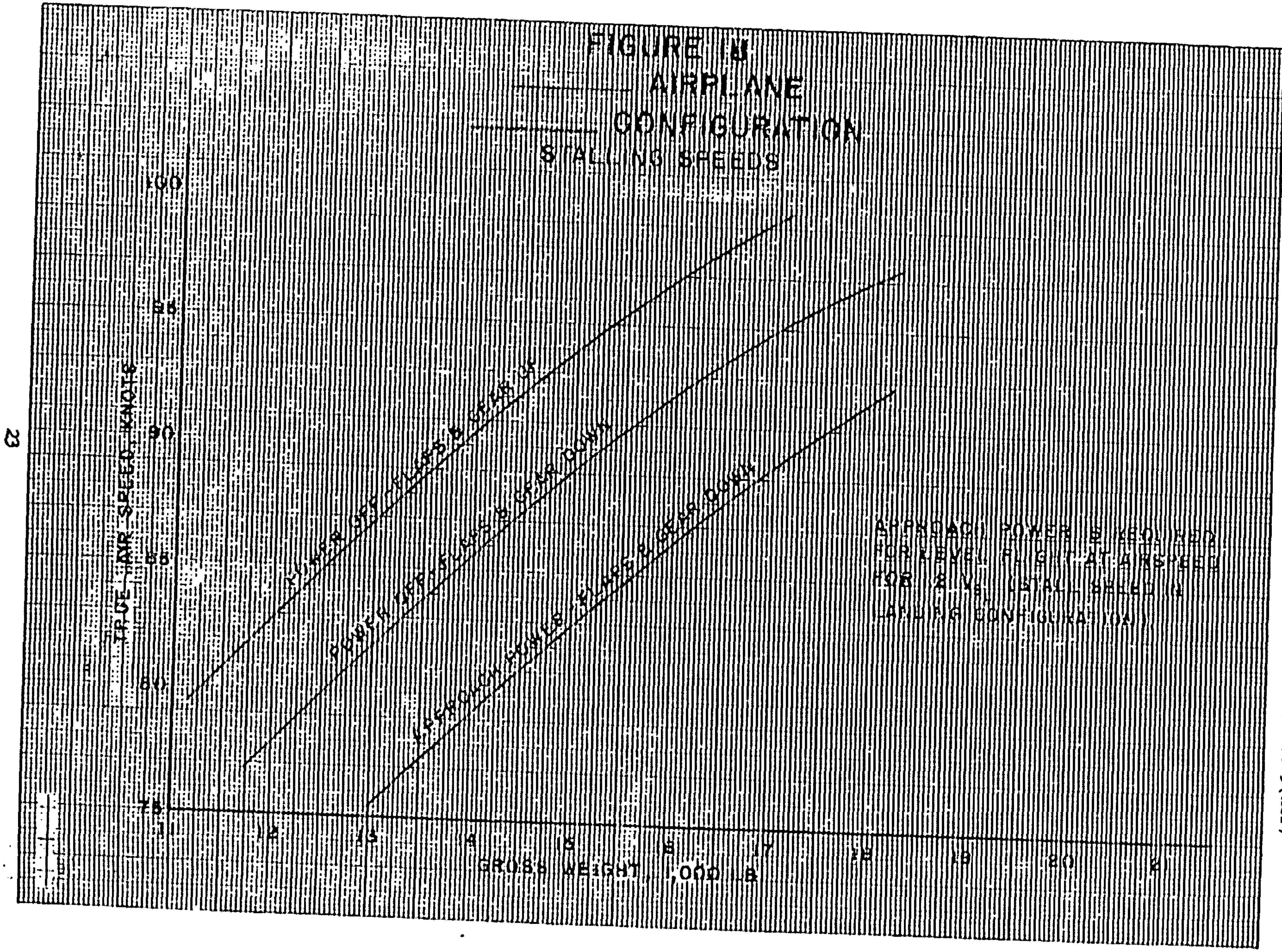


FIGURE 17
AIRPLANE
CONFIGURATION
RANGE AND ENDURANCE
W_F INCREASED BY 5%
MAXIMUM ENDURANCE
50,000 FT.
45,000 FT.
40,000 FT.
35,000 FT.
30,000 FT.
20,000 FT.
10,000 FT.
SEA LEVEL
99% MAXIMUM RANGE
50,000 FT.
45,000 FT.
40,000 FT.
35,000 FT.
30,000 FT.
20,000 FT.
10,000 FT.
SEA LEVEL
TRUE AIRSPEED-KNOTS
500
400
300
200
12
14
16
18
20
22
GROSS WEIGHT, 1000 LB


AIRPLANE
CONFIGURATION
STALLING SPEEDS
TRUE AIR SPEED, KNOTS
100
95
90
85
80
75
GROSS WEIGHT, 1000 LB
20
POWER OFF, FLAPS & GEAR UP
POWER OFF, FLAPS & GEAR DOWN
APPROACH POWER, FLAPS & GEAR DOWN

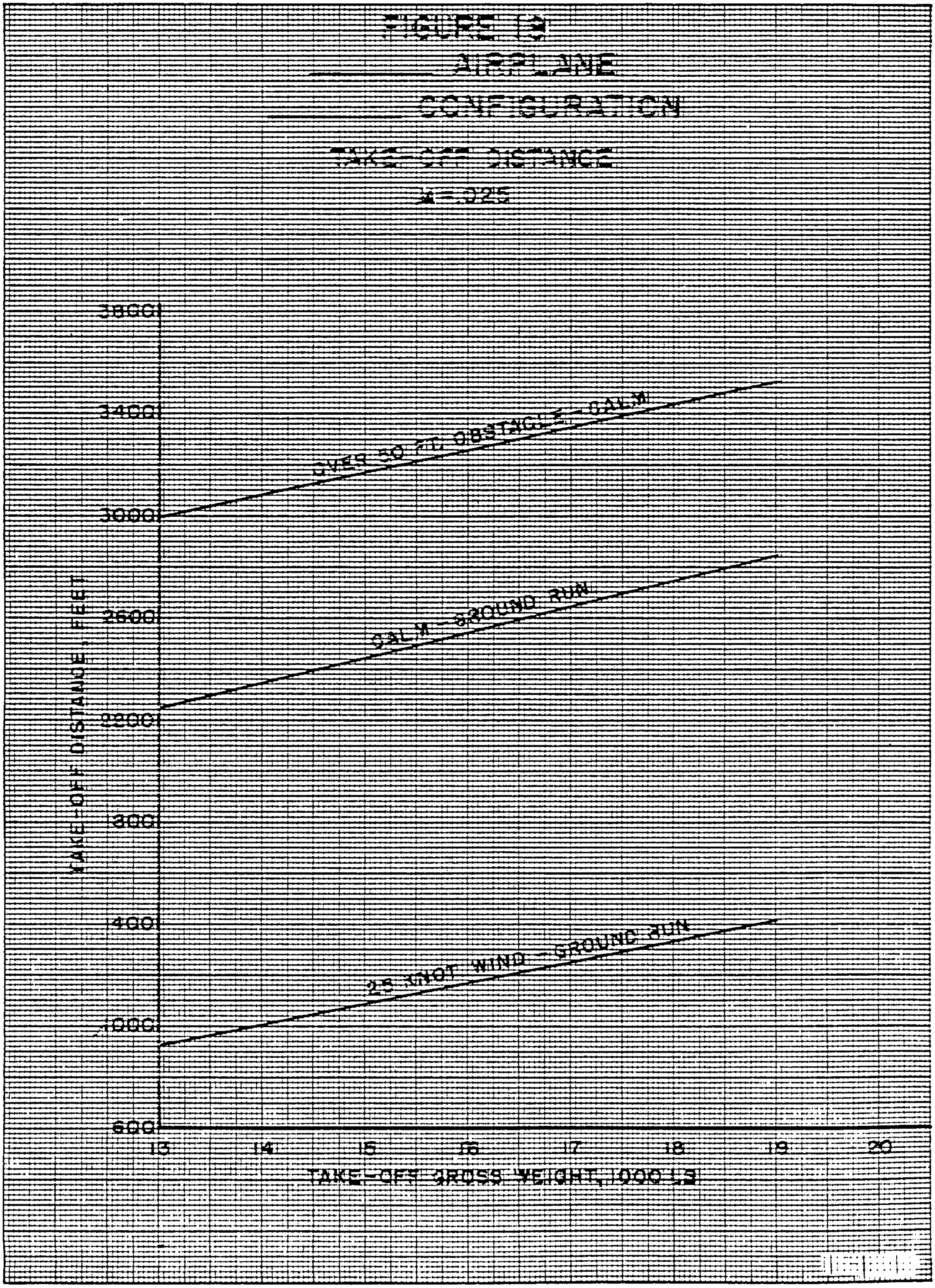


FIGURE
AIRPLANE
CONFIGURATION
TAKE-OFF DISTANCE
3800
3400
3000
2600
2200
1800
1400
1000
600
OVER 50 FT. OBSTACLE – CALM
CALM – GROUND RUN
25 KNOT WIND – GROUND RUN
TAKE-OFF DISTANCE, FEET
13
14
15
16
17
18
19
20
TAKE-OFF GROSS WEIGHT, 1000 LB

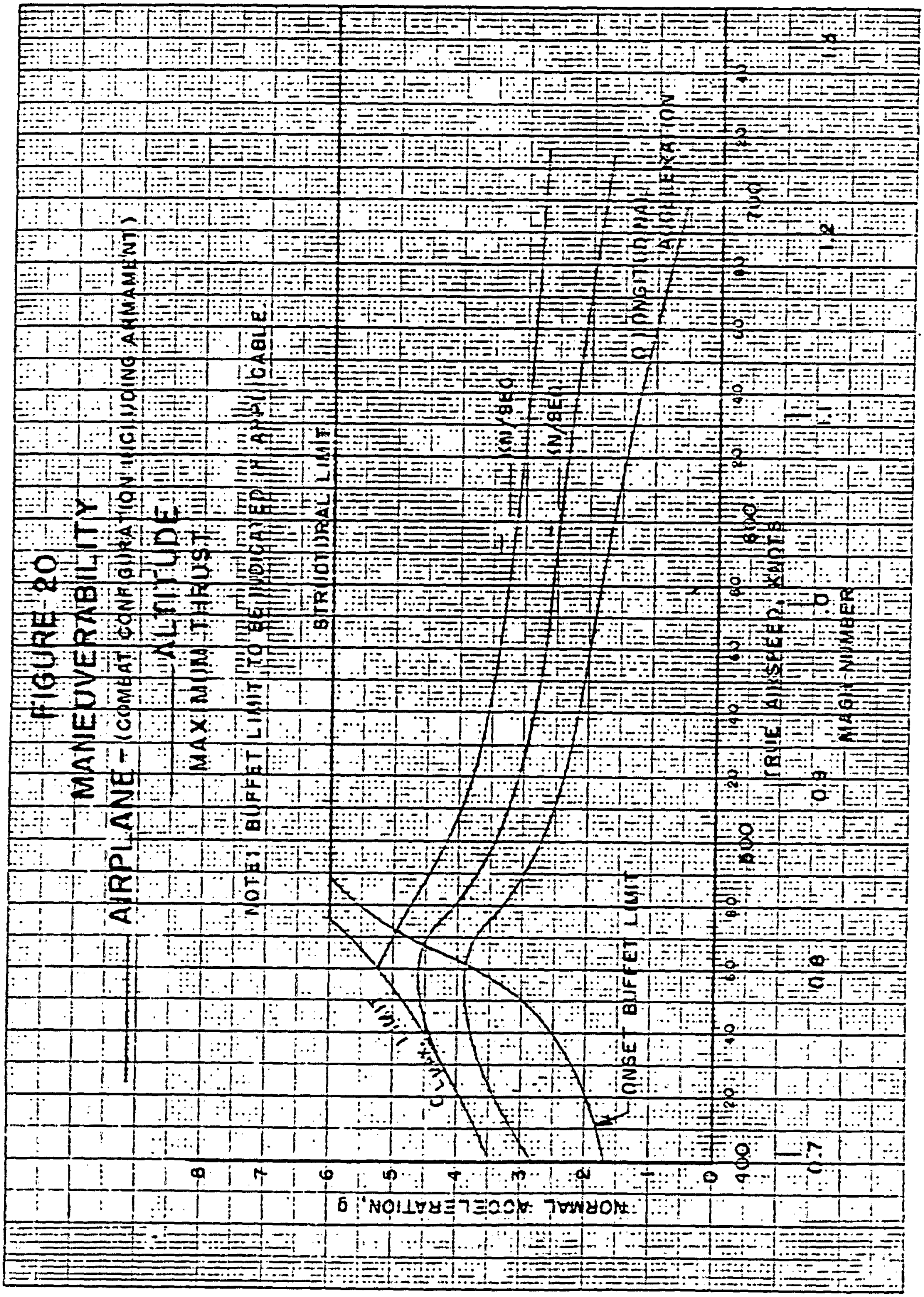


FIGURE 20
MANEUVERABILITY
AIRPLANE - (COMBAT CONFIGURATION INCLUDING ARMAMENT)
ALTITUDE
MAXIMUM THRUST
NOTE: BUFFET LIMIT TO BE INDICATED IF APPLICABLE
STRUCTURAL LIMIT
ONSET BUFFET LIMIT
LONGITUDINAL ACCELERATION
NORMAL ACCELERATION, g
TRUE AIRSPEED, KNOTS
MACH NUMBER
0
1
2
3
4
5
6
7
8
400
500
600
700
0.7
0.8
0.9
1.0
1.1
1.2

FIGURE 21

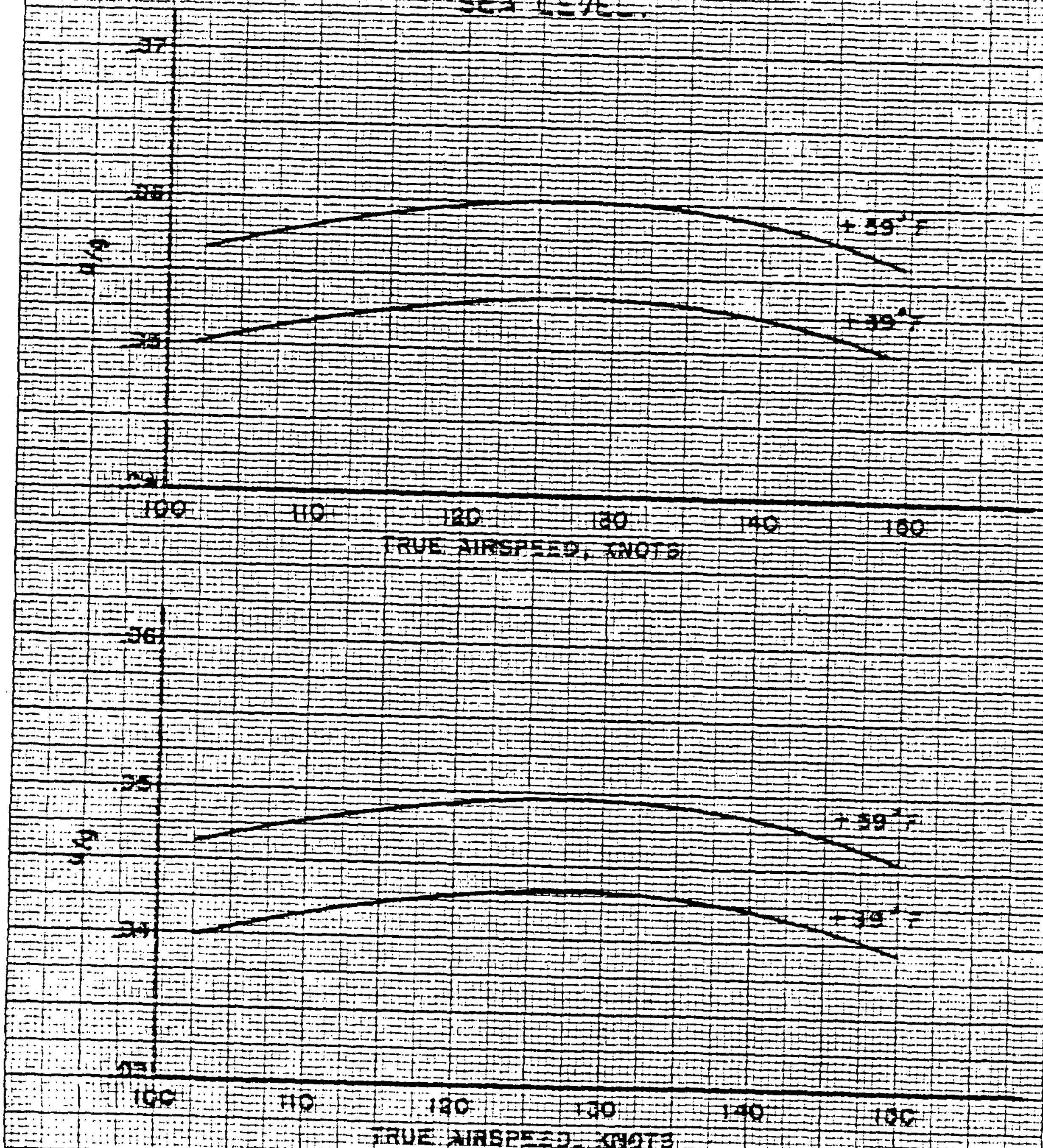
______ AIRPLANE

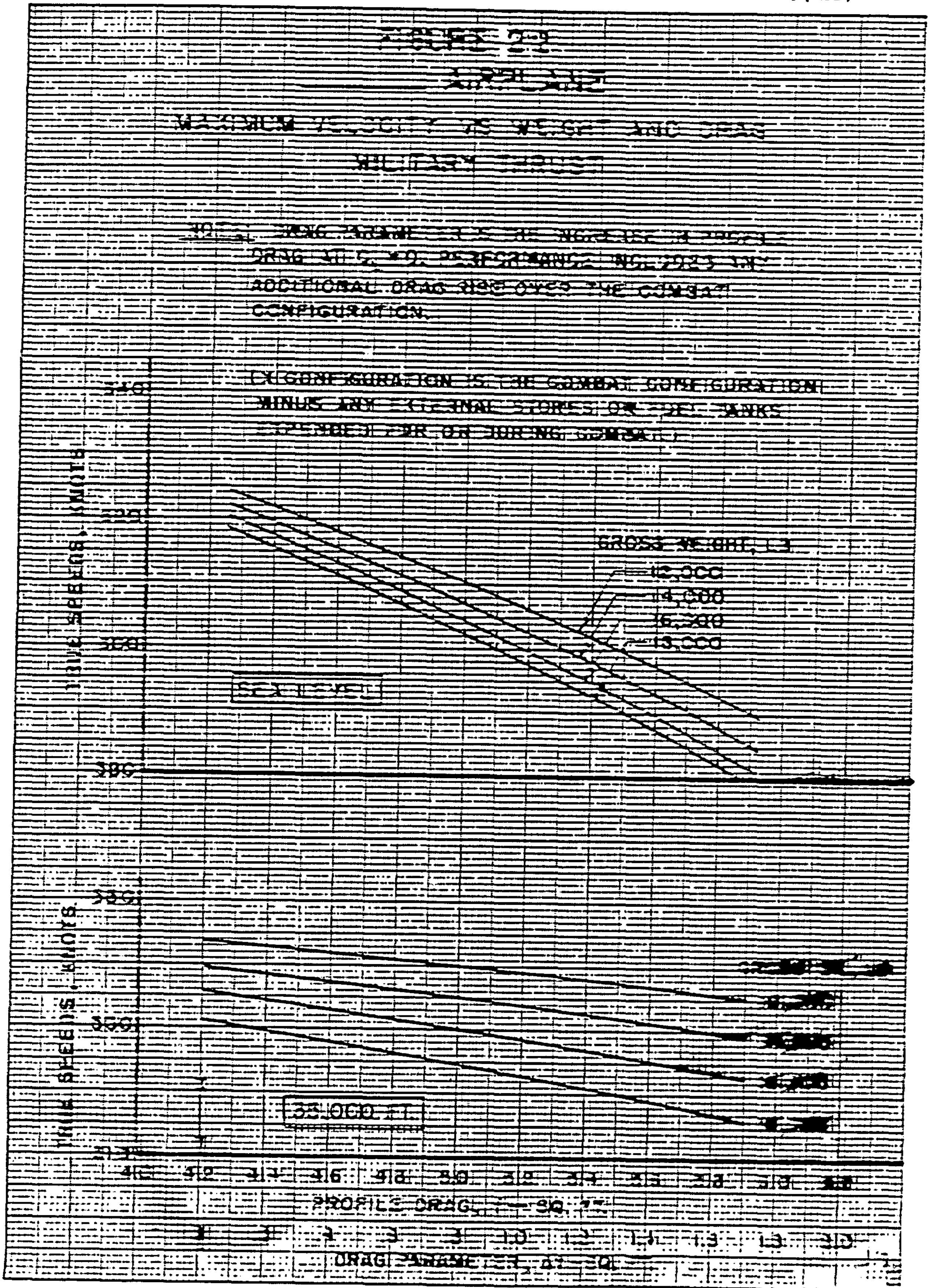
______ CONFIGURATION ______ THRUST

GROSS WEIGHT ______ LB

LONGITUDINAL ACCELERATION FOR CATAPULT TAKE-OFF

SEA LEVEL




CONFIGURATION.
GROSS WEIGHT, LB
12,000
14,000
35,000 FT.
PROFILE DRAG
DRAG PARAMETER

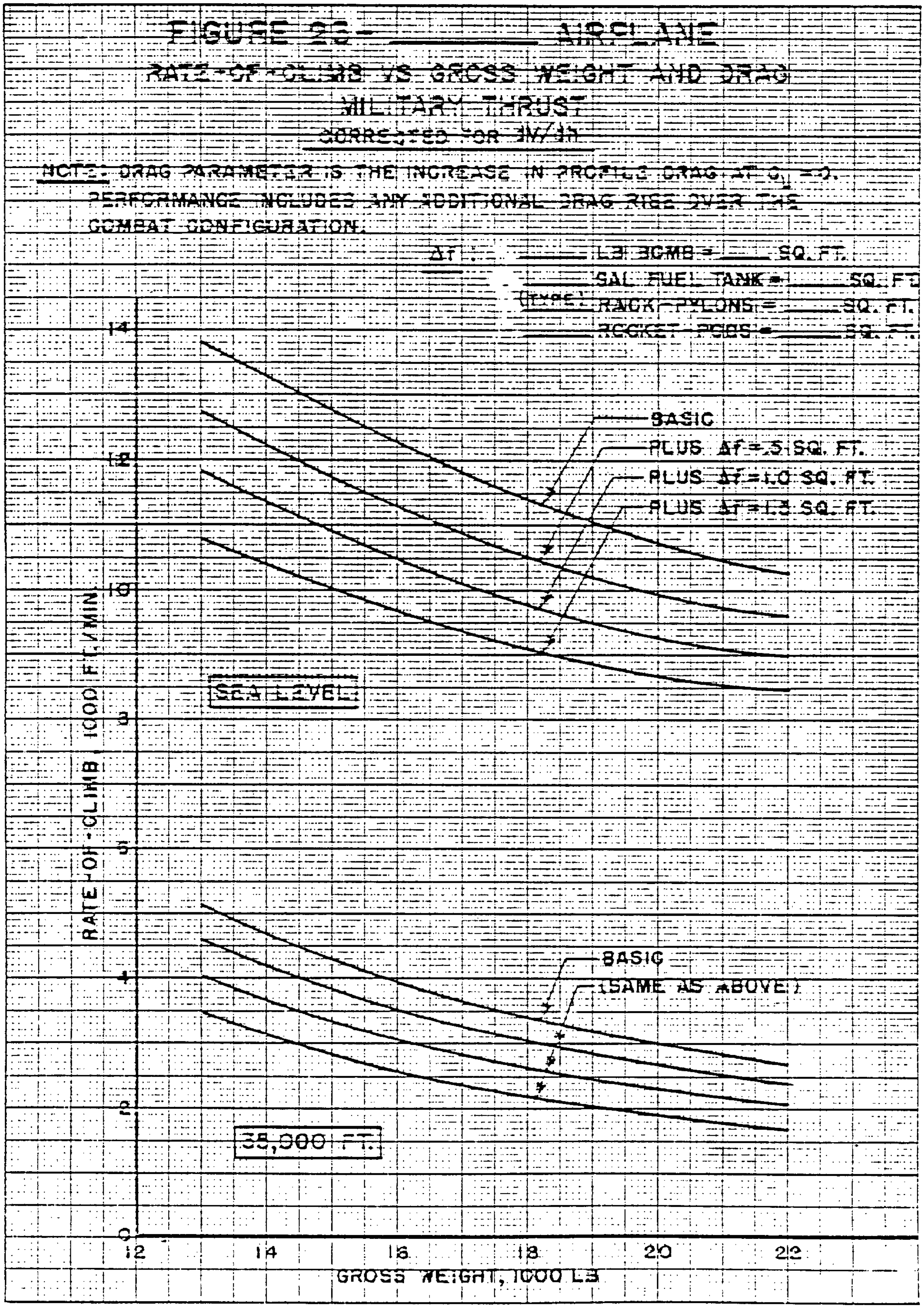

RATE-OF-CLIMB VS GROSS WEIGHT AND DRAG
MILITARY THRUST
BASIC
PLUS Δf = .5 SQ. FT.
PLUS Δf = 1.0 SQ. FT.
PLUS Δf = 1.5 SQ. FT.
SEA LEVEL
BASIC
(SAME AS ABOVE)
35,000 FT.
RATE-OF-CLIMB, 1000 FT./MIN
14
12
10
8
6
4
2
0
12
14
16
18
20
22
GROSS WEIGHT, 1000 LB

FIGURE [illegible]

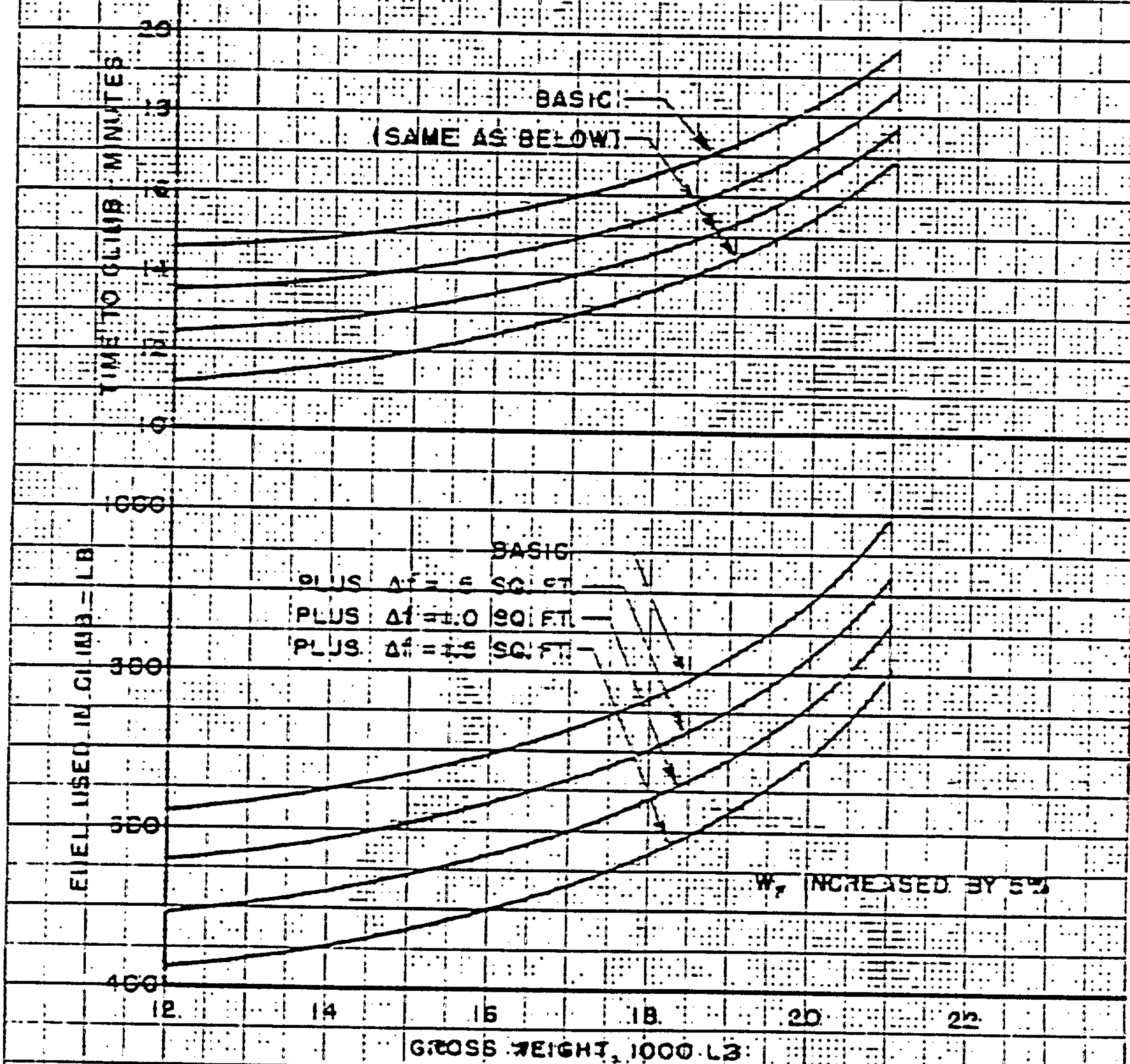
AIRPLANE

TIME AND FUEL USED IN CLIMB TO CRUISE CEILING

VS WEIGHT AND DRAG

MILITARY THRUST CLIMB

NOTE: DRAG PARAMETER IS THE INCREASE IN PROFILE DRAG AT $C_L = C_L$ PERFORMANCE INCLUDES ANY ADDITIONAL DRAG RISE OVER THE COMBAT CONFIGURATION.



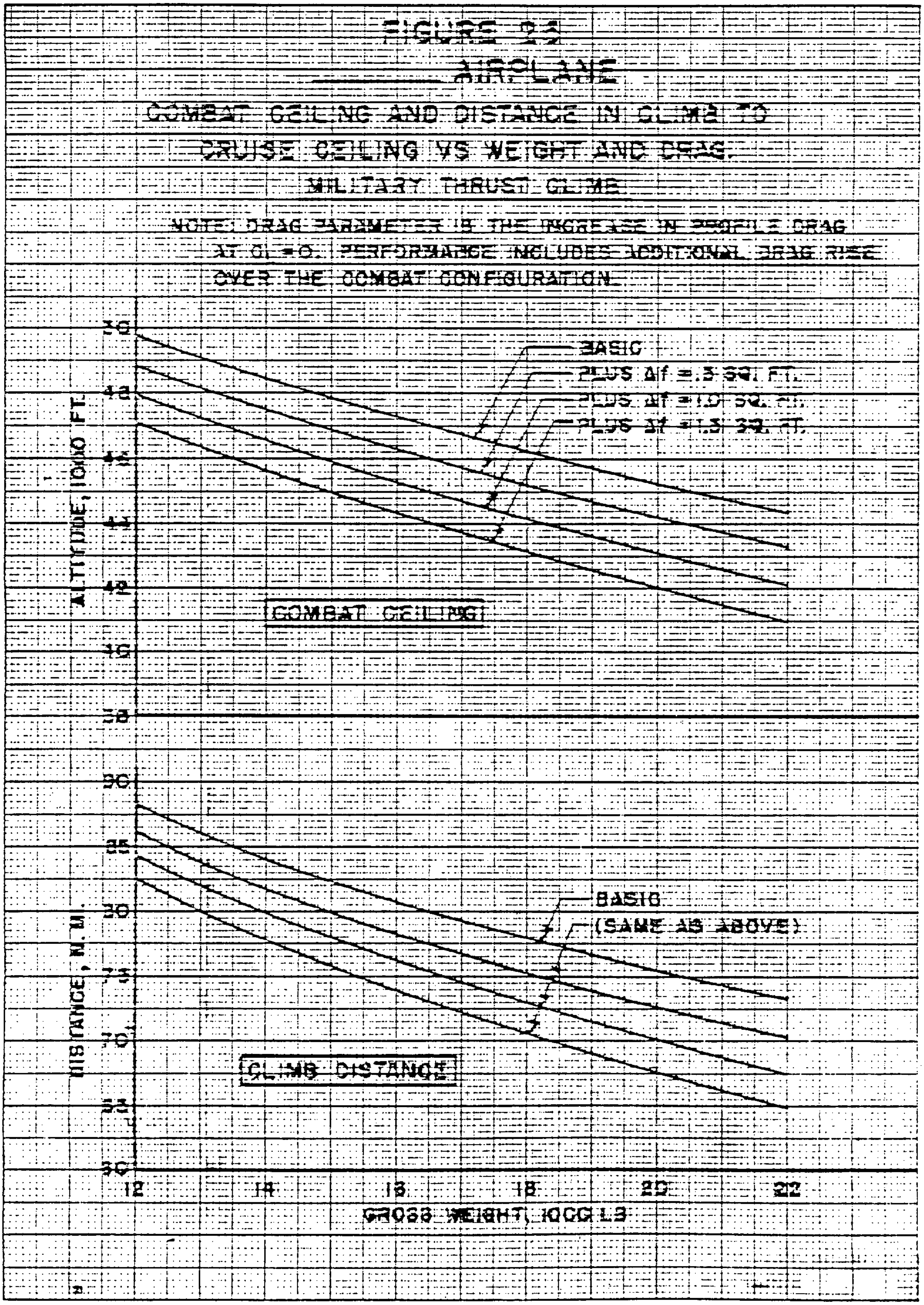
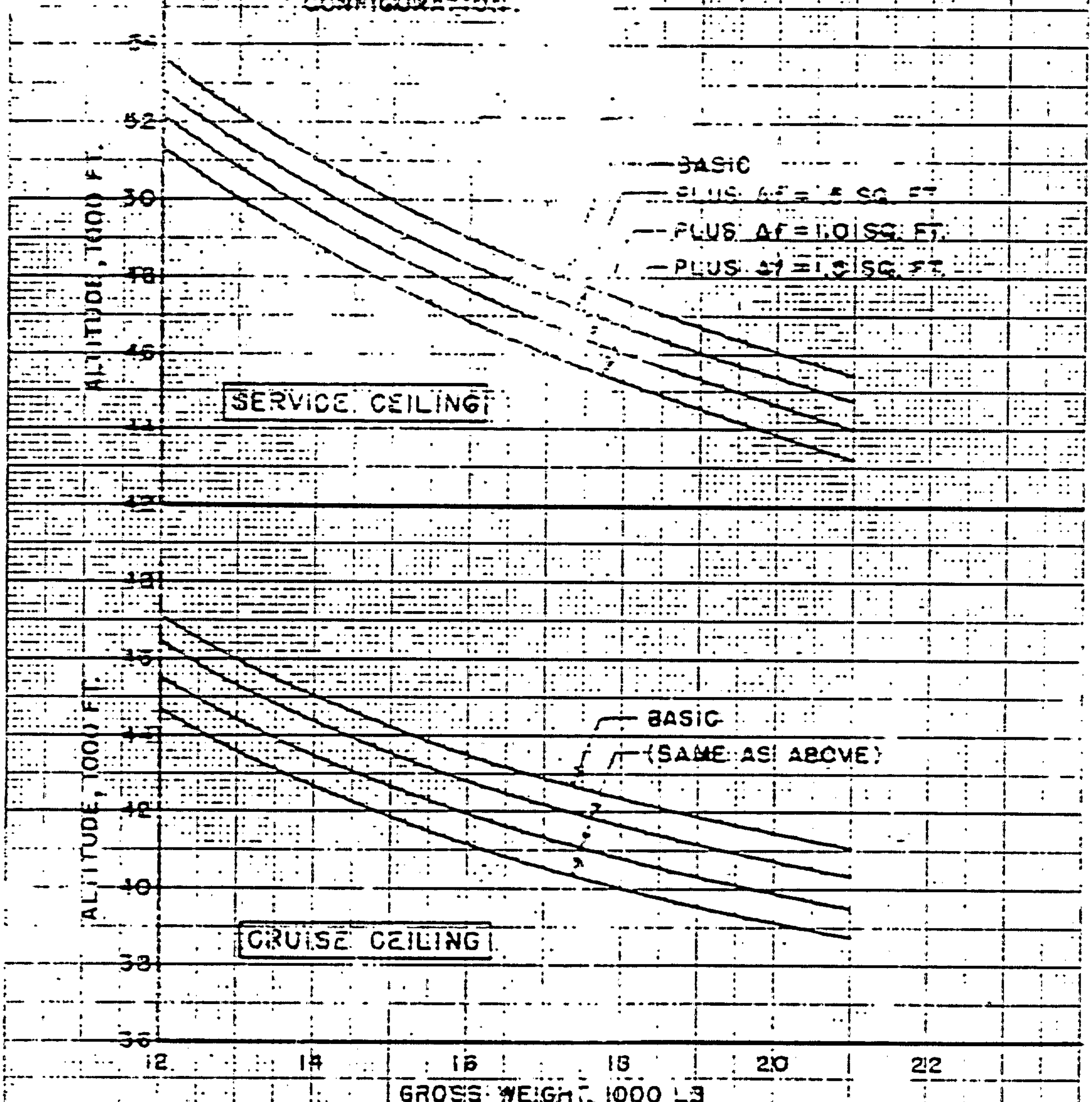

AIRPLANE
COMBAT CEILING AND DISTANCE IN CLIMB TO
CRUISE CEILING VS WEIGHT AND DRAG.
MILITARY THRUST CLIMB
NOTE: DRAG PARAMETER IS THE INCREASE IN PROFILE DRAG
AT CL = O. PERFORMANCE INCLUDES ADDITIONAL DRAG RISE
OVER THE COMBAT CONFIGURATION
BASIC
PLUS Δf = .5 SQ. FT.
PLUS Δf = 1.0 SQ. FT.
PLUS Δf = 1.5 SQ. FT.
ALTITUDE, 1000 FT.
COMBAT CEILING
BASIC
(SAME AS ABOVE)
DISTANCE, N. M.
CLIMB DISTANCE
12
14
18
20
22
GROSS WEIGHT, 1000 LB

FIGURE 93

AIRPLANE

CEILING VS WEIGHT AND DRAG

NOTE: DRAG PARAMETER IS THE INCREASE IN PROFILE DRAG AT $C_L = C$. PERFORMANCE INCLUDES ANY ADDITIONAL DRAG RISE OVER THE COMBAT CONFIGURATION.



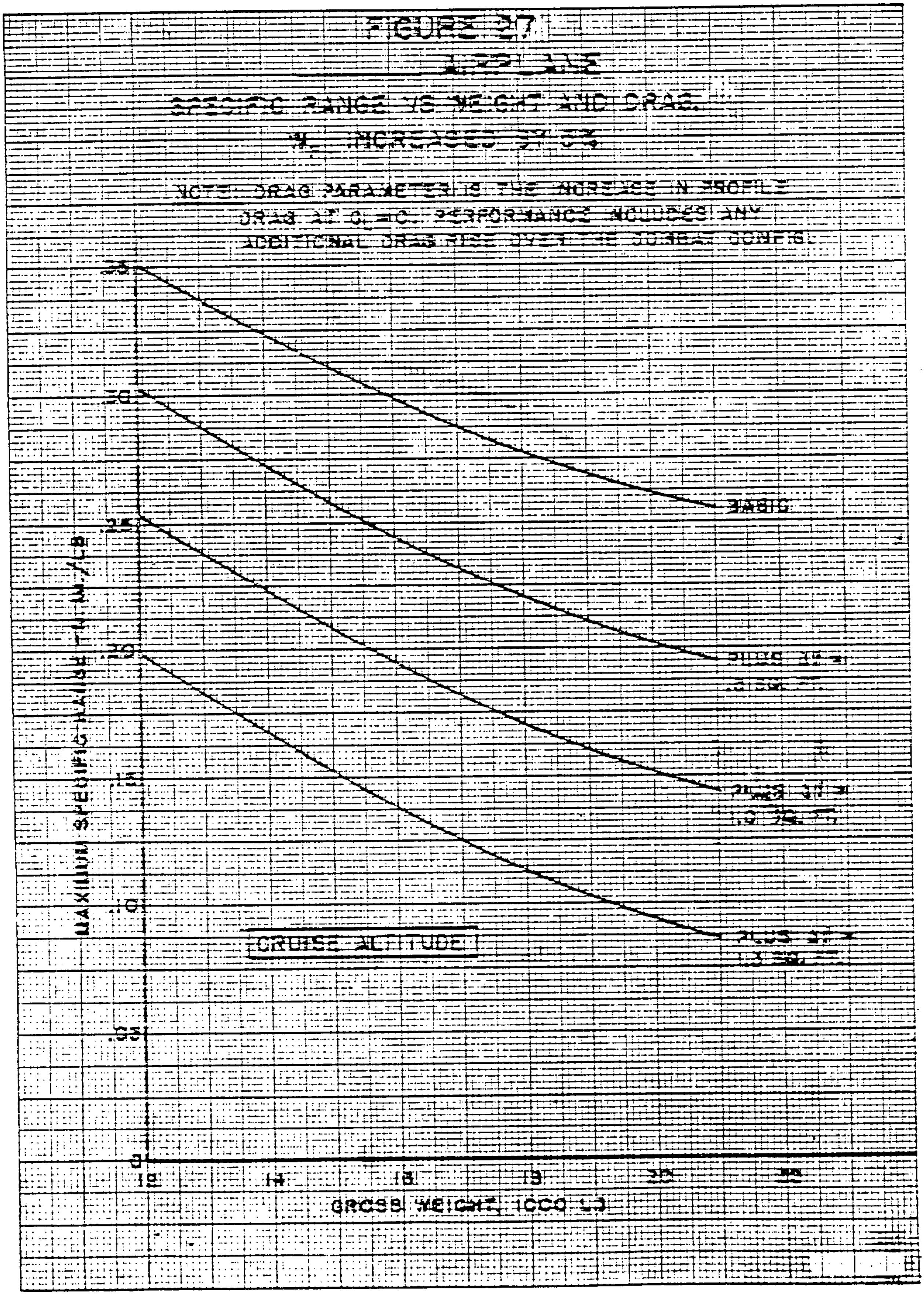


FIGURE 27
BASIC
CRUISE ALTITUDE

APPENDIX I

Combat Radius and Endurance Problems for Jet Aircraft

1. The following missions are intended for use in the preparation of Standard Aircraft Characteristics charts and supplement the problems of Table I of Specification MIL-C-5011A.

A. COMBAT AIR PATROL

1. Fuel allowance for starting engines, take-off, and accelerate to climb speed is the sum of the following:

   (a) Pounds of fuel used in 5 minutes at normal static thrust at sea level.
   (b) Pounds of fuel used in 1 minute at maximum static thrust at sea level (if after-burner is used for take-off).

2. Climb on course to cruise altitude with military thrust.

3. Cruise to patrol station 150 nautical miles from base at altitudes and speeds for maximum range.

4. Loiter on station at altitude and speed for maximum endurance.

5. Combat fuel allowance at 35,000 feet altitude is either of the following:

   (a) For aircraft not having afterburner installed - Fuel for 20 minutes at maximum speed with military thrust.
   (b) For aircraft having afterburner installed - Fuel for 15 minutes at maximum speed with military thrust plus 5 minutes at speed midway between maximum speed with military thrust and maximum speed with maximum thrust using the fuel flow at maximum thrust. (assume that initial return cruise altitude is attained at end of combat.)

6. Cruise to base 150 nautical miles at altitudes and speeds for maximum range.

7. Reserve fuel allowance:

   (a) 5% of initial fuel load.
   (b) 20 minutes at speed for maximum endurance at sea level. All engine used in landing approach shall be operating.

   Loiter time is the time of item 4.
   Mission time is the sum of time for items 2 through 6.
   Cycle time is the sum of time for items 2 through 7.

B. LOW ALTITUDE PHOTOGRAPHIC PROBLEM

1. Fuel allowance for starting engines, take-off, and accelerate to climb speed is the sum of the following:

   (a) Pounds of fuel used in 5 minutes at normal static thrust at sea level.
   (b) Pounds of fuel used in 1 minute at maximum static thrust at sea level (if after-burner is used for take-off).

2. Climb on course to cruise altitude with military thrust.

3. Cruise at altitudes and speeds for maximum range.

4. Descend to sea level - no fuel used, no credit for distance gained.

5. At sea level, run-in 50 nautical miles at maximum speed with military thrust.

6. Fuel allowance at target - 8 minutes with normal thrust at sea level (no credit for distance gained).

7. Fuel allowance for evasive action at sea level (no credit for distance gained) is either of the following:

(a) For aircraft not having afterburner installed - Fuel for 5 minutes at maximum speed with military thrust.
(b) For aircraft having afterburner installed - Fuel for 2 minutes at speed midway between maximum speed with military thrust and maximum speed with maximum thrust using the fuel flow at maximum thrust.

8. At sea level, run-out 50 nautical miles at maximum speed with military thrust.

9. Climb on course to cruise altitude with military thrust.

10. Cruise at altitudes and speeds for maximum range.

11. Reserve fuel allowance:

(a) 5% of initial fuel load.
(b) 20 minutes at speed for maximum endurance at sea level. All engine used in landing approach shall be operating.

Radius is the sum of distances gained in items 2, 3, and 5 when equal to sum of distance gained in items 8, 9, and 10.
Mission time is the sum of time for items 2 through 10.
Cycle time is the sum of time for items 2 through 11.

C. HIGH ALTITUDE PHOTOGRAPHIC PROBLEM

1. Fuel allowance for starting engines, take-off, and accelerate to climb speed is the sum of the following:

(a) Pounds of fuel used in 5 minutes at normal static thrust at sea level.
(b) Pounds of fuel used in 1 minute at maximum static thrust at sea level (if afterburner is used for take-off).

2. Climb on course to cruise altitude with military thrust.

3. Cruise at altitudes and speeds for maximum range.

4. Descend to 35,000 feet altitude - no fuel used, no credit for distance gained.

5. At 35,000 feet altitude, run-in 50 nautical miles at maximum speed with military thrust.

6. Fuel allowance at target - 12 minutes with normal thrust at 35,000 feet altitude (no credit for distance gained).

7. Fuel allowance for evasive action at 35,000 feet altitude (no credit for distance gained) is either of the following:

(a) For aircraft not having afterburner installed - Fuel for 5 minutes at maximum speed with military thrust.
(b) For aircraft having afterburner installed - Fuel for 3 minutes at speed midway between maximum speed with military thrust and maximum speed with maximum thrust using the fuel flow at maximum thrust.

8. At 35,000 feet altitude, run-out 50 nautical miles at maximum speed with military thrust.

9. Climb on course to cruise altitude with military thrust.

10. Cruise at altitudes and speeds for maximum range.

11. Reserve fuel allowance:

(a) 5% of initial fuel load.
(b) 20 minutes at speed for maximum endurance at sea level.

Radius is the sum of distance gained in items 2, 3, and 5 when equal to sum of distance gained in items 8, 9, and 10.
Mission time is the sum of time for items 2 through 10.
Cycle time is the sum of time for items 2 through 11.

D. SPECIAL STORE PROBLEM - SEA LEVEL ALTITUDE STORE DELIVERY

1. Fuel allowance for starting engines, take-off, and accelerate to climb speed is the sum of the following:

   (a) Pounds of fuel used in 5 minutes at normal static thrust at sea level.
   (b) Pounds of fuel used in 1 minute at maximum static thrust at sea level (if afterburner is used for take-off).

2. Climb on course to cruise altitude with military thrust.

3. Cruise at altitudes and speeds for maximum range.

4. Descend to sea level - no fuel used, no credit for distance gained.

5. At sea level, run-in 50 nautical miles at maximum speed with military thrust.

6. Fuel allowance for store delivery and evasive action at sea level (no credit for distance gained) is either of the following:

   (a) For aircraft not having afterburner installed - Fuel for 5 minutes at maximum speed with military thrust.
   (b) For aircraft having afterburner installed - Fuel for 2 minutes at speed midway between maximum speed with military thrust and maximum speed with maximum thrust using the fuel flow at maximum thrust.

7. At sea level, run-out 50 nautical miles at maximum speed with military thrust.

8. Climb on course to cruise altitude with military thrust.

9. Cruise at altitudes and speeds for maximum range.

10. Reserve fuel allowance:

   (a) 5% of initial fuel load.
   (b) 20 minutes at speed for maximum endurance at sea level. All engines used in landing approach shall be operating.

Radius is the sum of distances gained in items 2, 3, and 5 when equal to sum of distances gained in items 7, 8, and 9.
Mission time is the sum of time for items 2 through 9.
Cycle time is the sum of time for items 2 through 10.

E. SPECIAL STORE PROBLEM - 15,000 FEET ALTITUDE STORE DELIVERY

1. Fuel allowance for starting engines, take-off, and accelerate to climb speed is the sum of the following:

   (a) Pounds of fuel used in 5 minutes at normal static thrust at sea level.
   (b) Pounds of fuel used in 1 minute at maximum static thrust at sea level (if afterburner is used for take-off).

2. Climb on course to cruise altitude with military thrust.

3. Cruise at altitudes and speeds for maximum range.

4. Descend to 15,000 feet altitude - no fuel used, no credit for distance gained.

5. Fuel allowance for store delivery and evasive action at 15,000 ft. altitude (no credit for distance gained) is either of the following:

(a) For aircraft not having afterburner installed - Fuel for 5 minutes at maximum speed with military thrust.
(b) For aircraft having afterburner installed - Fuel for 2 minutes at speed midway between maximum speed with military thrust and maximum speed with maximum thrust using the fuel flow at maximum thrust.

6. Climb on course to cruise altitude with maximum thrust.

7. Cruise at altitudes and speeds for maximum range.

8. Reserve fuel allowance:

(a) 5% initial fuel load.
(b) 20 minutes at speed for maximum endurance at sea level. All engines used in landing approach shall be operating.

Radius is the sum of distance gained in 2 and 3 when equal to sum of distances gained in items 6 and 7.
Mission time is the sum of time for items 2 through 7.
Cycle time is the sum of time for item 2 through 8.

F. INFLIGHT REFUELING PROBLEM FOR JET RECEIVER AIRCRAFT

1. Fuel allowance for starting engines, take-off, and accelerate to climb speed is the sum of the following:

(a) Pounds of fuel used in 5 minutes at normal static thrust at sea level.
(b) Pounds of fuel used in 1 minute at maximum static thrust at sea level (if afterburner is used for take-off).

2. Climb on course to cruise altitude with military thrust.

3. Cruise at altitudes and speeds for maximum range.

4. Descend to 35,000 feet altitude for rendezvous with tanker - no fuel used, no credit for distance gained.

5. For rendezvous, hook-up and flight contingencies prior to fuel transfer allow fuel for 15 minutes at speed for maximum endurance. If additional receiver aircraft are successively refueled by a single tanker, fuel of the initial receiver shall be reduced after transfer by an amount equivalent to 5 minutes at speed for maximum endurance for each additional aircraft in the formation, prior to proceeding with the mission.

6. Assume no fuel used or credit distance gained during transfer. The refueling point is established by the following:

(a) Receiver to have sufficient fuel to return to base with the normal reserve of MIL-C-5011A upon completion of rendezvous period of item 5 above.
(b) End point of refueling operation shall not exceed 80% of the receiver total radius.
(c) End point of refueling operation shall not exceed the tanker radius.

7. Remainder of mission shall conform to the applicable mission of the aircraft.

G. BUDDY MISSIONS

1. Fuel allowances and mission profile are same as 3.2.6 except that fuel allowance for rendezvous, hook-up, and flight contingencies prior to fuel transfer (3.2.6(5)) shall be 5 minutes at speed for maximum endurance at refueling altitude.