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RAND DOCUMENT

AIRCRAFT PAYLOAD LIMITS FOR THE AIRBASE ATTACK STUDY (U)

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[redacted]

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PREFACE

At the request of Phil Dadant this information was generated using an existing Rand developed JOSS program. These data will be used in connection with the Airbase Attack Study.

The data presented in this Document are to provide the maximum payload drag area limits for three aircraft at specified mission radii. These data can be used to determine the maximum number of selected weapons that can be carried.

The maximum number of weapons are presented for the selected ordnance under consideration by the study.

CONTENTS

I. INTRODUCTION

The purpose of this study is the development of maximum payload limits as a function of configuration drag area* for three aircraft (F-4E, A-7D, F-111A). This is presented for all three aircraft using mission radii of 250, 300, and 350 miles and also for the F-111A with mission radii of 450, 500, and 550 miles. Knowing the weapon loading configuration limits these payload limits will define possible loads of specific weapons. These weapon loading configuration limits for suggested weapons for airbase attack are presented by Ref. 1. With these data as input the possible maximum loads for each weapon are determined for all three aircraft using a mission radius of 300 miles and also for the F-111A with a mission radius of 500 miles.

The aircraft combat radius calculation procedure for various mission profiles and external store configurations** (a JOSS program) was used to generate radius as a function of number of weapons carried. This data is then cross-plotted to generate the desired payload limit lines.

The program includes input data for the aircraft as separate items. Because of the specific configuration of the aircraft being studied here it was necessary to make several modifications to these aircraft input.

Because the number of weapon types being considered by the Airbase Attack Study would require many different modifications to the program and aircraft input, it was decided to use a general approach to the problem. This being to develop the maximum payload as a function of drag area so that any type of weapon can be considered with minimal effort.

This Document contains the aircraft input modifications, a sample calculation, the maximum payload limit curves and the maximum ordnance loads for the weapons considered.

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*For the external stores (including weapon racks but not pylons).

**RM-5948-PR presents the documentation and instructions for use of this procedure.

II. AIRCRAFT INPUT MODIFICATIONS

Three aircraft are considered in this Document (F-4E, A-7D and F-111A). To allow for certain configuration changes the associated aircraft input had to be modified.

Each aircraft is to carry an ECM pod (weight = 269 lbs, drag area* = .28) on one of the external store pylons. This weight and drag area is accounted for by adding it to the pylon weight and drag (see Appendix B for the F-4E aircraft input). Step 99.41 adds the ECM pod weight (269) to the pylon weight (v); step 99.43 adds the ECM pod drag area (.28) to the pylon drag (O). The F-4E is configured without Sparrows.

Because of the various types of weapon racks available the decision was made to eliminate the rack weight and rack drag as separate items and include them in the total weapon weight and drag. Rack weight/unit ordnance (Q) and rack drag/unit ordnance (U) are set = 0. (See Appendix B, steps 99.4 and 99.42.) The weapon code number used here is 117.

The base weapon used in this study is defined as the weapon plus equivalent rack per weapon. The weapon code number (ℓ) is 117 with the input for the original M117 being replaced by the input for the base weapon.

The external fuel tank limitations with the M117 do not allow you to reach the maximum allowable takeoff weight for few numbers of weapons. In order to simulate the maximum payload takeoff situation the base weapon weight was arbitrarily set equal to 2000. This base weapon uses the same weapon position, external fuel tank compatibility tables as the M117 which are sufficient for the purpose of this study.

Five levels of drag area per base weapon (y) are to be used for each aircraft mission to allow for developing payload as a function of drag. The drag area (y) for the M117 is therefore set = Z(5)

*Drag area (i.e., drag/dynam ic pressure) is the drag index, DI, used in the flight manual multiplied by a conversion factor. Appendix A details these conversion factors.

which will be an input quantity at calculation time. (See Appendix B, step 99.44.)

This will then generate the configuration drag area which is defined as the drag area for the total payload carried.

III. MISSION DEFINITIONS

The first mission defined for the three selected aircraft (F-4E, A-7D, F-111A) is with the first 200 miles at optimum speed and altitude and the miles to target at optimum speed, zero altitude. The F-111A also flies a mission with the first 400 miles at optimum speed and altitude and the miles to target at optimum speed, zero altitude.

All missions are to include 5 minutes of combat and 0 minutes of loiter. There is no refueling of the aircraft and the external fuel tanks (if carried) are dropped before combat even if fuel is remaining in them. Mil-C rules are used for takeoff and combat fuel allowances.

IV. MAXIMUM PAYLOAD LIMITS

PRESENTATION OF LIMITS

The following four curves show the maximum payload versus configuration drag area for the F-4E, A-7D, and F-111A at the specified total radii.

This maximum payload is defined as the weight per weapon plus the rack weight per weapon multiplied by the number of weapons. The same is true for the drag area.

This payload is not to include the ECM weight (it has been accounted for as part of the total pylon weight) or the external fuel tank weight (if carried).

Figure 1 is the maximum payload limit as a function of configuration drag area of the F-4E for three mission radii (250 n mi, 300 n mi, and 350 n mi).

The A-7D maximum payload curves for these same mission radii are presented as Fig. 2. Figure 3 is for the F-111A with 250, 300, and 350 mile radius mission. The F-111A limits for missions of 450, 500, and 550 mile radius are given by Fig. 4.

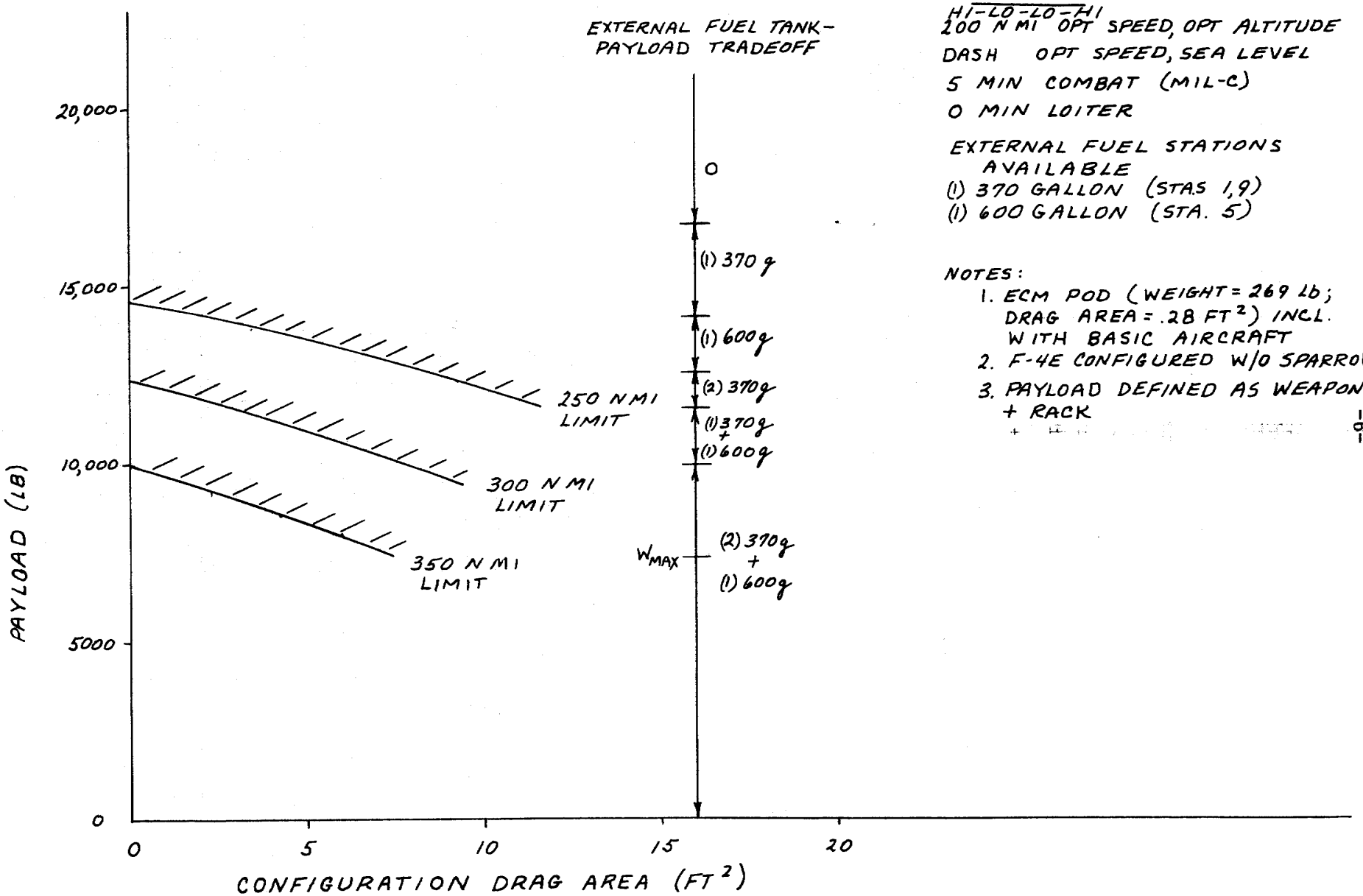
The external fuel tank-payload tradeoff scales for maximum allowable takeoff weight are shown on each of these four figures. These scales show what external tanks are required for the mission under consideration.

If no external fuel tanks are required for the desired mission at maximum allowable takeoff weight, no fuel tanks will be required for the same mission at a lighter takeoff weight.

In the case of the F-4E, where external tanks are required for the 300 mile radius mission at maximum takeoff weight, tanks will be necessary at lighter takeoff weights.

Figure 5 shows total fuel weight as a function of payload for various configuration drag areas. Figure 5 determines what external fuel tanks are necessary when at less than maximum takeoff weight.

The substantiating data for the preparation of these plots are presented by Appendix D. The lines shown on Figs. 1 through 4 are maximum payload limits. Any point falling above the line for the



MISSION
HI-LO-LO-HI
200 N MI OPT SPEED, OPT ALTITUDE
DASH OPT SPEED, SEA LEVEL
5 MIN COMBAT (MIL-C)
0 MIN LOITER

EXTERNAL FUEL STATIONS AVAILABLE
(1) 370 GALLON (STAS 1,9)
(1) 600 GALLON (STA. 5)

NOTES:
1. ECM POD (WEIGHT = 269 lb; DRAG AREA = .28 FT²) INCL. WITH BASIC AIRCRAFT
2. F-4E CONFIGURED W/O SPARROWS
3. PAYLOAD DEFINED AS WEAPON + RACK

FIGURE 1 - MAXIMUM PAYLOAD LIMITS OF THE F-4E FOR VARIOUS MISSION RADII

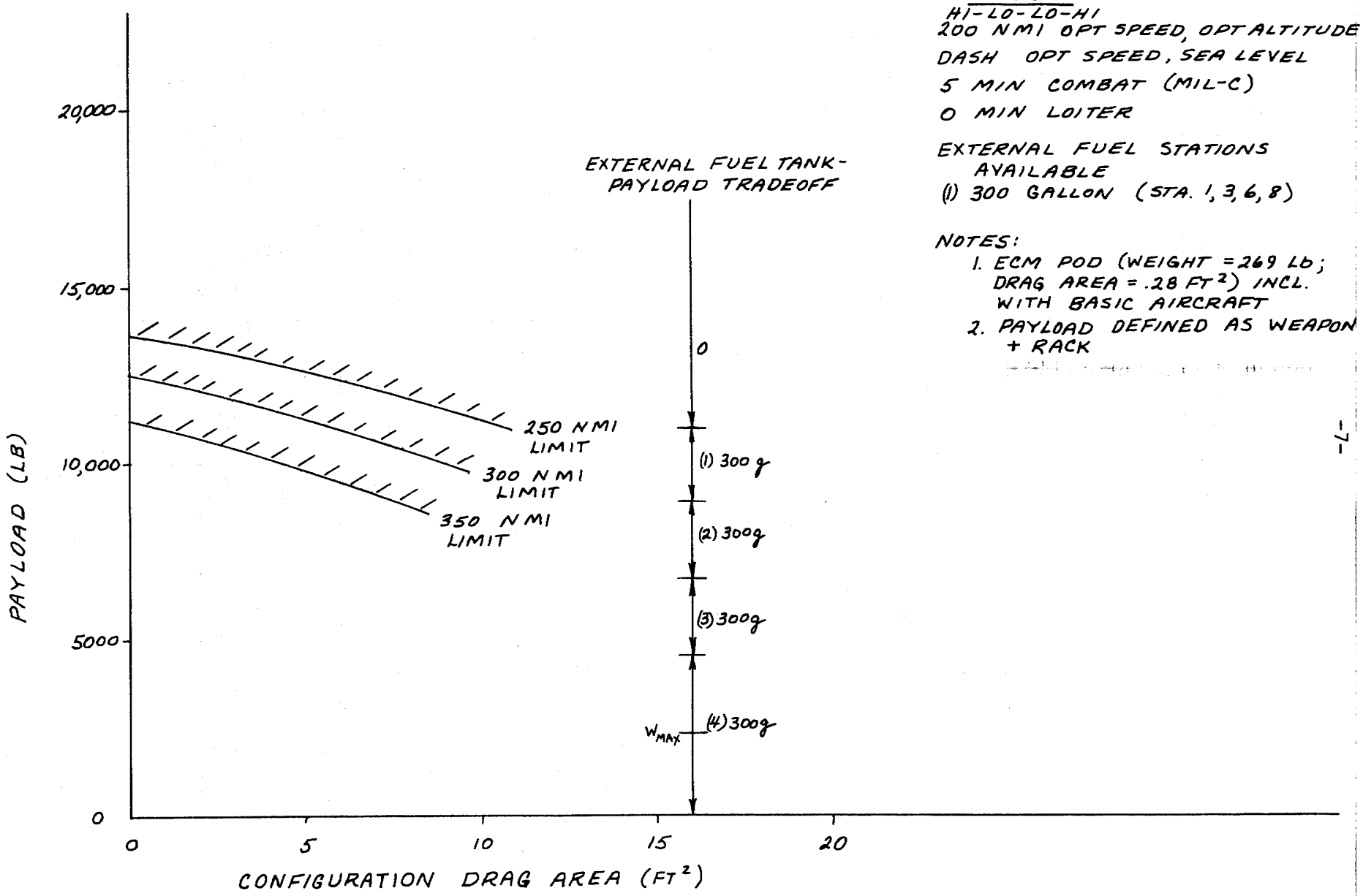


FIGURE 2 - MAXIMUM PAYLOAD LIMITS OF THE A-7D FOR VARIOUS MISSION RADII

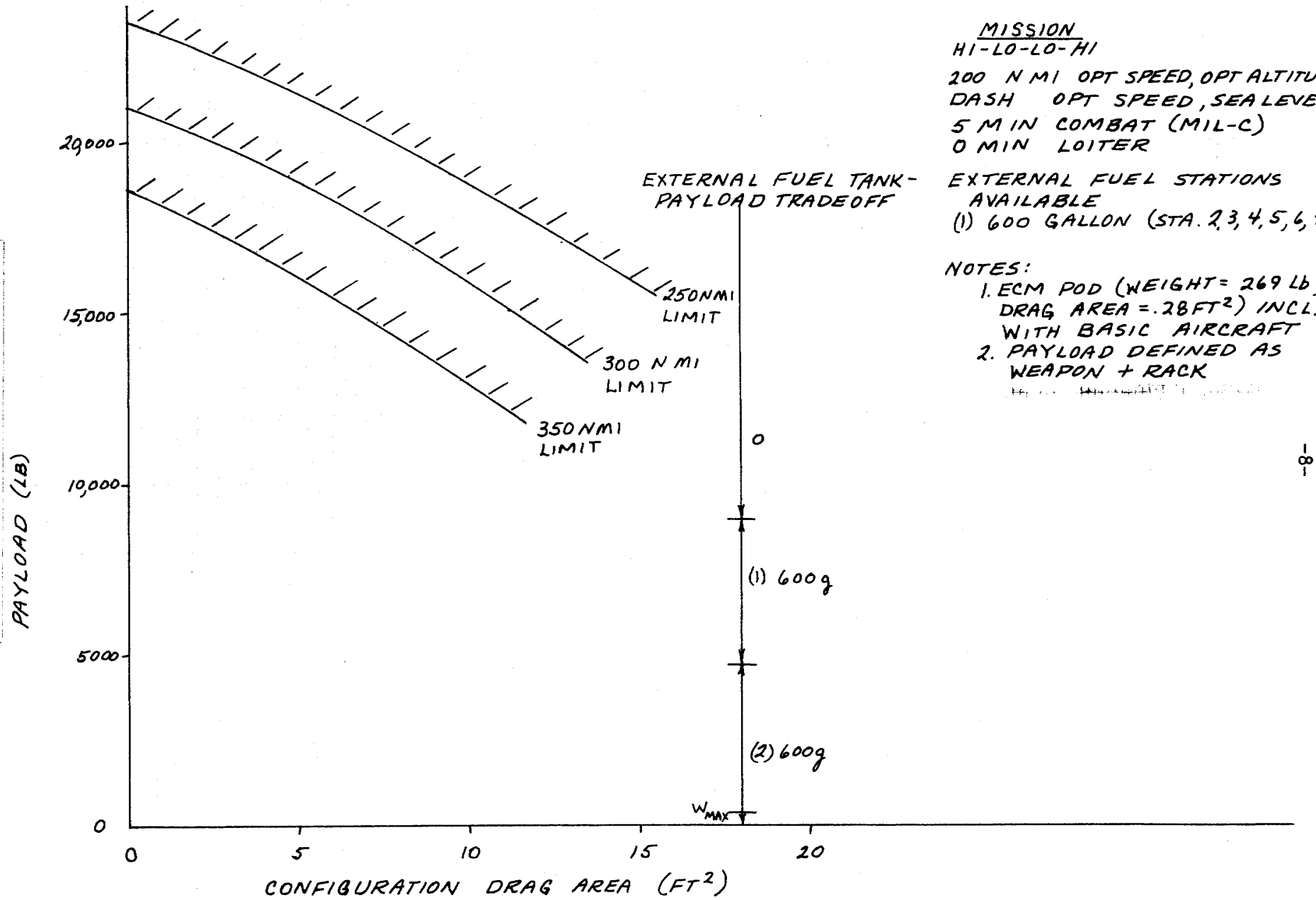
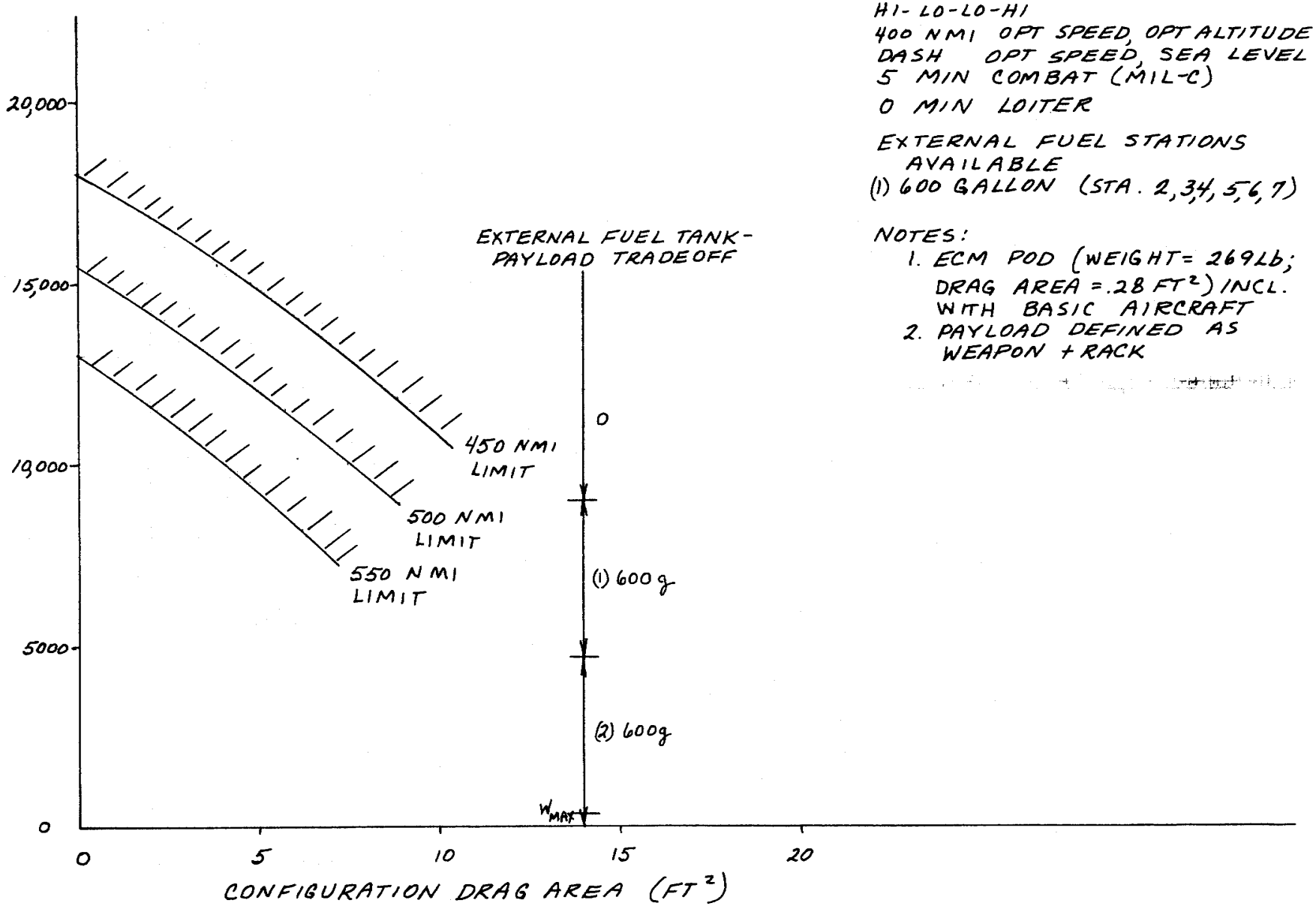


FIGURE 3 - MAXIMUM PAYLOAD LIMITS OF THE F-111A FOR VARIOUS MISSION RADII (U)



MISSION

HI-LO-LO-HI
400 NMI OPT SPEED, OPT ALTITUDE
DASH OPT SPEED, SEA LEVEL
5 MIN COMBAT (MIL-C)
0 MIN LOITER

EXTERNAL FUEL STATIONS AVAILABLE
(1) 600 GALLON (STA. 2, 3, 4, 5, 6, 7)

NOTES:
1. ECM POD (WEIGHT = 269 Lb; DRAG AREA = .28 FT²) INCL. WITH BASIC AIRCRAFT
2. PAYLOAD DEFINED AS WEAPON + RACK

FIGURE 4- MAXIMUM PAYLOAD LIMITS OF THE F-111A FOR VARIOUS MISSION RADII (U)

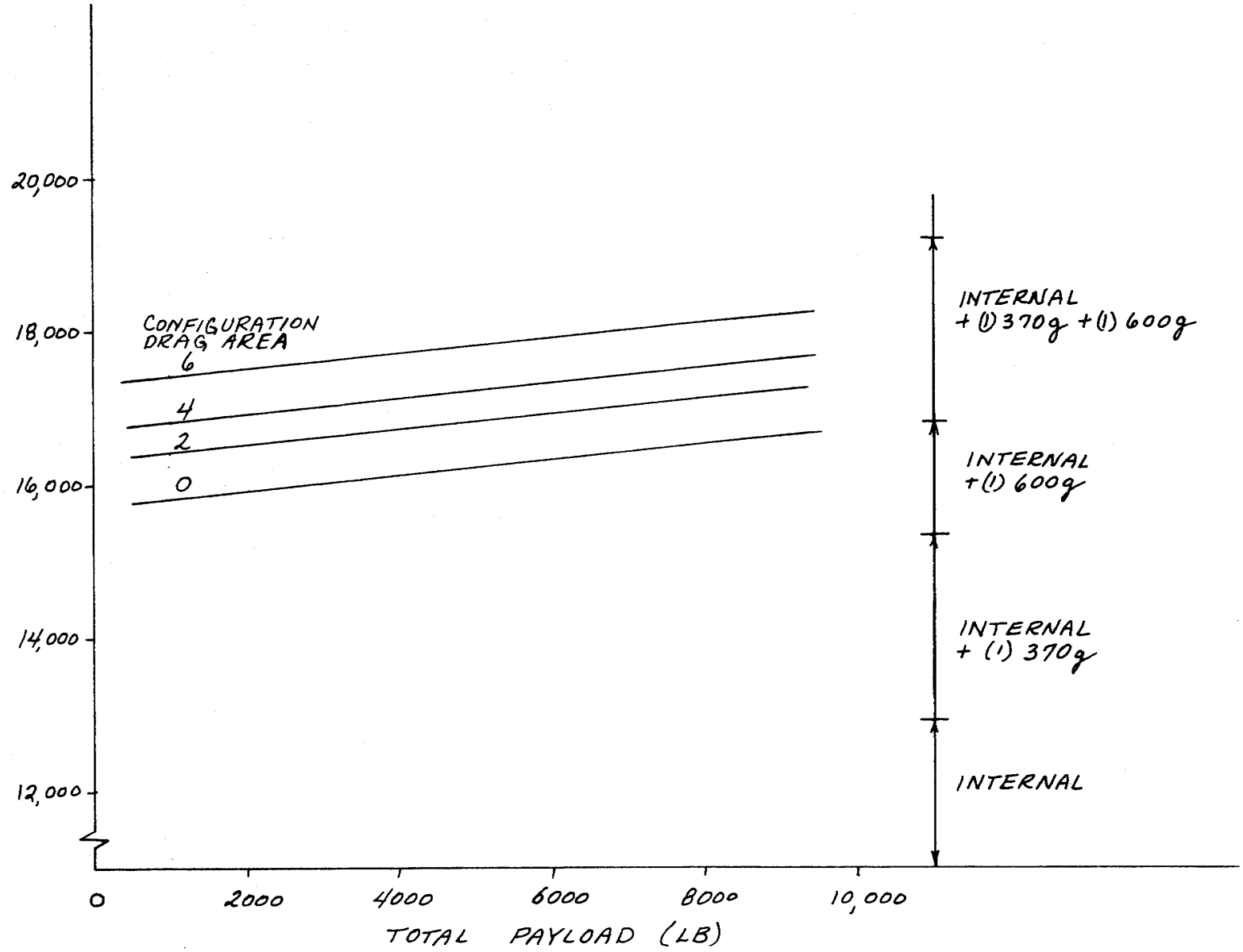


FIGURE 5 - F-4E 300 MILE MISSION TOTAL FUEL WEIGHT AS A FUNCTION OF PAYLOAD FOR VARIOUS LEVELS OF CONFIGURATION DRAG AREA

specified mission denotes an impossible loading configuration for the mission, while any point below the limit line shows a possible loading.

USAGE OF LIMIT LINES

To determine if the F-4E can be loaded with the maximum number of M117s and fly the specified mission of 300 mi radius, it is necessary to use the weapon plus rack weight and the corresponding drag index from Ref. 1. This drag index is converted to configuration drag area by multiplying by 0.1 for the F-4E.

With 10 M117s the payload weight is 8606 lb and the configuration drag area is 5.84 ft^2.

1. Using Fig. 1, plot this point (Fig. 6). Since the point falls well below the limit line this is a possible loading. It also shows that this loading will be less than maximum takeoff weight. To determine if one 370-gal and one 600-gal external fuel tanks are necessary:

2. Using Fig. 5, plot this point (Fig. 7). The point falls in the range requiring the two external fuel tanks. The number of M117s (10) the F-4E can carry for the specified mission is limited by the number of external store positions available.

Another example is with two MK84s. The payload weight is 3940 lb and configuration drag area is .68 ft^2.

1. Using Fig. 1, plot this point (Fig. 6). Again, this is a possible loading but also less than maximum takeoff weight. To determine if the two external fuel tanks are necessary:

2. Using Fig. 5, plot this point (Fig. 7). This point falls in the range requiring only one 600-gal external fuel tank. Carrying only one external fuel tank will free an outboard pylon which can carry one MK84. To check whether this greater payload weight (5910 lb) and configuration drag area (1.02 ft^2) necessitates additional external fuel tanks:

3. Plot this point using Fig. 5 (Fig. 7). The point still falls in the range requiring only one 600-gal external fuel tank. The F-4E can carry three MK84s on the specified mission. This number is limited by the number of external store positions available.

(U) (S) For the F-111A* assume that 20 M117s can be carried for the 300-mi radius mission. This leads to a payload weight of 17,140 lb and a configuration drag area of 11.6 ft^2. To find if this number of M117s can be carried:

1. Using Fig. 3, plot this point labeling it 20 weapons. Since it falls above the limit line this is an impossible loading. (Fig. 8). To determine the number of M117s that can be carried for this mission:

2. Connect this point plotted (Step 1) with a straight line to the origin (0,0).

3. On the line move to the left on the configuration drag area scale by the increment of drag area per equivalent M117 (i.e., 58) and mark on the line labeling 19 weapons. Continue doing this until the mark on this line is below the limit line. The number of M117s at this point (18) is the maximum number that can be carried for the 300-mi radius mission. The number of M117s that the F-111A can carry on the 300-mi radius mission is shown to be limited by the payload weight constriction.

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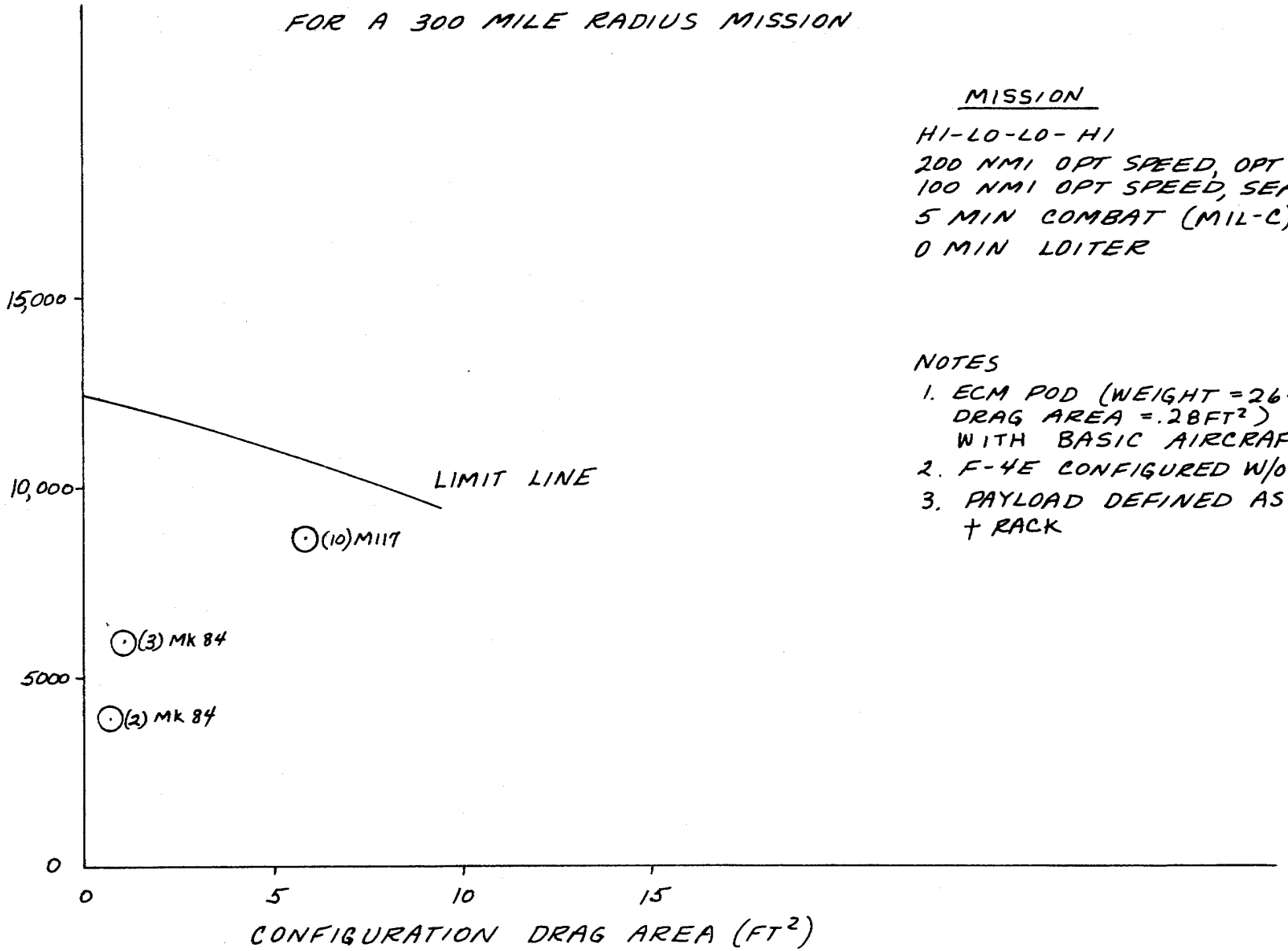
*(U) The configuration drag area for the F-111A is based on weapon drag estimates from the F-4E.

MAXIMUM PAYLOAD LIMIT OF THE F-4E
FOR A 300 MILE RADIUS MISSION



MISSION

HI-LO-LO-HI
200 NMI OPT SPEED, OPT ALTITUDE
100 NMI OPT SPEED, SEA LEVEL
5 MIN COMBAT (MIL-C)
0 MIN LOITER

NOTES

1. ECM POD (WEIGHT = 269LB; DRAG AREA = .28FT²) INCL. WITH BASIC AIRCRAFT
2. F-4E CONFIGURED W/O SPARROWS
3. PAYLOAD DEFINED AS WEAPON + RACK

FIGURE 6 - F-4E EXAMPLE

F-4E 300 MILE RADIUS TOTAL FUEL WEIGHT
AS A FUNCTION OF PAYLOAD FOR VARIOUS DRAG AREAS

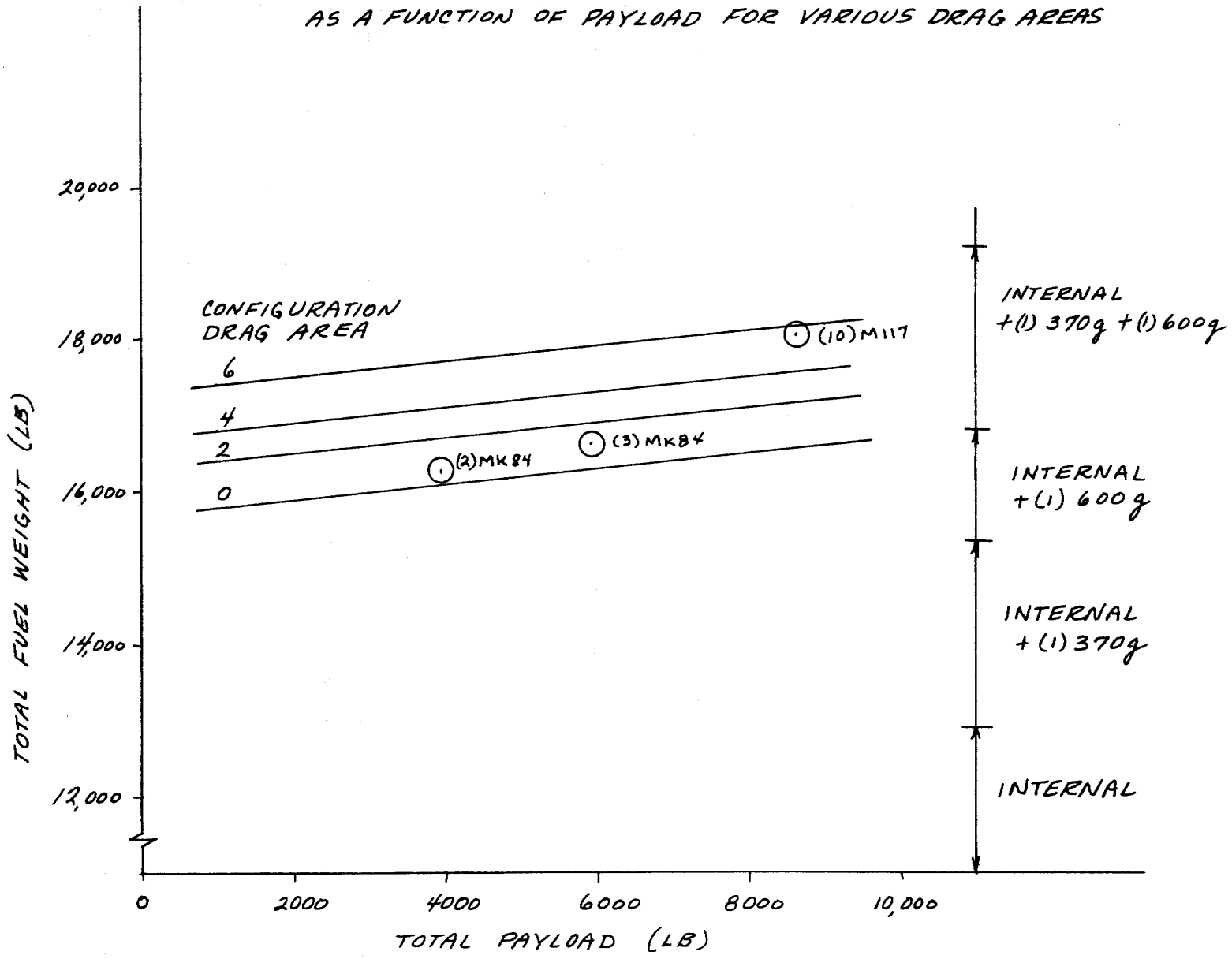
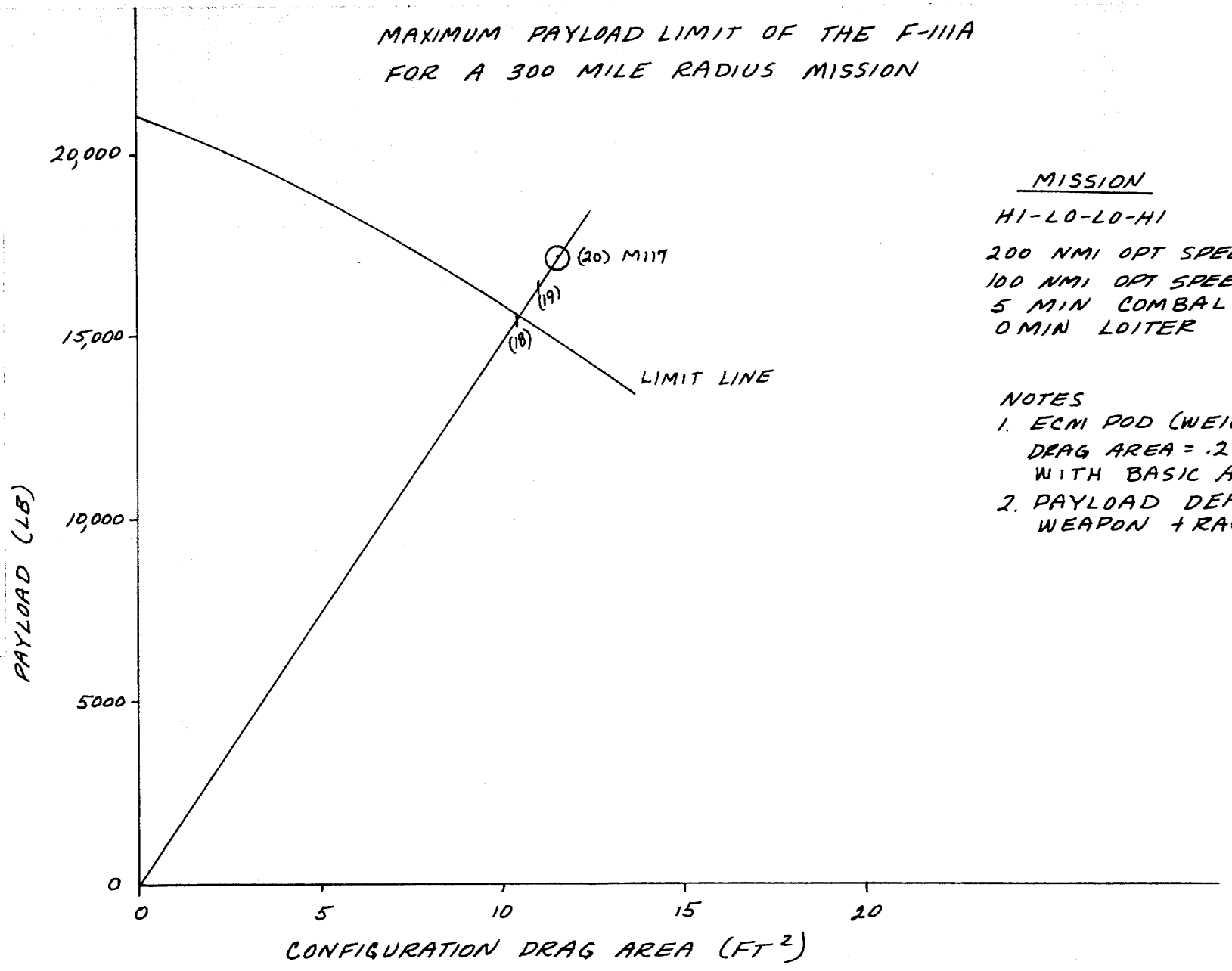


FIGURE 7 - F-4E EXTERNAL FUEL TANKS REQUIRED EXAMPLE



MISSION

HI-LO-LO-HI

200 NMI OPT SPEED, OPT ALTITUDE
100 NMI OPT SPEED, SEA LEVEL
5 MIN COMBAL (MIL-C)
0 MIN LOITER

NOTES
1. ECM POD (WEIGHT = 269LB; DRAG AREA = .28FT²) INCL. WITH BASIC AIRCRAFT
2. PAYLOAD DEFINED AS WEAPON + RACK

FIGURE 8 - F-111A EXAMPLE (U)

V. ORDNANCE LOADOUTS

(U) (X) Table 1 presents the maximum number of weapons that can be carried for the specified missions for the three aircraft. Reference 1 does not give the loading configuration weights or drag areas for the AGM-X or HSM munitions. The weights are estimated to be 3000 lb and 2700 lb, respectively, and the drag areas are .66 ft^2 and .46 ft^2. The F-4E can carry a maximum of three AGM-X (one on each outboard pylon and one on the centerline) and a maximum of five HSM (one on each of the five pylons). The A-7D can carry a maximum of four AGM-X (one on each of stations 1, 2, 7, and 8) and a maximum of four HSM (the same stations as the AGM-X). The F-111A can carry a maximum of eight AGM-X (one on each of the 8 stations) and a maximum of eight HSM (one on each of the 8 stations).

(U) Table 1

ORDNANCE LOADOUTS FOR THE AIRBASE ATTACK STUDY[a] (U)

Ordnance	Mission[b] F-4E[c] 300 n mi radius	A-7D[d] 300 n mi radius	F-111A[d] 300 n mi radius	F-111A[d] 500 n mi radius
GP Bombs and Rockets				
M-117	10	12	18	12
M-117R	8	11	15	10
MK-81	11	35[e]	47[e]	33
MK-82	11	20	30	20
MK-82SE	11	17	26	17
MK-83	2[f]	5[e]	7[e]	7[e]
MK-84	3[f]	4[e]	7[e]	5
Hi Density Munition	(11)[g]	20	28	19
FAE bomb	(2)	4[e]	6[e]	5
ZUNI and pod	8	17[e]	23[e]	16
Clustered ZUNI	(8)	12	19	12
Area Munitions (Bomblets)	(number of clusters)			
REBIT[h]	(8)	11	16	11
REB-LEK	(8)	12	17	11
Follow-thru (med)	(8)	12	17	11
Follow-thru (hvy)	(8)	13	19	12
FAE bomblet	(11)	20	30	20
Area Munitions (Bomblets)	(number of bomblets)			
REBIT[h]	(48)	66	96	66
REB-LEK	(128)	192	272	176
Follow-thru (med)	(128)	192	272	176
Follow-thru (hvy)	(40)	65	95	60
FAE bomblet	(33)	60	90	60

Ordnance	Mission[b] F-4E[c] 300 n mi radius	A-7D[d] 300 n mi radius	F-111A[d] 300 n mi radius	F-111A[d] 500 n mi radius
Guided bombs				
MK-82EO	11[f]	17[e]	26[e]	17
MK-84EO	3[f]	4[e]	7[e]	5
MK-82IR	11[f]	17[e]	26[e]	17
MK-84IR	3[f]	4[e]	7[e]	5
MK-82 laser	11[f]	17[e]	26[e]	17
MK-84 laser	3[f]	4[e]	7[e]	5
MK-82 area cor.	11[f]	17[e]	26[e]	17
MK-84 area cor.	3[f]	4[e]	7[e]	5
Walleye I	3[f]	5[e]	7[e]	7[e]
Walleye II	(3)[f]	4[e]	6[e]	6[e]
Guided Missiles				
Bullpup AGM12B	3[f]	5[e]	7[e]	7[e]
Bullpup AGM12C	3[f]	4[e]	7[e]	7[e]
Maverick AGM65	3[f]	5[e]	7[e]	7[e]
Bulldog	3[f]	5[e]	7[e]	7[e]
Hard structure munition	(3)[f]	4	7[e]	5
Standoff Weapons				
Condor	(3)[f]	5[e]	7[e]	7[e]
AGM-X	(1)[f]	4	6	4

[a] Include one electronic countermeasure (ECM) pod.

[b] HI-LO-LO-HI profile, all at speed for maximum range with 5 minutes combat and no loiter. HI legs at altitude for maximum range. Each LO leg 100 n mi at sea level.

[c] The F-4E weapon loadings are all station limited because one 370 G and one 600 G external fuel tanks are necessary (unless footnoted otherwise). The F-4E is configured without Sparrows.

[d] All A-7D and F-111A data are based on weapon drag areas for the F-4E.

[e] Number loaded limited by available weapon positions.

[f] Takeoff weight less than maximum allowable takeoff weight; only one 600 G external fuel tank needed for mission.

[g] ( ) indicates based on estimated weight and/or drag values.

[h] Another type REBIT (3 inch, 50-lb) would allow the F-4E and F-111A (300 n mi radius) to carry two more dispensers and the A-7D and F-111A (500 n mi radius) to carry one more dispenser. There are 13 of this type REBIT per dispenser.

Appendix A

DRAG AREA AS RELATED TO DRAG INDEX

Drag area (i.e., drag/dynamic pressure) has a relationship to the drag indeix. For the F-4E this drag index is given in the flight manual as an absolute value and thus can be converted directly to drag area (drag area = C_DS = .1 x drag index). In the case of the F-111A it is suspected that the drag index is given as an absolute value leading to the conversion (drag area = C_D = .0525 x drag index). The drag index given for the A-7D is a relative drag index rather than an absolute index making it inappropriate to use drag area = C_DS = .0375 x drag index. If drag area is known directly it is not necessary to be concerned about these conversion factors. (See D-20196-PR for more information on the A-7D drag index.)

Appendix B

SAMPLE AIRCRAFT INPUT PART

This Appendix contains a JOSS listing of the aircraft input part for the F-4E used by the combat radius calculation procedure (HARD). RM-5948-PR describes this calculation procedure and the related aircraft inputs.

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Recall item 9.
Done.
Type all.

99.1 Set W=62000.
99.12 Set M=31201.
99.14 Set I=12896.
99.15 Set F=.063.
99.2 Set V=1825.
99.24 Set P(1)=.983.
99.25 Set D=[c(1)=1:1090;c(1)=2:133;c(1)=3:1650;c(1)=4:437].
99.4 Set Q=[l=117:0;l=7:121;35.3].
99.41 Set v=1014+269.
99.42 Set U=[l=117:0;l=7:.49;.143].
99.43 Set O=1.46+.28.
99.431 Set Z(2)=.1.
99.44 Set y=[l=117:Z(5);l=82:.11;l=821:.24;l=7:.33;0].
99.45 To step 2.2 if Z(1)=1.
99.5 Set x=[n≤6:8710;7≤n≤12:6305;13≤n≤18:3900;19≤n≤24:0].
99.51 Set x=[n=11:4810;12≤n≤14:3900;n=15:2405;n≥16:0;x] if l=117.
99.52 Set x=[3≤n≤4:6305;5≤n≤6:3900;n=7:0;x] if l=7.
99.55 To step 7.17 if Z(1)=0.
99.56 Set x=[e=0:0;first(x=2405,3900,4810,6305,8710:x≥e)].
99.6 Type " 82   821   117    7".
99.602 Type " 24   241  19    7".
99.61 Type "(0,100),(5,100),(20,100),(0,120),(100,100)".
99.620 Type "Combat: MRT  h=0   set c(1)=4".
99.621 Type "        MRT  h=35          2".
99.622 Type "        MAX  h=0           3".
99.65 To step 6.7.
99.7 Set P(1)=1-4.706/10*4•h(1)•(1+.03676•(s+o+t)) if h(1)<100.
99.701 Set R=1500+35•s.
99.702 Set P(11)=1-.000471•(1+.037•s)•max[0,min[35,h(4)]-h(11)].
99.7021 Set V=580+.0067•[w(2)-580]/[1-.273•(1+(s+o+t)/9.3)] if c(10)=1.
99.7022 Set D=1000•(60-h(11))•[.01609+3.21•h(11)*2/10*7] if c(10)=1.
99.712 Set K(0,100)=1.494.
99.713 Set J(0,100)=.688.
99.714 Set A(0,100)=.0381.
99.722 Set K(5,100)=2.579.
99.723 Set J(5,100)=.6475.
99.724 Set A(5,100)=.0394.
99.732 Set K(20,100)=26.63.
99.733 Set J(20,100)=.4595.
99.734 Set A(20,100)=.0442.
99.772 Set K(0,120)=.0225.
99.773 Set J(0,120)=1.
99.774 Set A(0,120)=.01178.
99.782 Set K(100,100)=3834.
99.783 Set J(100,100)=.0126.
99.784 Set A(100,100)=.0503.
99.84 To step 2.87 if Z(1)=1.
99.85 To step 7.466.
99.9 Set E(1)=[h(10)=0:91.7;h(10)=30:80;91.7/exp[.0026•h(10)]].
99.91 Set E(2)=1.1619.
```

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99.92 Set E(1)=E(1)•exp[.03672•(s+o)]/45000*E(2).
99.95 To step 7.6.

Delete all.

Appendix C

SAMPLE JOSS RUN

This Appendix contains the JOSS listing of an F-4E calculation. This is for the 300 mile total radius mission as described in Section III of this Document.

The aircraft code number (Z(10)) for the F-4E is 99. The weapon code (ℓ) used here is 117. The weight per weapon (u) is set = 2000 to run a configuration as close to maximum allowable take-off weight at as few weapons carried as possible. This case is for 0 drag per weapon.

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Recall item 7 (hard).
Done.
Do part 1.
For automatic variation in no. of wpns (HARD-3), set Z(1)=0
For specified loading configuration (HARD-3A), set Z(1)=1
Z(1) = 0
For air-to-ground combat, set Z(4)=0
For air-to-air combat, set Z(4)=1
Z(4) = 0

Aircraft code no., Z(10) = 99

Available wpn code no. / max no. carried
82 821 117 7
24 241 19 7

wpn code no., (1) = 117

PROFILE LEG, i:	1	2	3	4
Leg distance,S(i):	S(1)	S(2)	S(3)	S(4)
Cruise alt/1000,h(i)	h(1)	h(2)	h(3)	h(4)
Cruise speed ind.,m(i)	m(1)	m(2)	m(3)	m(4)

Payload is dropped between legs 2 and 3.
For 2-leg mission [S(2)=S(3)], set P(2)=1, otherwise, P(2)=4

P(2) = 4

Opt alt and speed input as 100
Normal power (NRT) input as 110
Military power (MRT) input as 120
Full AB power (MAX) input as 200

Alt-speed combinations available for cruise, (h,m)
(0,100),(5,100),(20,100),(0,120),(100,100)

h(1) = 100
m(1) = 100
h(2) = 0
m(2) = 100
h(3) = 0
m(3) = 100
h(4) = 100
m(4) = 100
S(1) = 200
S(4) = 200

Set c(3)=1 if reserve is to include .05•total fuel in addition to R, otherwise set c(3)=0
c(3) = 1

Set c(4)=1 if all tanks are to be carried throughout the entire mission, otherwise =0

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c(4) = 0
Set c(5)=1 if tanks are dropped when empty (c(4)=0), but external fuel remaining at start of combat is discarded, otherwise =0
c(5) = 1
Set c(6)=1 [c(4)must=0] if all tanks are carried to target and dropped before combat, otherwise =0
c(6) = 0

Set Z(3)=0 if there is no refueling
Set Z(3)=1 for over-base refueling
Set Z(3)=distance from base if refueled
Z(3) = 0

For MIL-C takeoff and combat allowances set c(10)=0
For AFRDQ allowances, set c(10)=1 and do not input combat time C as noted below
c(10) = 0
Combat: MRT h=0 set c(1)=4
MRT h=35 2
MAX h=0 3
c(1) = 4
combat (target) altitude/1000 = h(11) = 0
loiter alt/1000 = h(10) = 0

At this point, if combat time C (only if c(10)=0), loiter time L and no. of weapons to be carried n are input, then giving the command 'Do part Z(10)' will result in the calculation of combat radius, then any desired value may be typed out. To provide automatic variation of C,L,or n with the printout now being used, complete parts 15,16,17, as needed and then command 'Do part 10'. Other inputs may be varied in a similar manner. If different printout is desired, change steps 9.2,21.5, as necessary.

Sample procedures:

```
9.1 Page.
9.2 Type form 2.
9.4 Line.

10.2 Do step 9.2.
10.22 Line.
10.3 To part 16 if c(10)=1.
10.4 To part 15.

15.2 Do part 16 for C=5.

16.2 Do part 17 for L=0.

17.1 Line.
17.2 Do part 18 for n=0(4)19.
17.7 Line.

18.4 Do part Z(10).
```

18.5 Type C,L,n,w(2),B,f,e,P(3),S(1),S(2),Z(3)+S(1)+S(2) in form 3.
18.8 Do part 9 if $=53.

20.2 Demand P(2).
20.55 Do part 4.
20.6 To part 10.

21.2 Demand C.
21.3 Demand L.
21.4 Demand n.
21.5 Type form 2.
21.6 Do part Z(10).
21.65 Do step 18.5.

25.2 Do part 3.
25.4 To part 10.

If profile is to be changed, altitude and speed for each leg must be input again. This may be done by commanding 'Do part 20'

To change weapon only, Do part 25

Climbs to cruise altitude after takeoff and after combat are automatically included. For 3 or 4-leg missions, second climb is to h(4). To allow for 2 climbs in the LO-LO profile command 'Do part 20', set P(2)=4, S(1)=0, S(4)=0

17.2 Do part 18 for n=0(1)19.

u=2000

Z(5)=0

[redacted]

* 0 drag
Do part 10.

C	L	n	T/O WT	TGT WT	FUEL	EXT	p	S(1)	S(2)	TOT
5	0	0	54639	44150	21606	8710	361	200	222	422
5	0	1	56639	46062	21606	8710	353	200	218	418
5	0	2	58639	47971	21606	8710	346	200	213	413
5	0	3	60639	49885	21606	8710	338	200	209	409
5	0	4	62000	51506	20967	8071	304	200	192	392
5	0	5	62000	52592	19119	6223	221	200	151	351
5	0	6	62000	53647	17213	4317	100	200	108	308
5	0	7	61937	54691	15301	2405	0	200	65	265
5	0	8	62000	55713	13364	468	0	200	20	220
5	0	9	62000	56788	11516	0	0	200	-23	177
5	0	10	62000	57797	9516	0	0	200	-69	131
5	0	11	62000	58814	7516	0	0	200	-115	85
5	0	12	62000	60683	5516	0	0	200	-200	0
5	0	13	62000	63039	3516	0	0	200	-305	-105
5	0	14	62000	65477	1516	0	0	200	-413	-213
5	0	15	62000	68003	-484	0	0	200	-523	-323
5	0	16	62000	70627	-2484	0	0	200	-636	-436
5	0	17	62000	73357	-4484	0	0	200	-753	-553
5	0	18	62000	76206	-6484	0	0	200	-873	-673
5	0	19	62000	79187	-8484	0	0	200	-997	-797

Appendix D

MAXIMUM PAYLOAD SUBSTANTIATING DATA

To establish maximum payload as a function of drag area for specific missions it is first necessary to calculate payload as a function of radius for various levels of drag for the specified missions. This is presented for the three aircraft concerned as Figs. 9 through 12.

Figure 13 shows drag area as a function of payload for five levels of drag per weapon. This figure is based on the weight per weapon being 2000 lbs.

Using Figs. 9 through 12 you can determine the maximum payload for the various levels of drag/weapon for the desired total radius. Then using Fig. 13 you determine the drag area as a function of this payload and drag weapon. These results are shown as Figs. 1 thru 4.

To determine the external fuel required for takeoff weights less than the maximum allowable, it was necessary to calculate mission performance at less than maximum takeoff weight for various payload weights and drag areas. This was done for the F-4E and the total fuel weight as a function of radius for the various payload weights and drag areas is shown as Fig. 14. Cross-plotting of Fig. 14 at the desired total radius you determine the fuel weight as a function of payload for various levels of configuration drag area. This was done for a radius of 300 mi and is shown as Fig. 5.

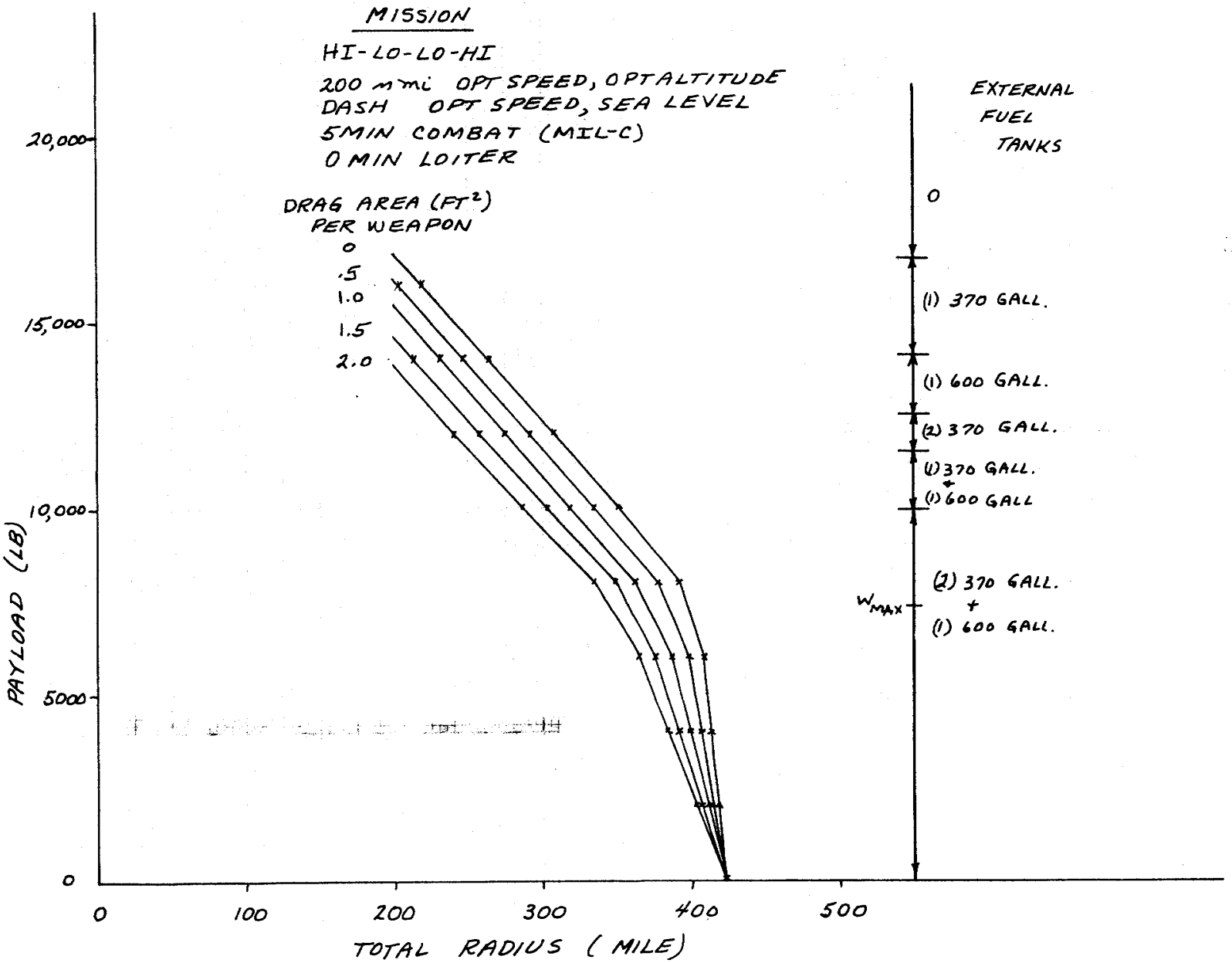


FIGURE - 9 - F-4E PAYLOAD VERSUS RADIUS FOR VARIOUS DRAG AREAS

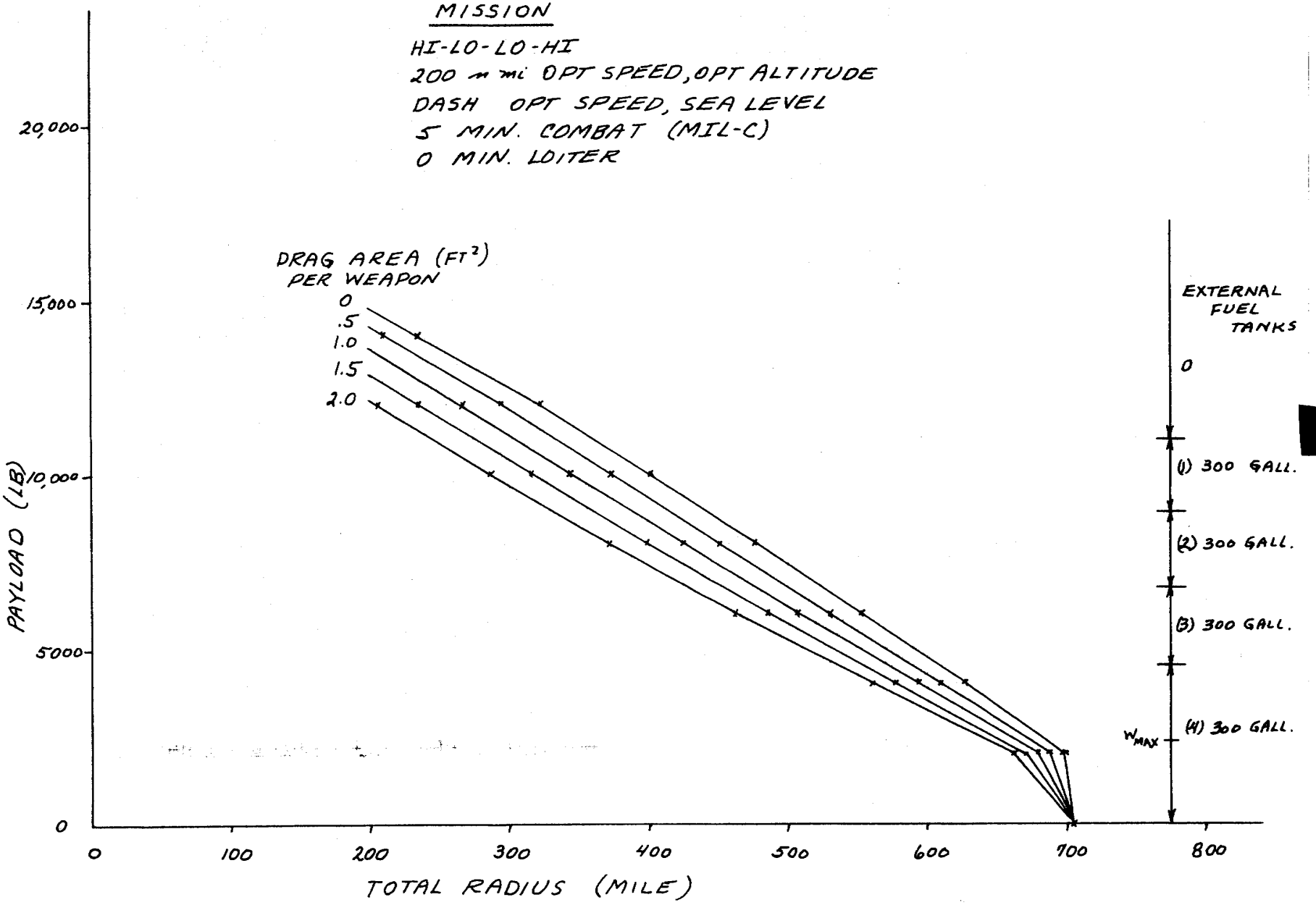


FIGURE 10 - A-7D PAYLOAD VERSUS RADIUS FOR VARIOUS DRAG AREAS

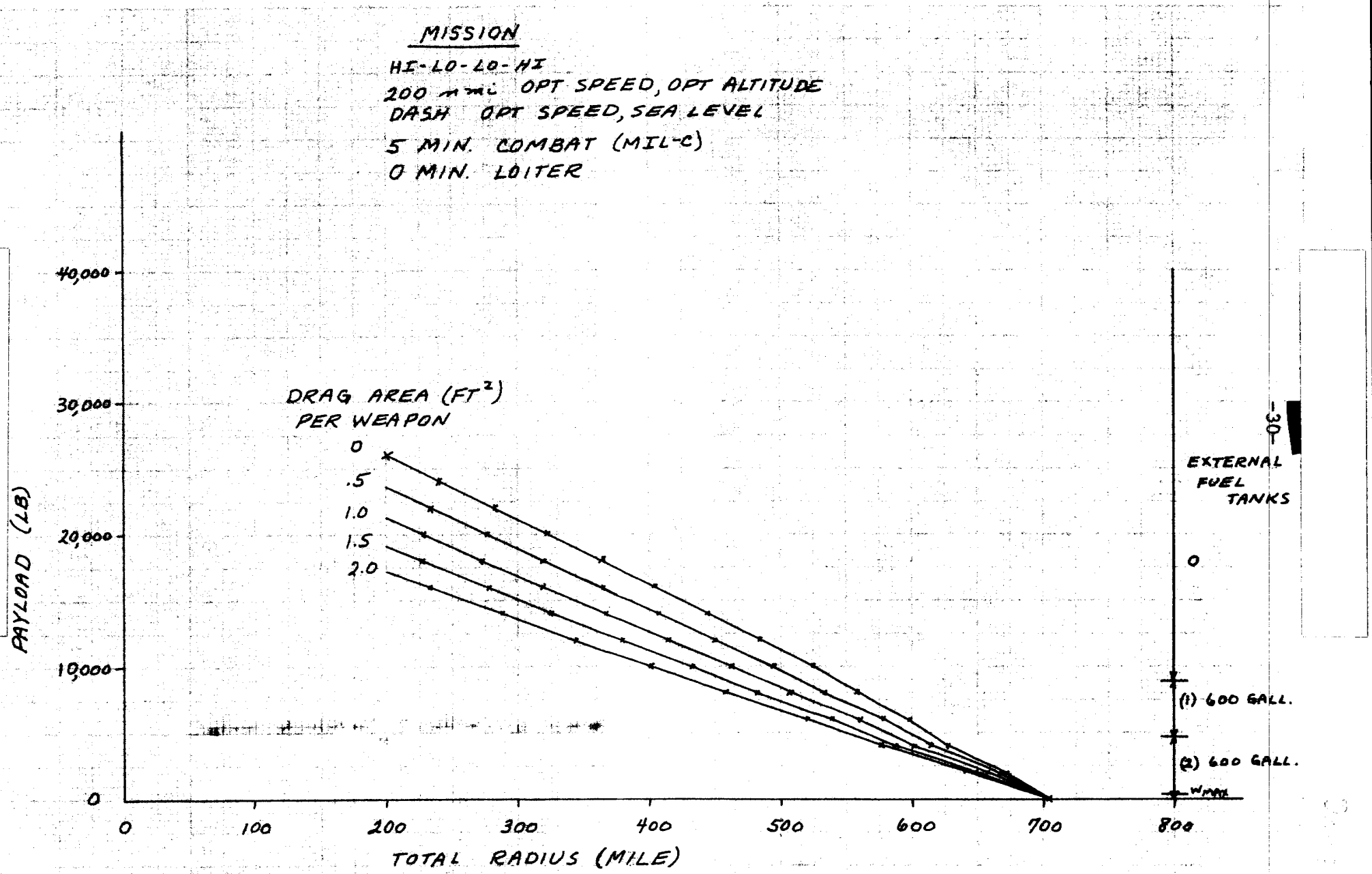


FIGURE IA - F-111A PAYLOAD VERSUS RADIUS FOR VARIOUS DRAG AREAS (U)

MISSION

HI-LO-LO-HI

400 nmi OPT SPEED, OPT ALTITUDE

DASH OPT SPEED, SEA LEVEL

5 MIN. COMBAT (MIL-C)

0 MIN. LOITER

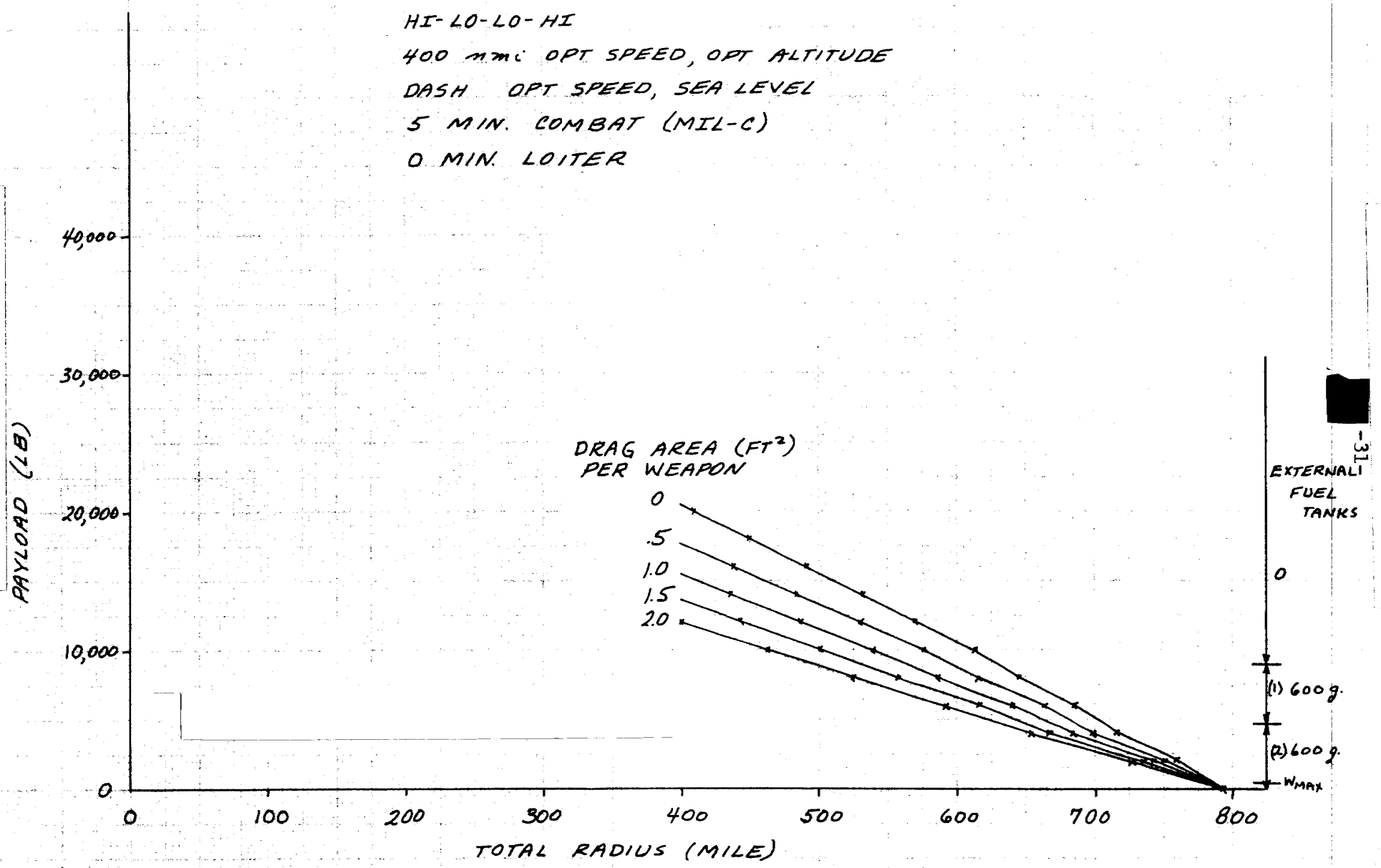


FIGURE 12- F-111A PAYLOAD VERSUS RADIUS FOR VARIOUS DRAG AREAS (U)

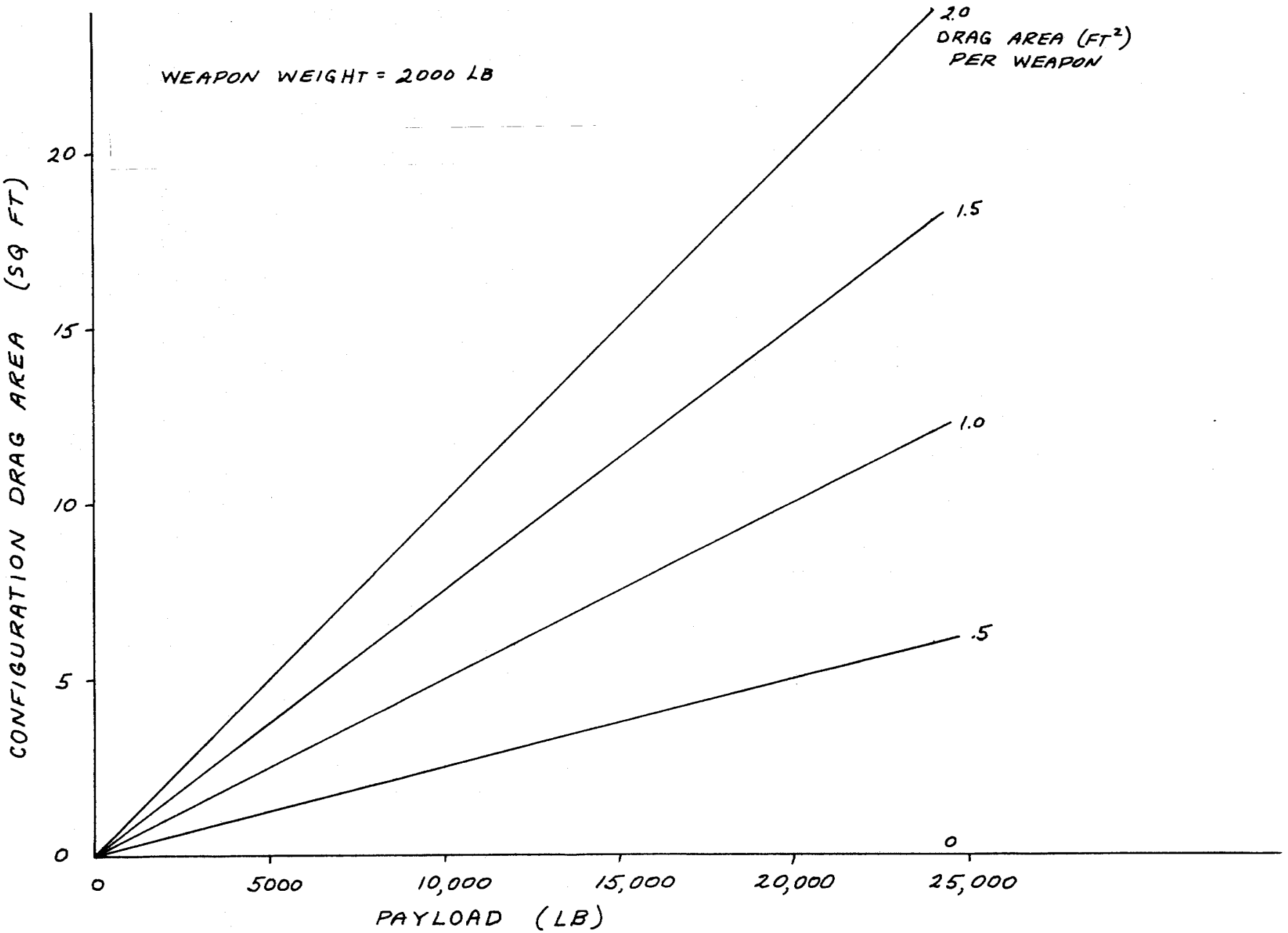
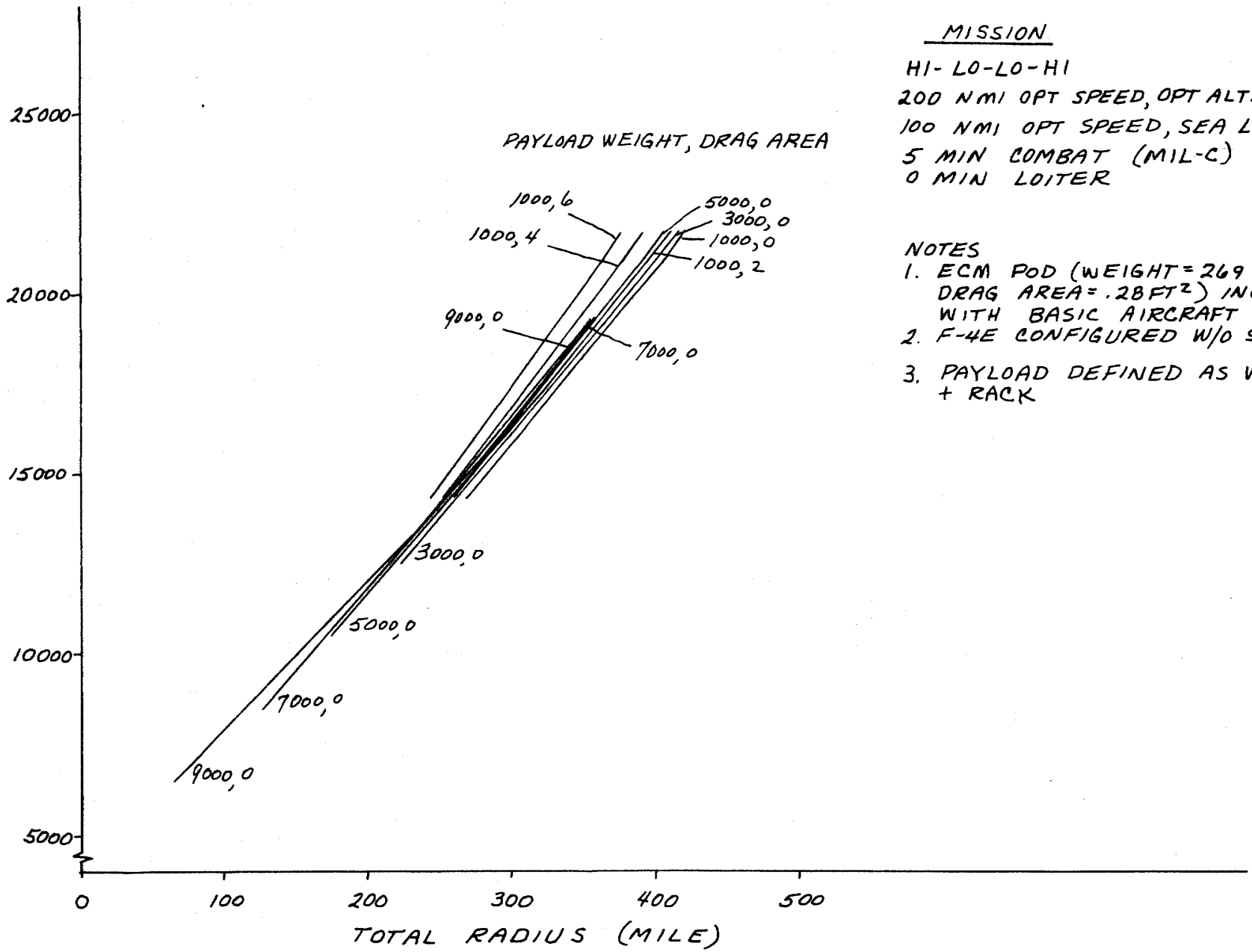


FIGURE 13- CONFIGURATION DRAG AREA AS A FUNCTION OF PAYLOAD WEIGHT



MISSION

HI-LO-LO-HI
200 NMI OPT SPEED, OPT ALTITUDE
100 NMI OPT SPEED, SEA LEVEL
5 MIN COMBAT (MIL-C)
0 MIN LOITER

NOTES
1. ECM POD (WEIGHT = 269 LB; DRAG AREA = .28 FT^2) INCL. WITH BASIC AIRCRAFT
2. F-4E CONFIGURED W/O SPARROWS
3. PAYLOAD DEFINED AS WEAPON + RACK

FIGURE 14 - F-4E TOTAL FUEL WEIGHT VERSUS RADIUS FOR VARIOUS PAYLOADS

1. East, C. B. Aircraft Munition Loads and A Listing of Suggested Weapons for Employment in Airbase Attack, (U) D(L)-20149-PR, April 15, 1970 (Secret).