THE
McDONNELL AIRCRAFT
CORPORATION

Presents

MODEL 40

TWIN-JET FIGHTER

CONFIDENTIAL REPORT
NUMBER S-144

SERIAL NO. 2
1 April 1946

SUMMARY

Model 40 is a twin-jet propelled fighter designed for a higher speed than any airplane has yet flown. The principal characteristics are:

1. The size has been kept to the minimum consistent with good design practice and maintenance.

2. Kneeling of the nose gear and folding of the wings to enable an increase in deck spot to 48 airplanes on a 200' x 96' deck space.

3. Zoomability: Maximum rate of climb of 52,000 feet per minute can be obtained in a zoom from V_{max} at sea level.

4. Performance consistent with guarantees (combat fuel):

	With Afterburning	Without Afterburning
High Speed at Sea Level (mph)	660	634
Rate of Climb at Sea Level (ft/min.)	10300	7100
Combat Weight (lbs)	14952	----
Combat Radius (nautical miles)	300	----

5. Two Westinghouse 24-C engines arranged for maximum ease of flying on one engine due to their location near centerline of fuselage. (Flight tests on the XFD-1 have shown practically no change of directional trim using one or both engines).

6. Engines placed in the wing roots, permitting intake and exhaust duct efficiencies approaching 100%, due to there being practically no ducts. The air being taken in at the stagnation point results in very little change in duct efficiencies with variations in speed and power.

7. Fuel arranged in the clear unobstructed fuselage at the C.G. of the airplane in order to provide a minimum of C.G. travel and achieve the simplest and lightest fuel system.

8. A rigid laminar flow wing 8% thick and sweptback 35° to reduce the adverse effects of compressibility at high Mach numbers.

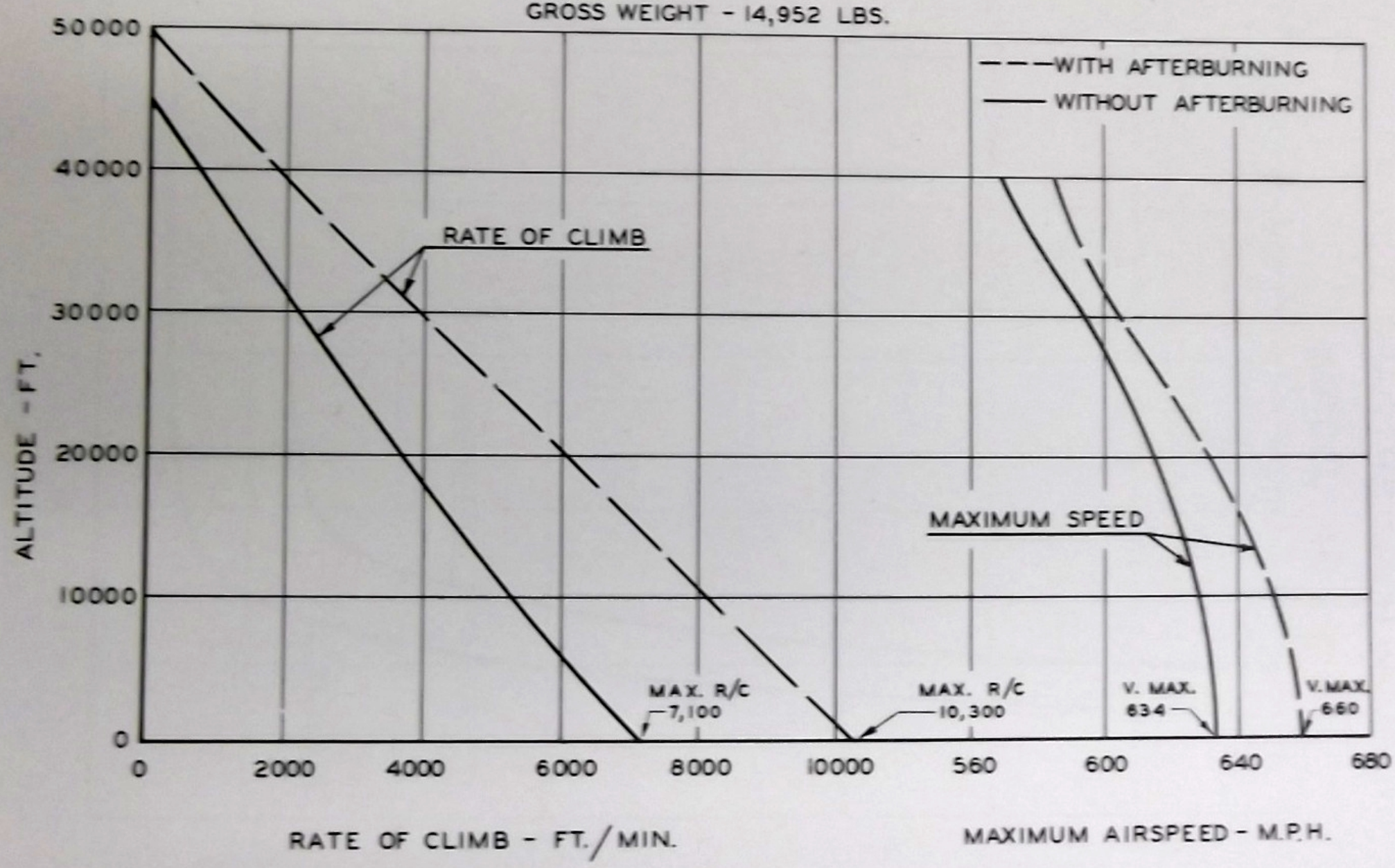
9. Wing tip M.A.C. leading edge flaps deflecting downward to eliminate tip stall. This flap plus the trailing edge flap provides a maximum lift coefficient of 1.6.

10. A console cockpit incorporating pressure and temperature controls, pilot ejection and superb all-around visibility, including 16°30' over the nose.

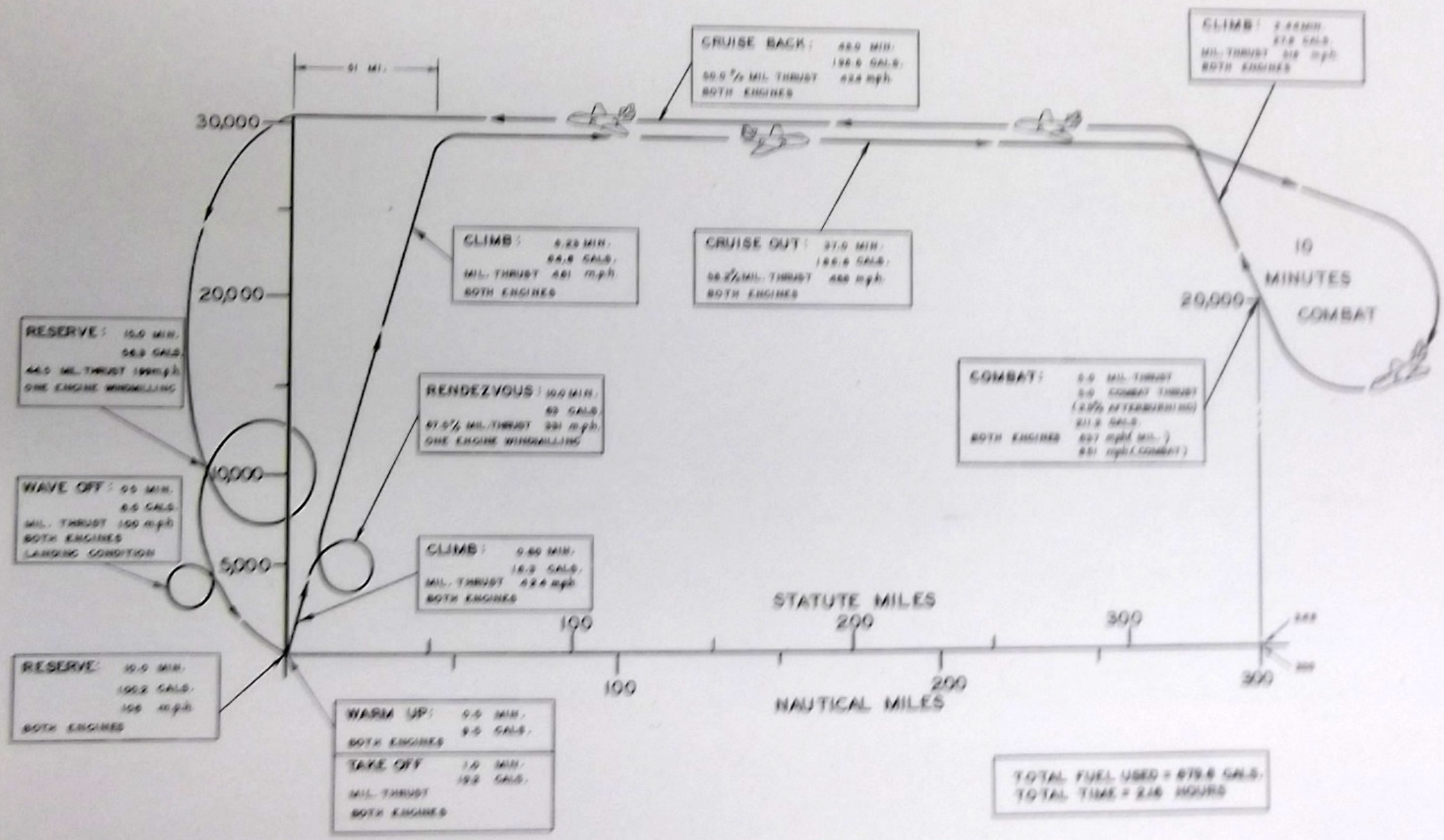
11. Four 20 mm. cannon with 250 rounds per gun, arranged so that four 60 caliber guns can be installed alternatively with a minimum of effort.

12. Speed brakes designed to open automatically and in so doing to limit the power-off dive speed to the maximum level flight speed of the airplane. A manual override is provided in order to give the pilot control over the drag of the airplane at lower speeds.

ESTIMATED RATE OF CLIMB & MAXIMUM AIRSPEED V.S. ALTITUDE

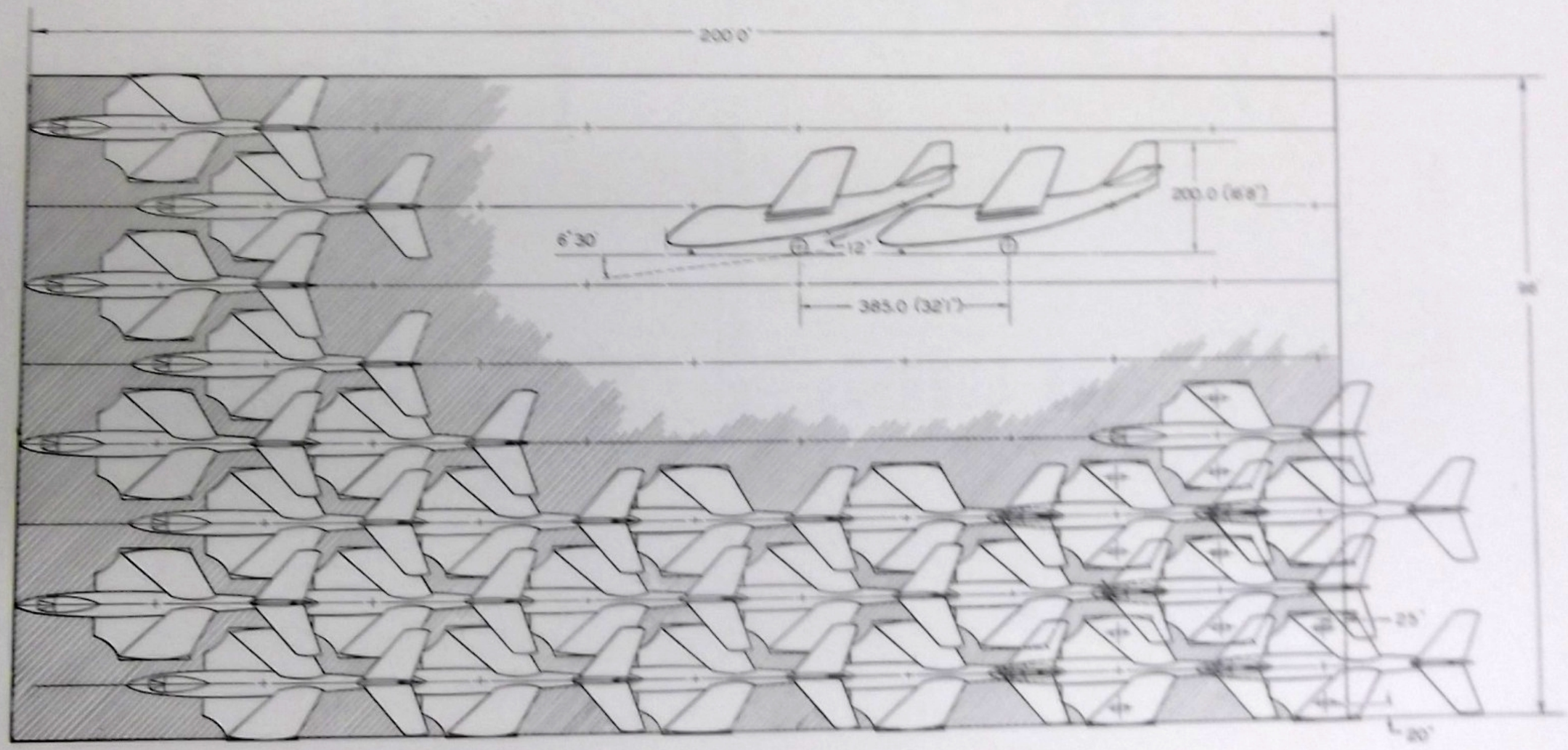


MODEL 40
COMBAT RADIUS



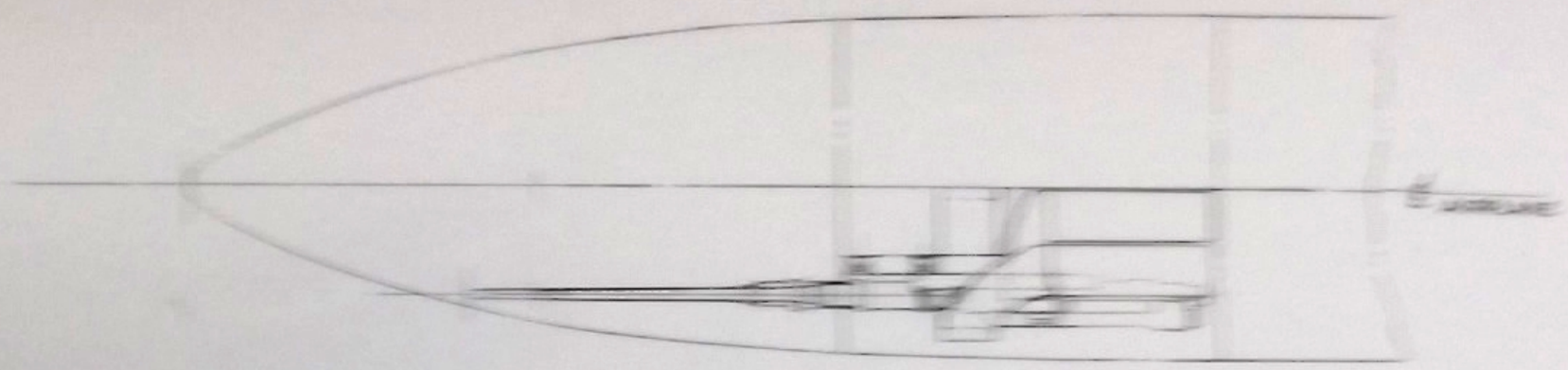
SPOTTING DIAGRAM

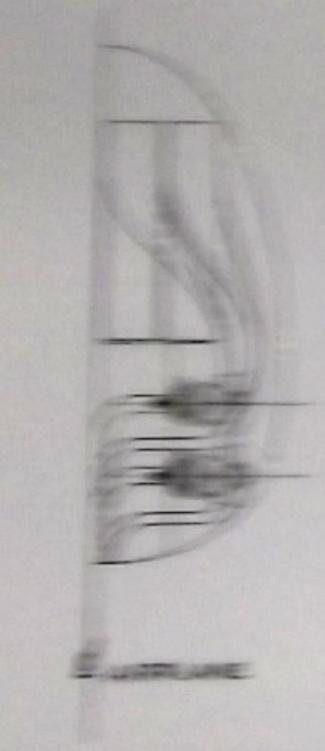
MODEL 40
48 AIRPLANES ON CARRIER DECK
KNEELED, WINGS FOLDED

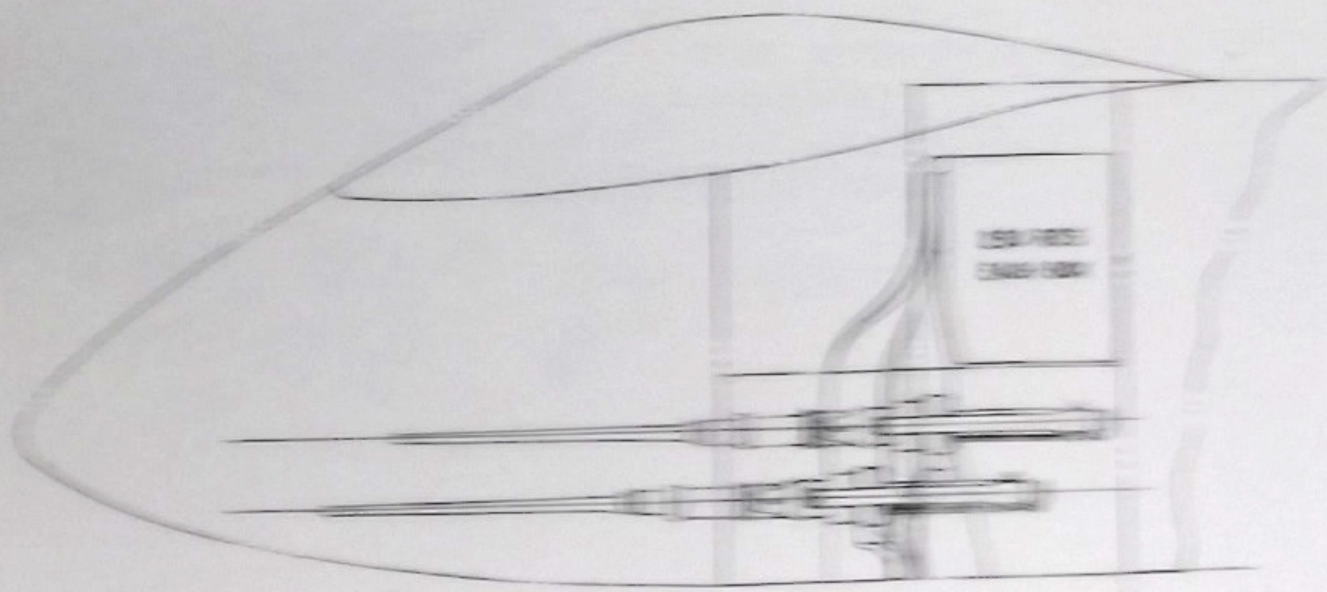


WEIGHT SUMMARY

Weight Empty			9796
Wing Group		2480	
Tail Group		450	
Body Group		1100	
Alighting Gear-Land Type		800	
Engine Section		15	
Power Plant Group		3542	
Engines (as installed)	2450		
Engine Accessories	80		
Power Plant Controls	40		
Lubrication System	40		
Fuel System	932		
Fixed Equipment		1409	
Instruments	65		
Surface Controls	370		
Electrical	325		
Communicating (IFF)	150		
Armament Provisions	310		
Furnishings	124		
Auxiliary Gear	65		
Useful Load - Fighter, Normal Fuel and Oil			
Gross Weight			14874
Useful Load		5078	
Crew	200		
Fuel (588 gals.)	3528		
Fuel (trapped in system)	18		
Oil	75		
Armament	1208		
Equipment	49		
Useful Load - Fighter, Max. Fuel and Oil			
Gross Weight			17226
Useful Load		7430	
Crew	200		
Fuel (980 gals.)	5880		
Fuel (trapped in system)	18		
Oil	75		
Armament	1208		
Equipment	49		





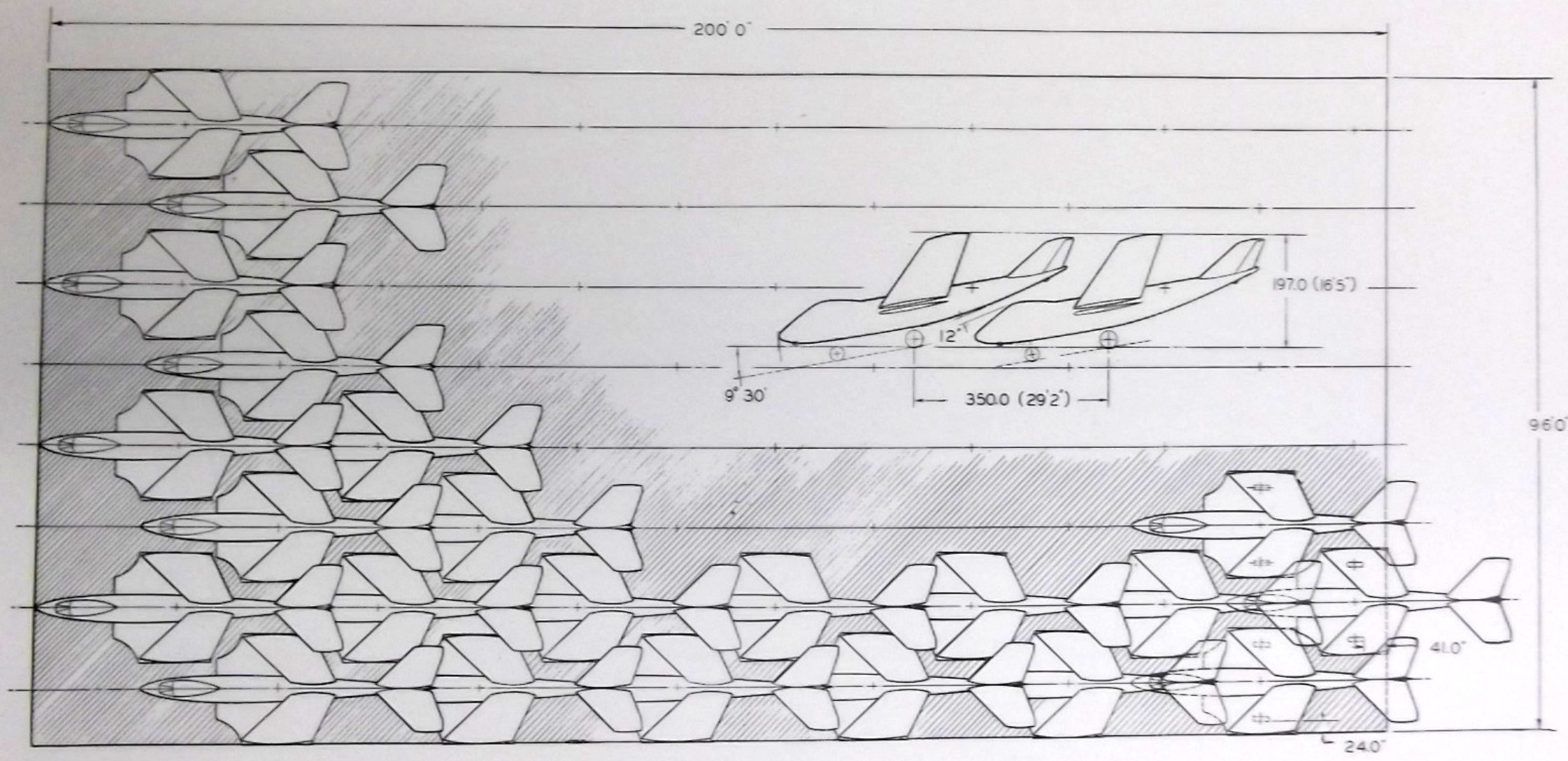


4 - 60 CAL GUNS

ALTERNATE ARMAMENT INSTALLATION

SPOTTING DIAGRAM

MODEL 40 (VEE TAIL)
52 AIRPLANES ON CARRIER DECK
KNEELED, WINGS FOLDED



PART I

CHARACTERISTICS

101a. The following characteristics are considered reasonable for this airplane and shall be equalled, or, if possible, bettered.

102a. The gross weights are estimated to be as follows:

(a) Fighter (585 gals fuel) (design fuel)	14,774#
(b) Fighter (900 gals fuel) (max fuel)	17,666#

103a. The useful load as a fighter with normal fuel and oil shall be as follows:

USEFUL LOAD			5070#
CREW (pilot and parachute)		200	
FUEL		5346	
Engine (585 gals) (in main tanks)	5340		
Trapped in system (3 gals)	18		
OIL		75	
Engine (10 gals) (in tanks)	75		
ARMAMENT		1200	
Fixed gun installation	1134		
Four 20 mm gun installation	483		
1000 rds ammunition	651		
Gunsight	60		
Gun camera	4		
EQUIPMENT		49	
Navigating (charts, plotting board shortboard)	4		
Oxygen	23		
Miscellaneous (one pararaft and equipment)	22.0		

103b. The useful load as a fighter with maximum fuel and oil shall be as follows:

USEFUL LOAD			7,130#
CREW (pilot and parachute)		200	
FUEL		5846	
Engine (570 gals) (in main tanks)	5700		
Trapped in system (3 gals)	18		
OIL		75	
Engine (10 gals)	75		
ARMAMENT (Same as 103a above)		1200	
EQUIPMENT (Same as 103a above)		49	

CHARACTERISTICS (Cont'd)

105a. The weight empty as a carrier fighter airplane is estimated to be as follows:

WEIGHT EMPTY			
Wing Group			
Center Section panel		1310	
Outer panels		735	
Ailerons		160	
Flaps		85	
Speed brakes		60	
Leading edge flap		130	
			450
Tail Group			
Stabilizer		290	
Elevator		78	
Fin		37	
Rudder		45	
			1100
Body Group			
Fuselage - less engine section		1100	
			800
Alighting Gear - Land Type			
Main alighting gear		575	
Auxiliary alighting gear (nose wheel)		225	
			15
Engine Section Group			3542
Power Plant Group			
Engine (as installed)		2450	
Engine accessories (duct valves)		80	
Power plant controls		40	
Lubricating system		40	
Fuel system		932	
Tanks and protection	732		
Piping, etc.	200		
			1409
Fixed Equipment Group			
Instruments		65	
Surface controls		370	
Electrical		325	
Communicating (IFF)		150	
Armament provisions (incl. gunfire protection)		310	
Furnishings		124	
Personnel accommodations	63		
Emergency accommodations	0		
Provisions for flight	11		
Air conditioning equipment	50		
			65
Auxiliary gear			
Arresting hook installation	65		

CHARACTERISTICS (Cont'd)

106a. **Unit weights:**

Weight of wing group per sq ft - total wing area (385.0 sq ft)	6.44#/sq ft
Weight of tail group per sq ft - gross tail surface area (137.6 sq ft)	3.27#/sq ft
Weight of fuel system per gal capacity (980 gals fuel capacity)	0.95#/gal.

107a. The thrust shall be as defined in paragraph 601c.

108a. Areas: (in accordance with BuAer Specification SR-45).

Wing area, incl. 45.0 sq ft of fuselage, ailerons, and flaps			385.0 sq ft
Wing flap area, trailing edge,			37.5 sq ft
leading edge,			23.7 sq ft
Ailerons (aft of hinge line) - total			29.4 sq ft
Horizontal tail area - total (incl. fuselage)	(chord plane)	94	sq ft
	(vert. proj.)	90.7	sq ft
Stabilizer to elevator hinge	(chord plane)	61.1 sq ft	
	(vert. proj.)	59.0 sq ft	
Elevator aft of hinge	(chord plane)	32.9 sq ft	
	(vert. proj.)	31.9 sq ft	
Tabs (included in elevator area)		-	
Vertical tail area - total (incl. 3.0 sq ft of dorsal)			43.6 sq ft
Fin to rudder hinge (incl. dorsal)		29.4 sq ft	
Rudder aft of hinge		14.2 sq ft	
Tabs (included in rudder area)		-	

110a. The unit loadings shall be as follows:

	WING LOAD Lbs/sq ft (385)	THRUST LOAD (NORMAL) 4960 lbs thrust lb/lb.
(a) Fighter (588 gals fuel)	38.63	3.06
(b) Fighter (980 gals fuel)	44.74	3.54

111a. The airfoil section for the wings and the tail surfaces shall be as follows: (parallel to centerline of airplane).

Wing at theoretical root	NACA 65_1-008
Wing at theoretical tip	NACA 65_1-008
Horizontal tail	NACA 65_1-008
Vertical tail	NACA 65_1-008

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112a. The performance is estimated to be as follows: (consistent with contract guarantees and based on notes appended).

	FIGHTER (Combat Fuel)	FIGHTER (Max. Fuel)
Fuel (gals)	601	980
Gross Weight (lbs.)	14952	17226
High Speed, COMBAT THRUST		
at sea level (mph)	660	660
at 10,000 ft. (mph)	652	652
at 20,000 ft. (mph)	632	632
at 30,000 ft. (mph)	606	606
at 40,000 ft. (mph)	587	586
High Speed, MILITARY THRUST		
at sea level (mph)	634	634
at 10,000 ft. (mph)	629	627
at 20,000 ft (mph)	617	615
at 30,000 ft. (mph)	594	591
at 40,000 ft. (mph)	567	554
Stalling speed at sea level with full load, without power (mph) (landing flap setting)	97	104
Stalling speed at sea level with full load less fuel without power (mph) flaps down	85	85
Stalling speed at sea level with full load less 3/4 fuel without power (mph) (flaps down)		90
Rate of Climb, COMBAT POWER		
Initial R/C at sea level (ft./min.)	10300	8860
at 10,000 ft. (ft./min.)	8150	6950
at 20,000 ft. (ft./min.)	6110	5170
at 30,000 ft. (ft./min.)	3920	3200
at 40,000 ft. (ft./min.)	1870	1280
Rate of Climb, MILITARY POWER		
Initial R/C, at sea level (ft./min.)	7100	6050
at 10,000 ft. (ft./min.)	5310	4500
at 20,000 ft. (ft./min.)	3700	3050
at 30,000 ft. (ft./min.)	2120	1620
at 40,000 ft. (ft./min.)	690	230
Time of Climb, COMBAT POWER		
to 20,000 ft. (min.)	2.49	2.92
to 30,000 ft. (min.)	4.49	5.31
Time of Climb, MILITARY POWER		
to 20,000 ft. (min.)	3.83	4.55
to 30,000 ft. (min.)	7.27	8.83
Service Ceiling, COMBAT POWER (ft.)	49230	46200
Service Ceiling, MILITARY POWER (ft.)	44250	40850
Take-off Climb (ft./min.)		506
Wave-off R/C (1/4 total fuel) (ft./min.)		1000
Max. Endurance at 30,000 ft. (hr.)		3.83
Max. Range at 30,000 ft. (mi.)		1408

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	FIGHTER (Combat Fuel)	(Max. Fuel)
Average speed for Max. range, 30,000 ft (mph)		450
Average speed for Max. endurance, 30,000 ft (mph)		315
Take-off distance in calm (ft.) (take-off flap setting)		1560
Take-off distance in 15 knot wind (take-off flap setting) (ft.)		1140
Take off distance in 25 knot wind (take off flap setting (ft.)	1.15	889
Radius of action, fighter radius (statute mi.)		346 - 300 n.
Interceptor Radius (statute miles)		115 100 n.
Cruising Radius, endurance (hrs)		3.02

NOTES:

(1) The performance given above is with flush type radio antenna and is based on Westinghouse Corrected Performance Chart for Model 24C dated 17 November 1944. (See following page). The performance as determined from flight will be corrected for differences in thrust measured by thrust meters.

(2) Combat thrust includes afterburning and is taken as military thrust increased 2%.

(3) Take-off rate of climb is calculated at sea level with temperature of 95°F (when loaded with full internal ammunition and fuel required for fighter radius of action)at a speed of 115 mph, landing gear down and flaps adjusted for take-off.

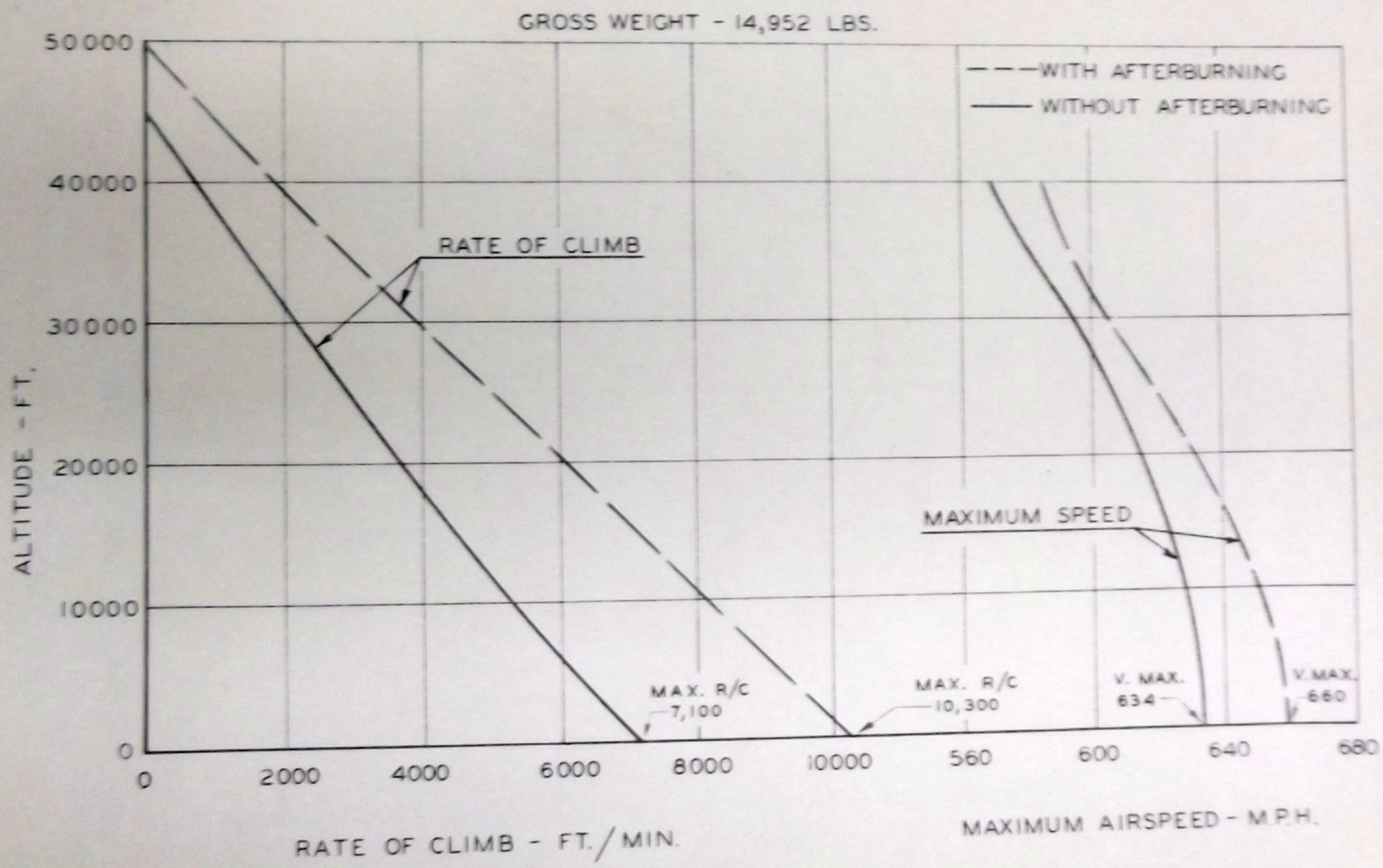
(4) Wave-off rate of climb at sea level is computed with temperature 95°F (when loaded with full internal ammunition and 1/4 total fuel) at a speed of 100 mph, landing gear and flaps down.

(5) The radius of action formula is taken from Confidential Outline Specification 08-105, Amendment No. 1, dated 8 February 1946. The calculated drag is used and the fuel consumption taken from the engine specification is increased 7-1/2%.

112b. Contract Guarantees: The following items shall be guaranteed and demonstrated:

(a)	Weight Empty, (lbs.)	9796
(b)	High Speed at 20,000 ft., military thrust, combat fuel (mph)	617
(c)	Rate of Climb at 10,000 ft., Military Thrust, combat fuel (ft./min.)	5310
(d)	Stalling Speed at Sea Level with full load less 3/4 fuel without power (mph) (flaps down)	90
(e)	Catapult Rate of Climb at 115 mph, 95°F, (ft./min.)	506

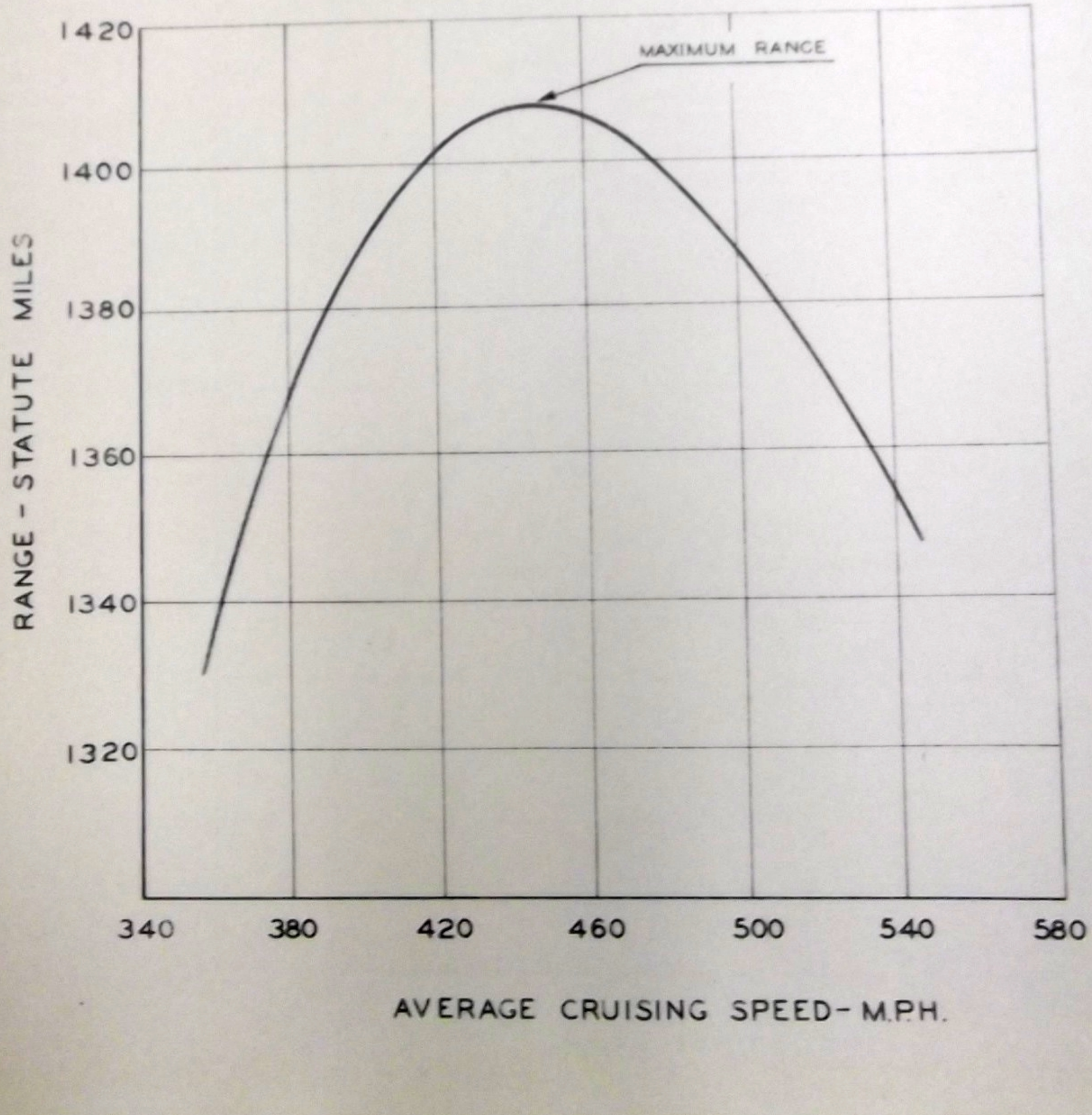
ESTIMATED RATE OF CLIMB & MAXIMUM AIRSPEED V.S. ALTITUDE.



RANGE VS SPEED

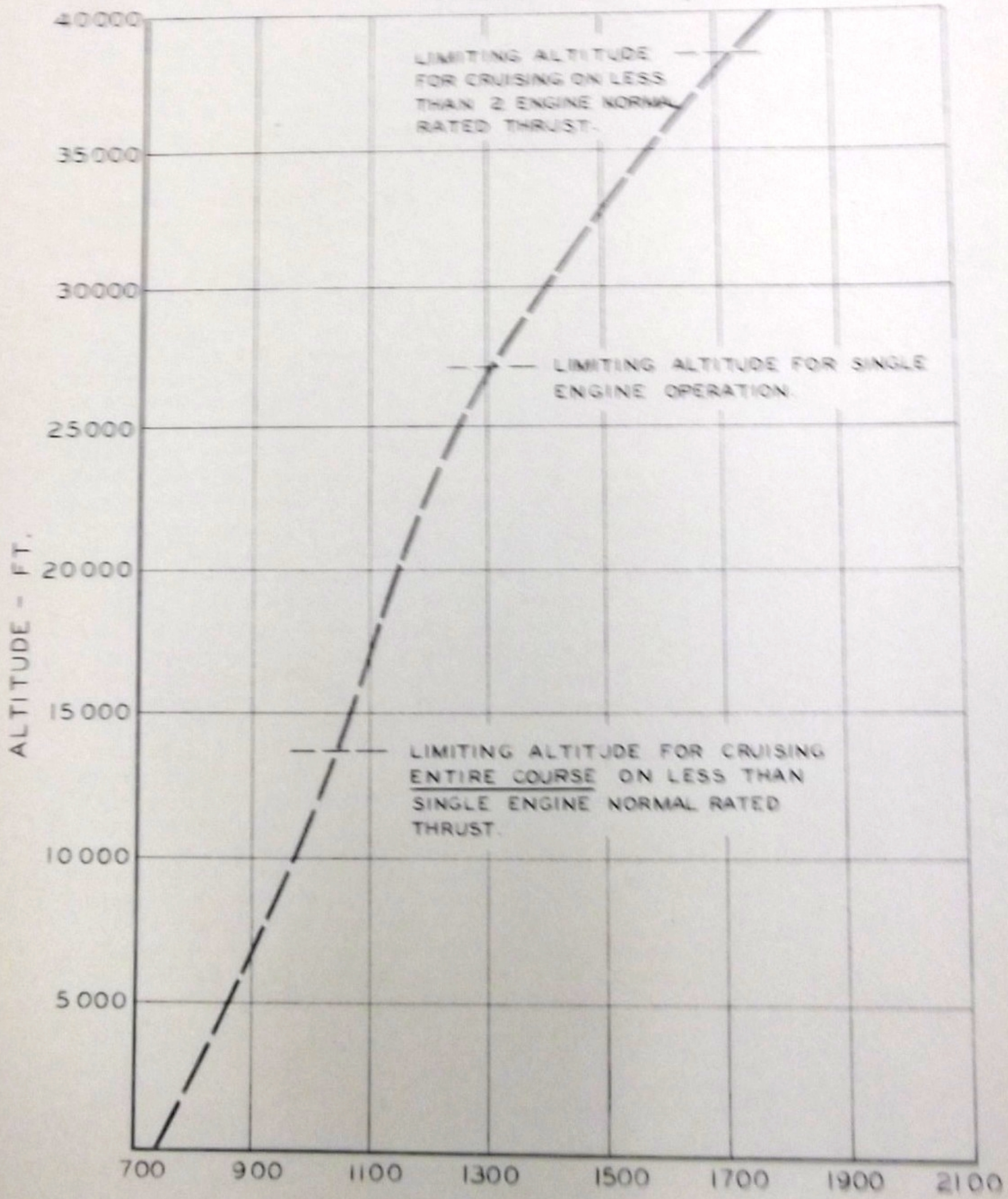
2 ENGINE OPERATION AT 30,000 FT.

980 GALS. FUEL

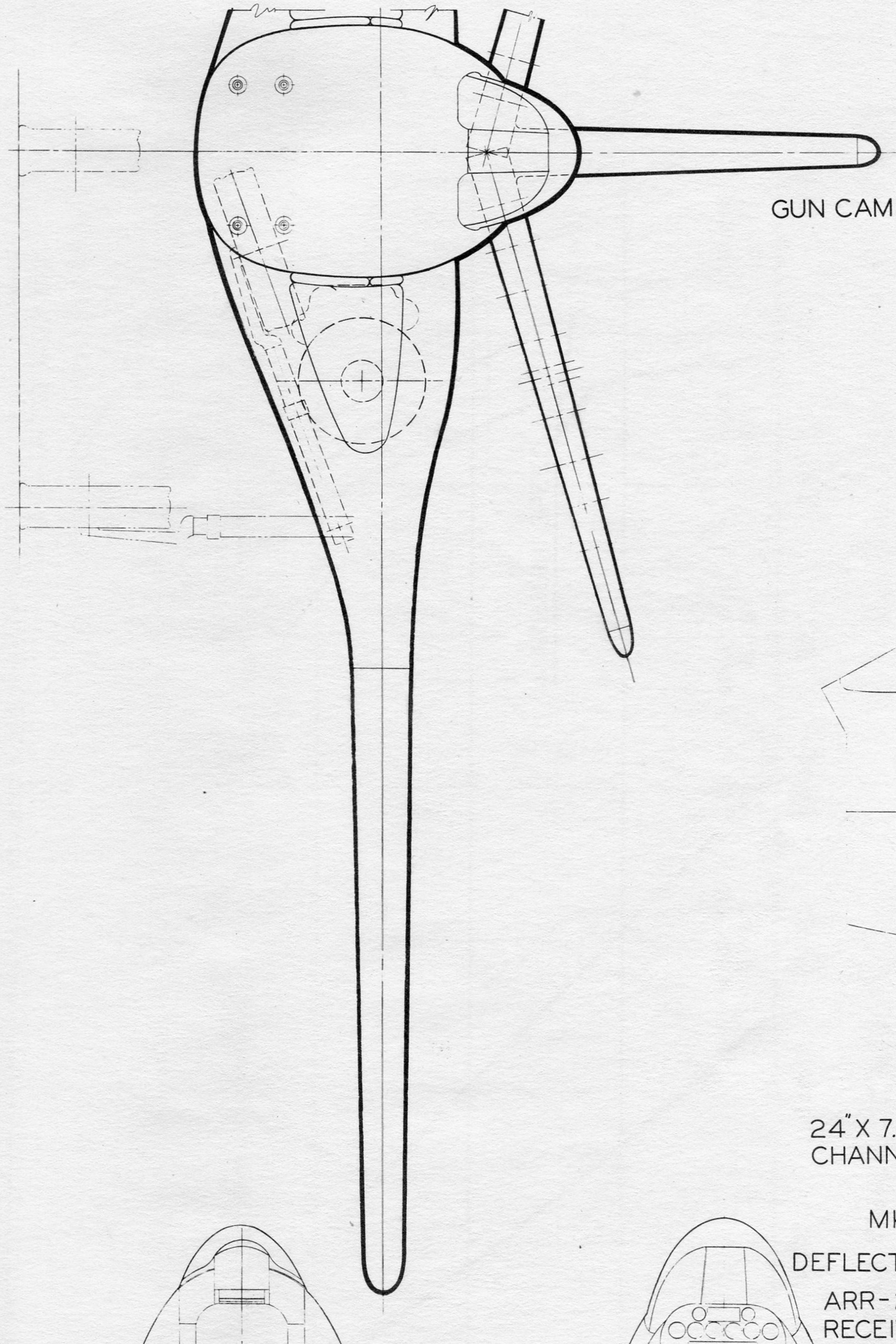


MAX. RANGE VS ALTITUDE
980 GALS. FUEL

TAKE OFF G.W. 17,220



GUN CAME



24" X 7.
CHANN

MK

DEFLECT

ARR-2
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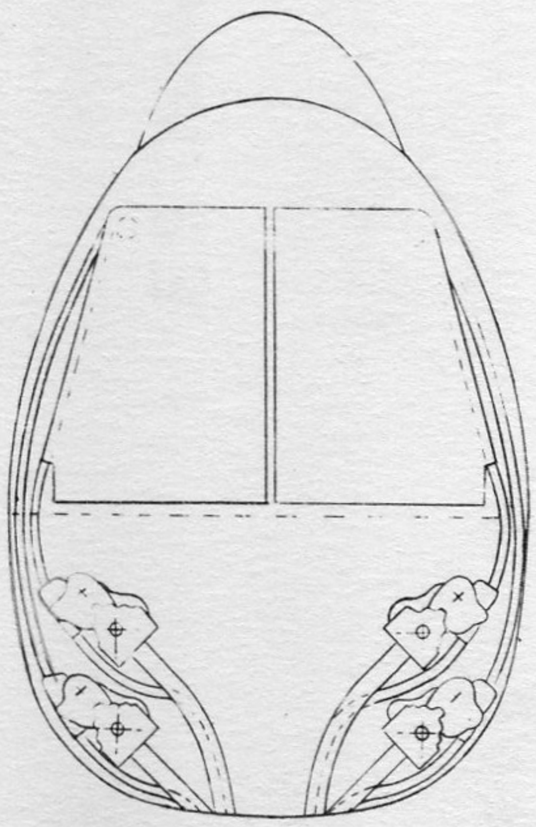
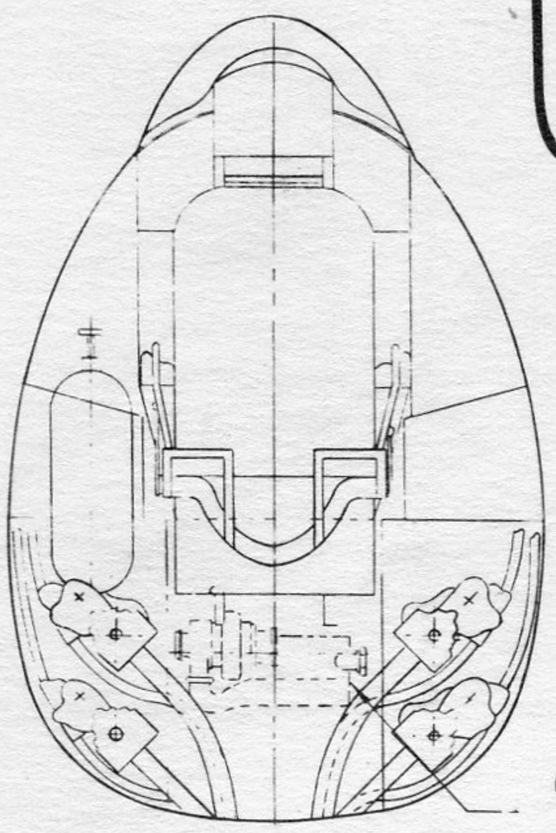
MK 6

MK
INV

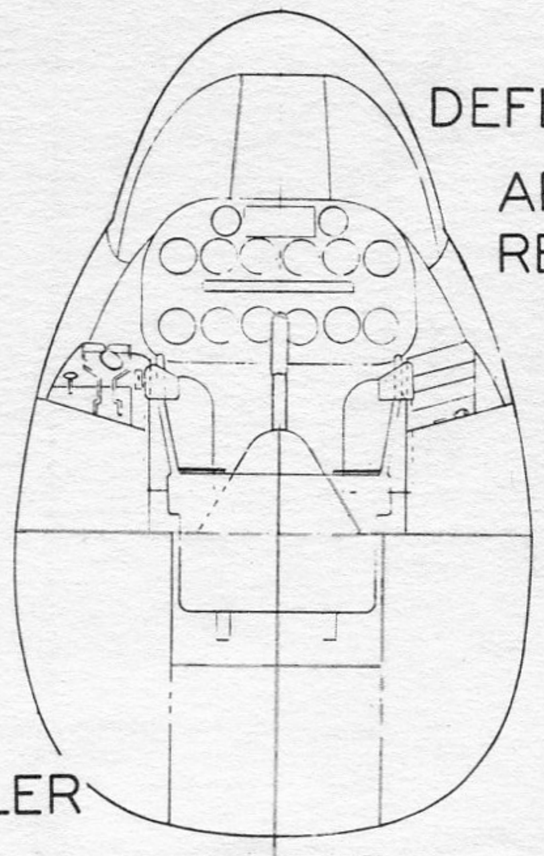


SECTION **E-E**



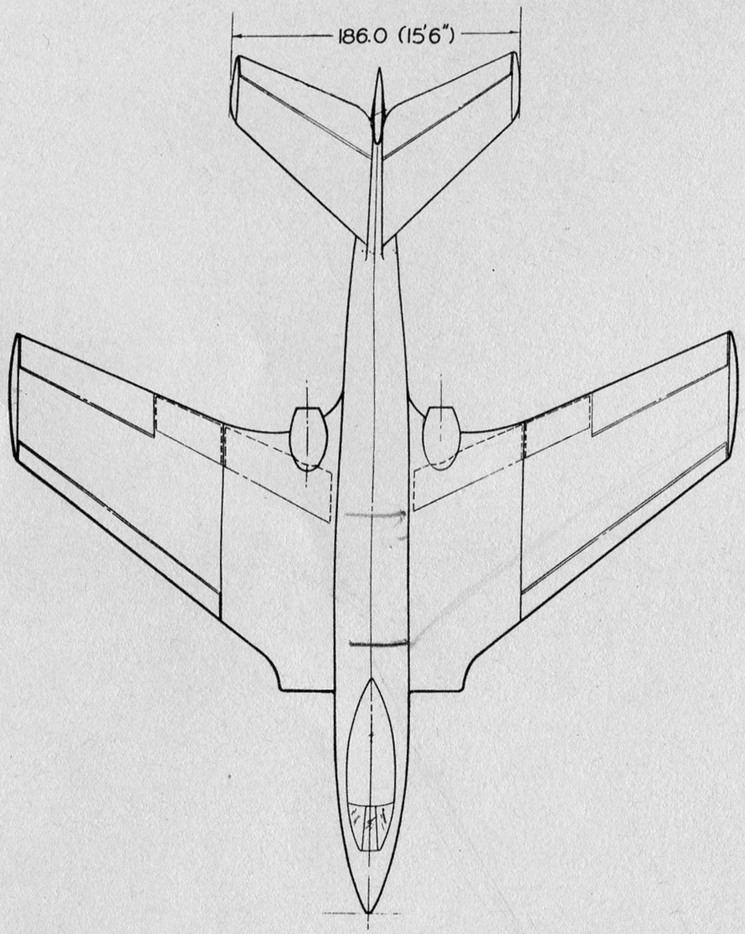
SECTION **D-D**

CABIN AIR COOLER
AND TURBINE

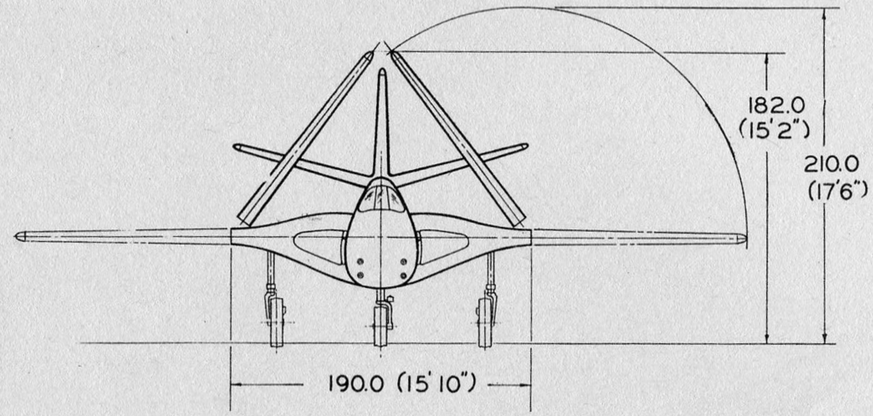


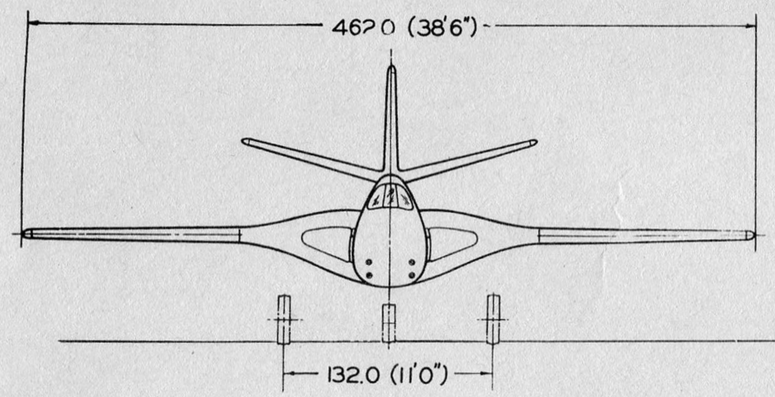
SECTION **C-C**

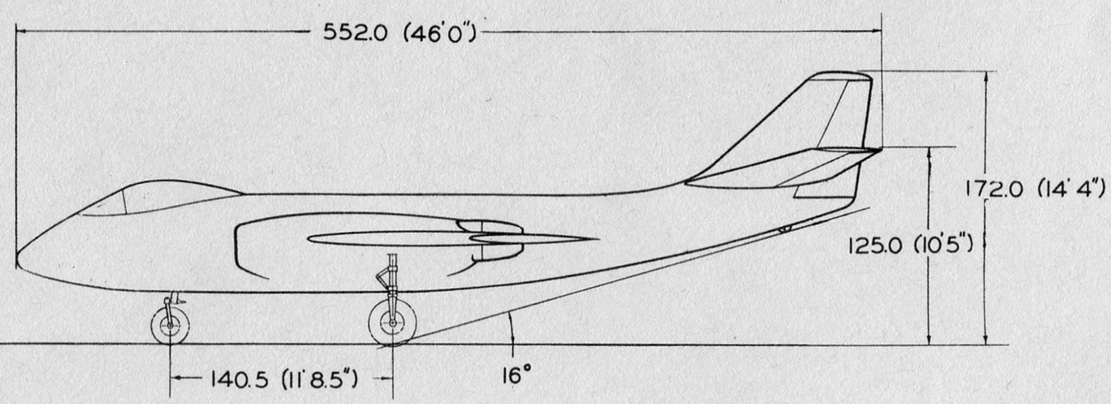
GENERAL ARRANGEMENT
MODEL 40



WING:		
TOTAL WING AREA INCLUDING AILERONS & FUS. AREA OF 45.0 SQ.FT.		385 SQ.FT.
AILERON AREA (AFT OF HINGE LINE) TOTAL		29.4 SQ.FT.
TRAILING EDGE FLAP AREA		37.5 SQ.FT.
LEADING EDGE FLAP AREA		23.7 SQ.FT.
INCIDENCE		0°
SWEEPBACK (.25 CHORD LINE)		35°
TAIL		
TOTAL HORIZONTAL TAIL AREA (INC. FUS)	(CHORD PLANE)	94 SQ.FT.
	(HORIZ. PROJ.)	90.7 SQ.FT.
STABILIZER AREA	(CHORD PLANE)	61.1 SQ.FT.
	(HORIZ. PLANE)	59 SQ.FT.
ELEVATOR (AFT OF HINGE LINE)	(CHORD PLANE)	32.9 SQ.FT.
	(HORIZ PLANE)	31.8 SQ.FT.
DIHEDRAL		15°
INCIDENCE		0°
SWEEPBACK (.25 CHORD LINE)		40°
TOTAL VERTICAL TAIL AREA INCLUDING 30 SQ FT. OF DORSAL		43.6 SQ.FT.
FIN AREA (INC. DORSAL)		29.4 SQ.FT.
RUDDER AREA (AFT OF HINGE LINE)		14.2 SQ.FT.
SWEEPBACK (.25 CHORD LINE)		40°
AIRFOIL DESIGNATIONS:		
WING AT THEORETICAL ROOT		NACA 65,-008
WING AT THEORETICAL TIP		NACA 65,-008
TAIL AT THEORETICAL ROOT		NACA 65,-008
TAIL AT THEORETICAL TIP		NACA 65,-008
HIGH LIFT DEVICE:		
TRAILING EDGE FLAP ANGLE MAX. DEGREES		60°
LEADING EDGE FLAP ANGLE MAX. DEGREES		30°
M.A.C:		
LENGTH		124.46
INCIDENCE		0°







ISSUE OF PAGES

AIRPLANE CHARACTERISTICS & PERFORMANCE

BUREAU OF AERONAUTICS, NAVY DEPT.

COLUMN NUMBER		1	2	3	4
LOADING CONDITION		COMBAT	COMBAT	TAKE-OFF	LANDING 1/4 FUEL
GROSS WEIGHT	LBS.	14952	14952	17226	12816
EMPTY WEIGHT	LBS.	11346			
FUEL / OIL	GALS.	601/10	601/10	980/10	245/10
FIXED GUNS / AMMUNITION		4 - 20 MM/1000 RDS.			
FLEXIBLE GUNS / AMMUNITION					
ENGINE POWER USED FOR PERFORMANCE		Combat (Afterburning)	Military	Military	Military
WING LOADING	LBS / SQ FT.	38.83	38.83	44.74	33.28
Thrust LOADING (1)	LBS / Lb.	1.99	2.49	2.87	2.14
V-MAX, SEA LEVEL	MPH.	660	634	634	634
V-MAX / CRITICAL ALT.	MPH. / FT.	632/20000'	617/20000'	615/20000'	617/20000'
V-STALL GROSS WEIGHT (2)	MPH.	97	97	104	90
V-STALL WITHOUT FUEL (2)	MPH.				
TIME-TO-CLIMB -10000 FT-	MIN.	1.08	1.61	1.90	
TIME-TO-CLIMB 20000 FT	MIN.	2.49	3.83	4.55	
SERVICE CEILING	FT.	49230	44250	40850	
TAKE-OFF DISTANCE -CALM-	FT.			1560	
TAKE-OFF DISTANCE -5 KN-	FT.			1140	
TAKE-OFF DISTANCE -25 KN-	FT.			889	
TAKE-OFF DISTANCE -50 FT OBST.	FT.				
TAKE-OFF TIME	SECONDS				
RATE OF CLIME -SL-	FT / MIN.	10300	7100	6050	
MAX RANGE / V-AV (3)	ST. M. / MPH			1408/450	
RANGE / V-AV -60%NSP- (3)	ST. MI. / MPH				
SEARCH RADIUS / V-AV -20%R-	NMI / KN				
Cruising Radius	**hrs.**			3.02	
Interceptor	N MI			100	
COMBAT RADIUS	N MI			300	

ENGINE / PROP GEAR RATIO

ENGINE RATING BHP/RPM/ALT

2 Westinghouse 24-C J.F. Units
Static Thrust S.L. 3000/lbs/Eng.

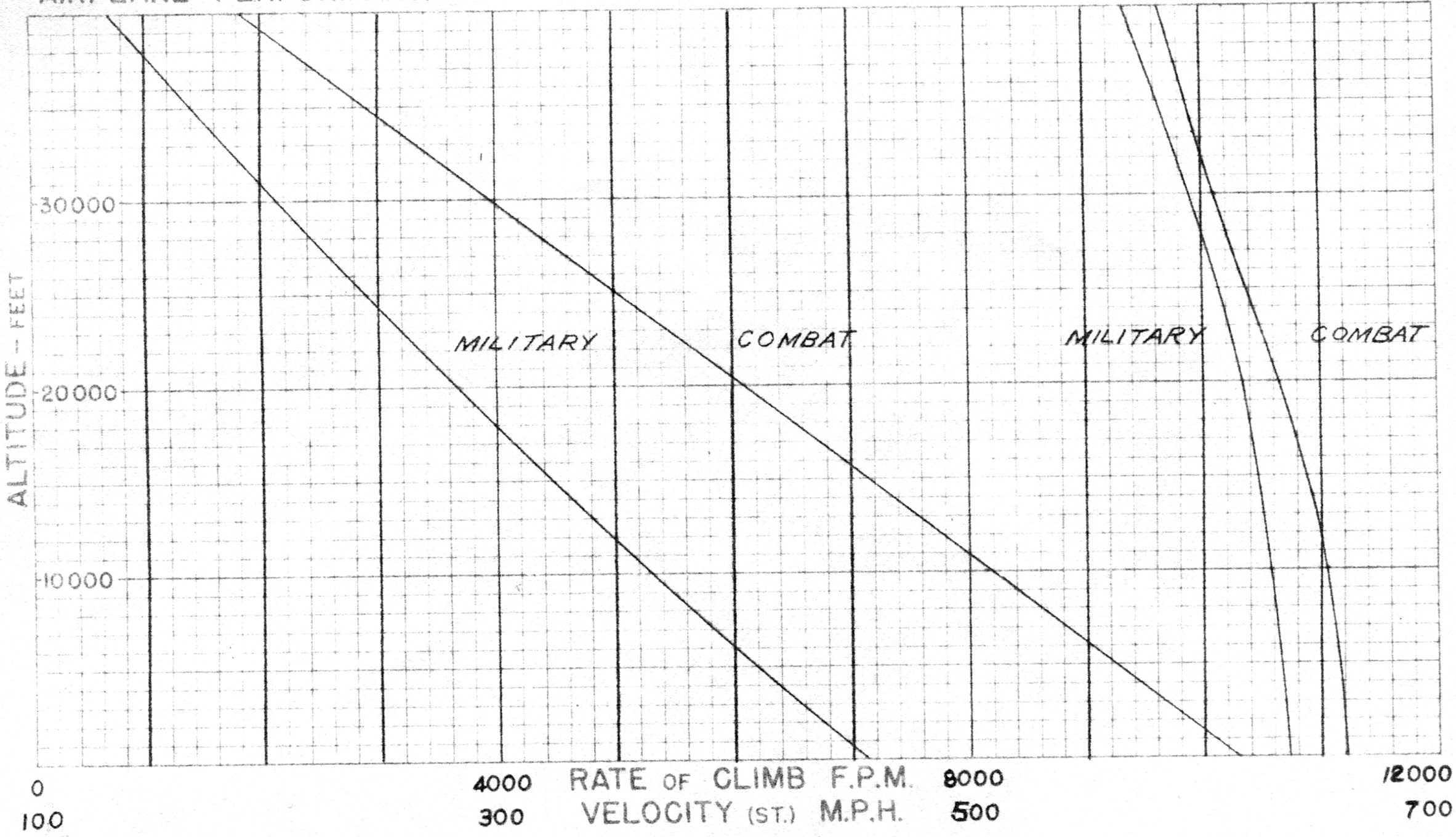
Afterburning for Combat Thrust 25% Increase Over Military Thrust

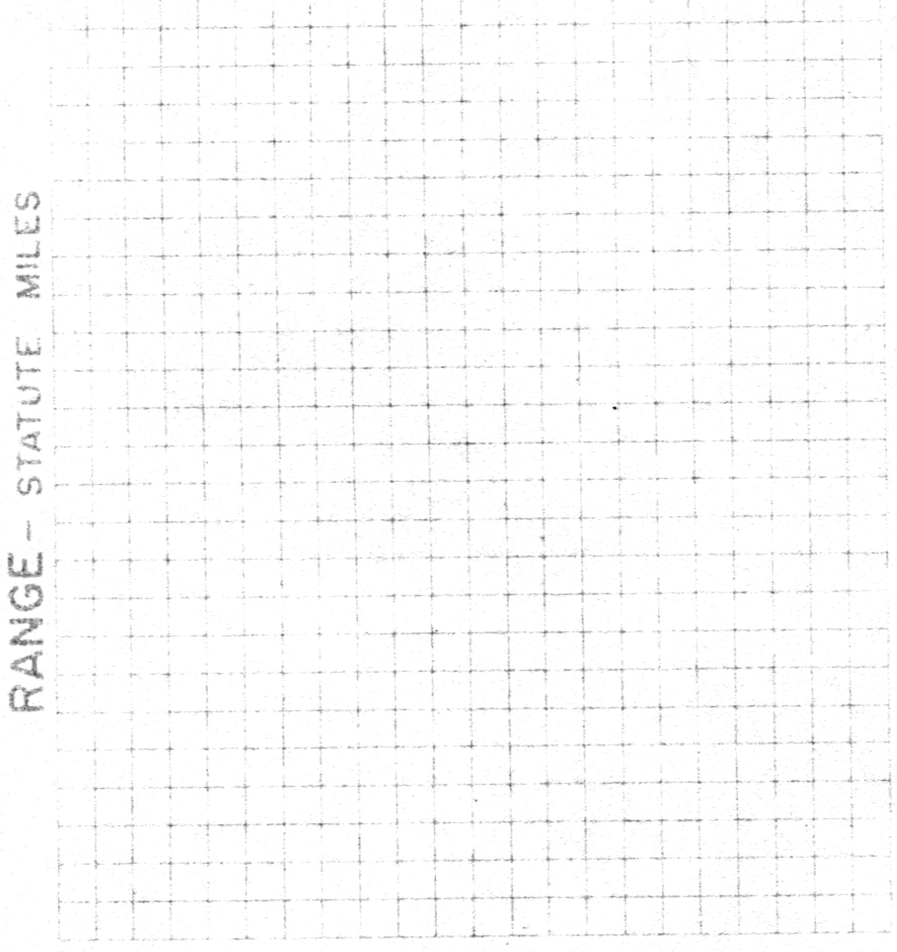
TANKAGE IN GALLONS		OIL	FUEL
AUX. FIXED	PROTECTED		980
	UNPROTECTED		
	TOTAL - FIXED INTERNAL		980
	DROPPABLE		
	DROPPABLE		
	TOTAL		

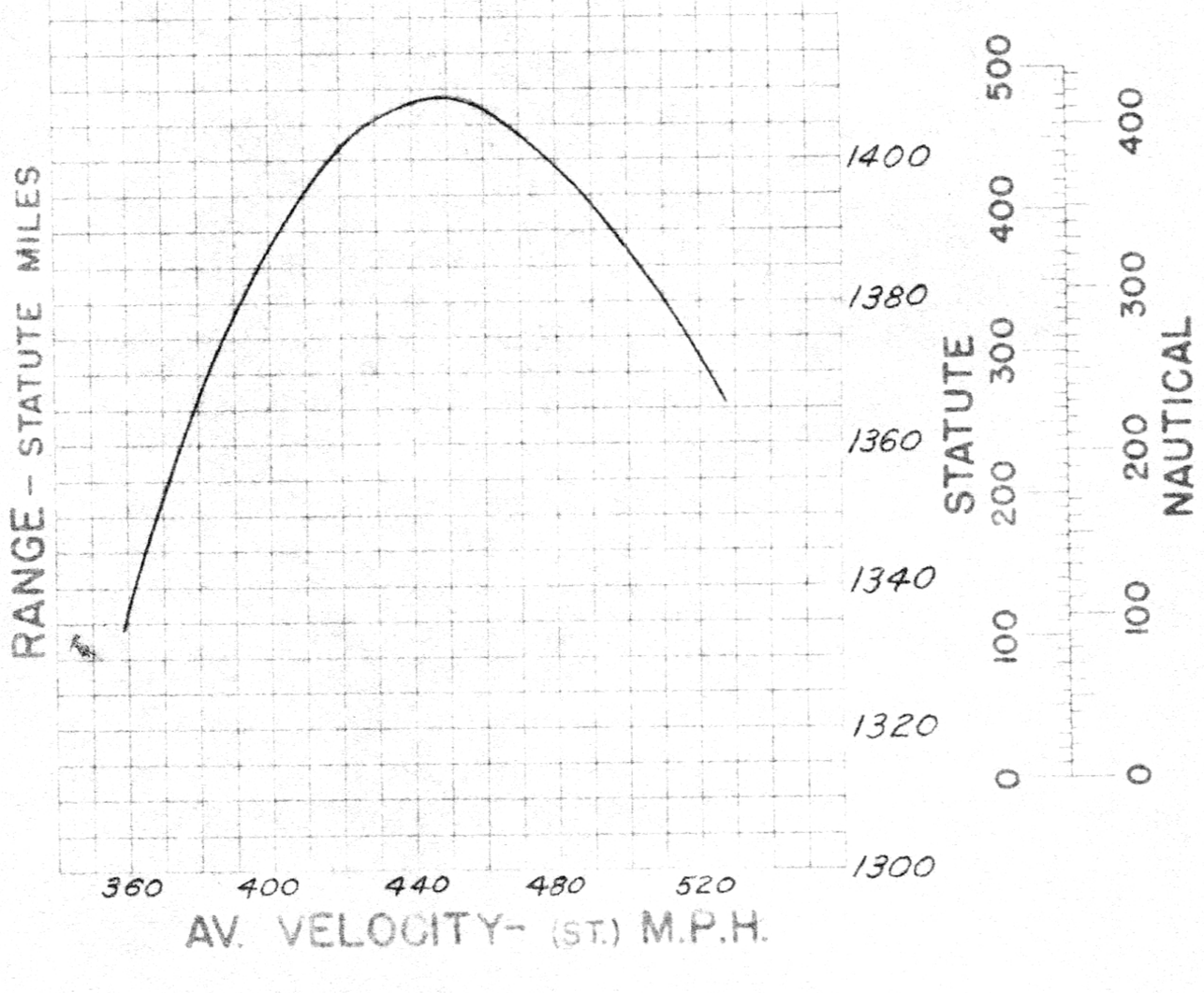
Performance is based on Proposed Guarantees. Range & Radius are based on NAVAER SR-152. OS-105 & SD-24-E. Fuel Consumption data increased by 7.5% to conform with past experience.

NOTE
STATUTE MILES USED EXCEPT RADIUS IS GIVEN IN NAUTICAL MILES & KNOTS
(1) **Static Thrust**
(2) STALL WITHOUT POWER - **Flaps Down**
(3) AT 30000' ALTITUDE

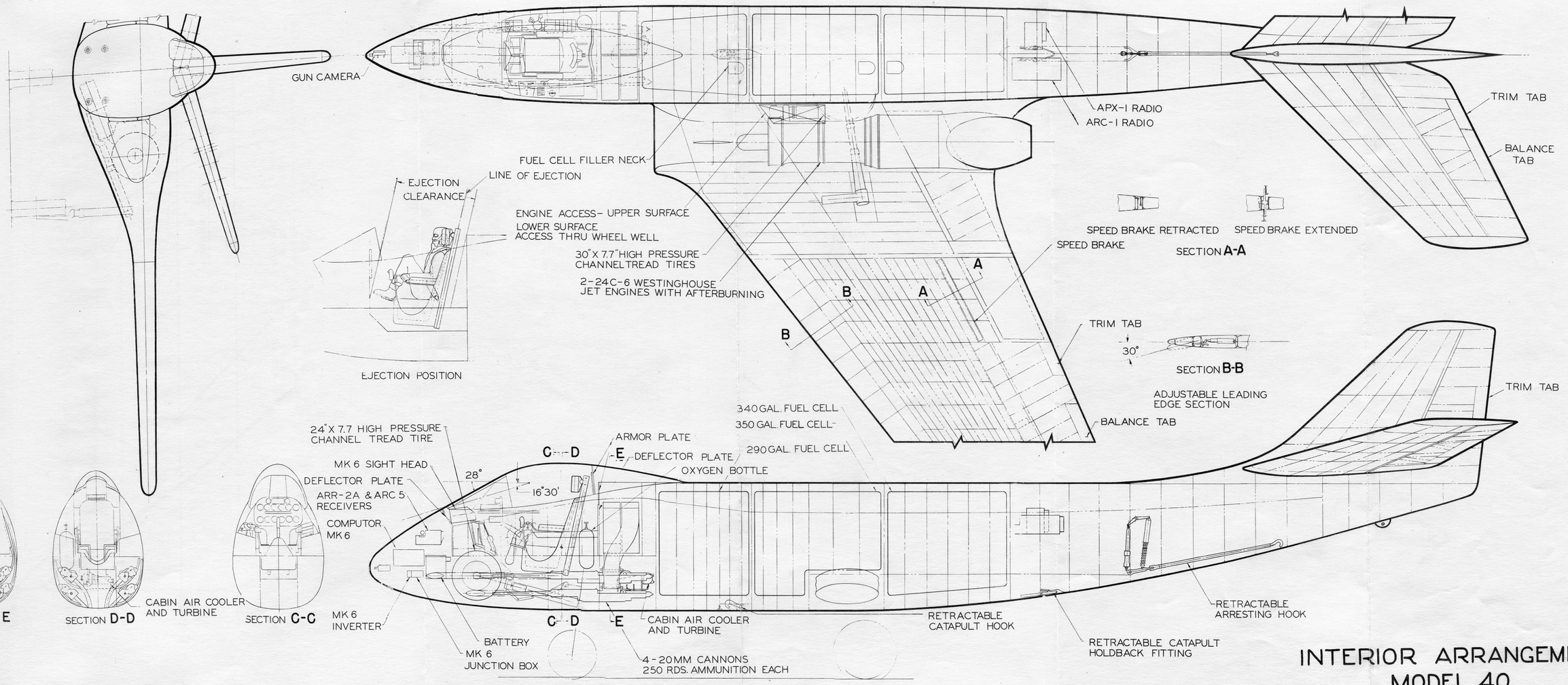
MCDONNELL AIRCRAFT CORP.







① LOADING CONDITION COLUMN NUMBER



INTERIOR ARRANGEMENT MODEL 40