

SD-261-4B
RESTRICTED

DETAIL SPECIFICATION

FOR

MODEL F4U-4 AIRPLANE

CLASS VF

(SINGLE ENGINE)

(SINGLE SEAT LANDPLANE)

INTRODUCTION

1a. This specification covers the requirements for the design of a single engine, single seat landplane fighter for use aboard aircraft carriers. This airplane shall be known as Model F4U-4 Airplane and is a development of Model F4U-1 Airplane.

1b. As a landplane, it shall take off from the deck of an aircraft carrier with or without the aid of a catapult and alight on the carrier deck in an arresting gear or on an ordinary landing field.

1c. The airplane shall not be designed for float type alighting gear.

1d. The airplane shall be designed for catapulting.

2a. General Specification for the Design of Airplanes for the United States Navy, No. SD-24-D dated 1 September 1935 and changes to 28 November 1940, form a part of this specification and shall be followed except as modified herein. The numbers of the paragraphs of this specification correspond to the numbers of the paragraphs of the General Specification.

3a. Material, process and design specifications in effect 28 November 1940, except as modified herein shall be considered part of this specification.

**12a. Deleted.

**12b. Deleted.

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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 (234 gallons)	12405
(b) Bomber (1-1000# class bomb, 384 gallons)	14562
(c) Fighter (384 gallons)	13529

**104a. The useful load as a carrier-fighter shall be as follows:

USEFUL LOAD		3163
CREW (pilot with parachute and life jacket)		200
FUEL (234 gallons)		1404
OIL (16 gallons)		120
FUEL & OIL (trapped)		154
WATER INJECTION MIXTURE (13.5 gallons)		101
ARMAMENT		1130.2
Fixed gun and sight installation (6-.50 cal. and 2400 rounds ammunition)	1125.7	
Provision for bomb installation	0	
Pyrotechnics	0	
Gun camera installation	4.5	
EQUIPMENT		54
Navigating	4.3	
1 set of charts	0.5	
1 Chartboard	2.8	
1 Plotting board	1.0	
Miscellaneous	49.5	
1 pararaft	22.0	
Oxygen equipment	27.5	

**104b. The useful load as a bomber with maximum fuel and oil and with one 1000 lb. class bomb shall be as follows:

USEFUL LOAD		5320
CREW (pilot)		200
FUEL (384 gallons)		2304
OIL (23.5 gallons)		176
FUEL & OIL (Trapped)		154
WATER INJECTION MIXTURE (13.5 gals.)		101
DROPPABLE FUEL TANK INSTALLATION		168
ARMAMENT		2162.9
Fixed gun and sight installation (6-.50 cal. and 2400 rds. ammu.)	1125.7	
Bomb installation (1-1000 lb. class)	1032.7	
Pyrotechnics	0	
Gun Camera installation	4.5	
EQUIPMENT (Same as 104a above)		54

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**104c. The useful load as a carrier-fighter with maximum fuel and oil shall be as follows:

USEFUL LOAD		
CREW (pilot)		4287
FUEL (384 gallons)		200
OIL (23.5 gallons)		2304
FUEL AND OIL (Trapped)		176
WATER INJECTION MIXTURE (13.5 gals.)		154
DROPPABLE FUEL TANK INSTALLATION		101
ARMAMENT		168
Fixed gun and sight installation (6 - .50 cal. and 2400 rds. ammu.)	1125.7	
Bomb installation	0	
Pyrotechnics	0	
Gun Camera installation	4.5	
EQUIPMENT (Same as 104s above)		54
		1130.2

**105a. The weight empty as a carrier landplane is estimated to be as follows:

WEIGHT EMPTY		
<u>Wing Group</u>		9242
Center Section		2185.5
Outer Panel	1146.2	
Tips	844.1	
Ailerons	6.6	
Flaps	74.1	
<u>Tail Group</u>	114.5	
Stabilizer		179.8
Elevator	78.0	
Fin	56.8	
Rudder	13.6	
<u>Body Group</u>	31.4	
Fuselage		1465.6
Alighting Gear	761.5	
Main Alighting Gear	704.1	
Auxiliary alighting gear	594.3	
<u>Engine Section Group</u>	109.8	
<u>Power Plant Group</u>		359.7
Engine (as installed)		4024.9
Engine Accessories	2537.0	
Power Plant Controls	285.5	
Propeller	60.7	
Starting System	644.6	
Water Injection System	29.7	
Tank	36.3	
Pump	14.2	
Piping and controls	11.3	
Lubricating System	10.8	
Tank		175.8
Piping, etc.	31.4	
<u>Fuel System</u>	144.4	
Tank and protection	169.9	255.3
Piping and etc.	85.4	

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**105a. (Continued)

<u>Fixed Equipment</u>		1026.3
Instruments	46.8	
Surface Controls	117.8	
Hydraulic System	125.0	
Electrical	195.5	
Communicating	131.7	
Armament Provisions	310.3	
Furnishings	57.5	
Auxiliary Gear	41.7	
Arresting Gear	41.7	

**106a. Unit Weights:

Weight of wing group per sq. ft. gross wing area (314 sq.ft.)	6.96
Weight of tail group per sq. ft. net tail area (79.9 sq. ft.)	2.25
Weight of lubricating system per gallon capacity (23.5 gals. oil)	7.48
Weight of fuel system per gallon capacity (maximum) (234 gals.)	1.09

107a. The power ratings shall be as specified in paragraph 503a.

**108a. Areas: (in accordance with Appendix 15).

Total wing area, including and including ailerons	37.7 sq. ft. fuselage	314sqft
Control surface areas:		
Ailerons (2 at 9.05)		18.10
Total stabilizer area (including 3.5 sq. ft. of fuselage area and 2.7 sq. ft. elevator balance)		36.0
Total elevator area aft of hinge, including 0.74 sq. ft. balance tab area and 1.36 sq. ft. trim tab area		21.9
Total fin area (including 1.66 sq. ft. of rudder balance) and 0.86 sq. ft. below the rudder		9.0
Total rudder area aft of hinge (0.85 sq.ft. tab area)		13.0
Total vertical tail area		22.0
Total horizontal tail area		57.9
Total flap area		36.4

**111a. The unit loadings shall be as follows:

	WING LOAD Lbs/Sq. Ft. (314)	POWER LOAD Lbs/BHP (1550)
(a) Fighter (234 gals.)	39.55	8.01
(b) Bomber (384 gals, & bombs)	46.40	9.40
(c) Fighter (384 gals.)	43.20	8.74

112a. The airfoil section shall be NACA-23016 for wing root and NACA-23009 for wing tip section.

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**113a. The performance is estimated to be as follows:

	<u>Fighter</u>	<u>Long Range Fighter</u>	<u>Bomber</u>
Bomb Load	None	None	1-1000
Gross Weight (lb.)	12,405	13,529	14,562
Fuel Quantity (gal.)	234	384	384
Fuel Weight (lb.)	1,404	2,304	2,304
High Speed @ Sea Level (knots)*	281	271	256
High Speed @ 8,100 ft. (knots)*	310	298	282
High Speed @ 9,600 ft. (knots)*	308	296	280
High Speed @ 23,100 ft. (knots)*	364	350	330
High Speed @ 25,500 ft. (knots)*	362	347	326
High Speed @ Max.Engine Rated Altitude 25,000 ft. (without ram)(knots)*	362	347	327
High Speed @ Airplane Critical Altitude 29,900 ft. (knots)*	383	366	344
High Speed @ Sea Level (knots)**	310	298	283
High Speed @ 3,500 ft. (knots)**	322	310	293
High Speed @ 8,000 ft. (knots)**	322	310	293
High Speed @ 23,000 ft. (knots)**	375	360	340
High Speed @ 25,800 ft. (knots)**	373	358	338
High Speed @ Max.Engine Rated Altitude 21,900 ft. (without ram)(knots)**	371	356	336
High Speed @ Airplane Critical Altitude 29,200 ft. (knots)**	387	370	348
High Speed @ Sea Level (knots)***	328	316	298
High Speed @ 1,500 ft. (knots)***	331	319	302
High Speed @ 5,000 ft. (knots)***	330	318	301
High Speed @ 20,000 ft. (knots)***	378	364	344
High Speed @ 22,500 ft. (knots)***	375	360	340
High Speed @ Max.Rated Altitude 19,900 ft. (without ram) (knots)***	378	364	344
High Speed @ Airplane Critical Altitude 26,200 ft. (knots)***	394	377	356
Stalling Speed @ Sea Level with Full Load without Power (knots)	78.3	81.7	84.6
Stalling Speed @ Sea Level with Full Load Less 1/2 Fuel without Power (knots)	76.0	78.0	81.3
Stalling Speed @ Sea Level with Full Load Less Fuel without Power (knots)	73.5	74.4	77.6
Stalling Speed @ Sea Level with Full Load with Minimum Power for Level Flight (knots)	69.9	73.0	75.6

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**113a. (Continued)

	Fighter	Long Range Fighter	Bomber
Initial Rate of Climb at Sea Level (ft./min.)*	2,580	2,230	1,900
Initial Rate of Climb at Sea Level (ft./min.)**	3,560	3,130	2,740
Initial Rate of Climb at Sea Level (ft./min.)***	4,360	3,900	3,470
Time to Climb to 10,000 ft. (min.)*	3.9	4.5	5.4
Time to Climb to 20,000 ft. (min.)*	8.0	9.4	11.3
Service Ceiling (ft.)*	40,850	38,350	35,550
Endurance at High Speed (hr.) (At max. rated altitude 25,000 feet.)	1.0	1.7	1.7
Endurance at 90% H.S. (hr.)	1.7	2.7	2.6
Endurance at 75% H.S. (hr.)	2.9	4.5	4.2
Endurance at 60% H.S. (hr.)	4.1	6.2	5.6
Max. Endurance at 7,000 ft. (hr.)	6.8	10.4	8.8
Max. Range at 7,000 ft. (naut. mi.)	950	1,480	1,260
Average Speed for Max. Range (knots)	160	162	162
Average Speed for Max. End. (knots)	121	121	121
Take-off Distance in Calm (ft.)***	685	844	1,013
Take-off Distance in 15-knot Wind (ft.)****	457	575	701
Take-off Distance in 25-knot Wind (ft.)****	324	415	514
Combat Radius (naut. mi.)	88	356	320
Normal Rated Power *			
Military Rated Power **			
Combat Power ***			
Take-off Power ****			

∅ Combat Radius shall be defined as follows:

- | | |
|---|---|
| (a) 20 minutes for warm-up and idling. | (h) Descend. |
| (b) 1 minute at rated take-off power. | (i) Cruise back at 1,500 at 170 knots true airspeed and automatic lean. |
| (c) 20 minutes for rendezvous at 60% normal S.L. power (nsp) and automatic lean. | (j) 60 minutes at V for max. range and automatic lean as allowance for rendezvous, landing and reserve. |
| (d) Climb to 15,000 ft. at 60% nsp and automatic lean. | Fuel consumption data have been increased by 15% in calculating endurance, range, and combat radius. |
| (e) Cruise out at V for max. Range and automatic lean. | |
| (f) Drop bombs and droppable tanks (if carried). | |
| (g) 20 minutes for combat at 15,000 ft. (10 min. at war emergency rated power and 10 min. at military rated power). | |

NOTES:

- (1) The above performance is based on critical altitudes obtained from flight test data.

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**113a. (Continued)

NOTES: (CONTINUED)

- (2) The above performance is based on the airplane with the engine specified in paragraph 503a and the propeller specified in paragraph 551b.
- (3) The above performance is calculated with all external armament and radio equipment as specified in place for each condition of loading.

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CHANCE VOUGHT AIRCRAFT - MODEL F4U-4 AIRPLANE

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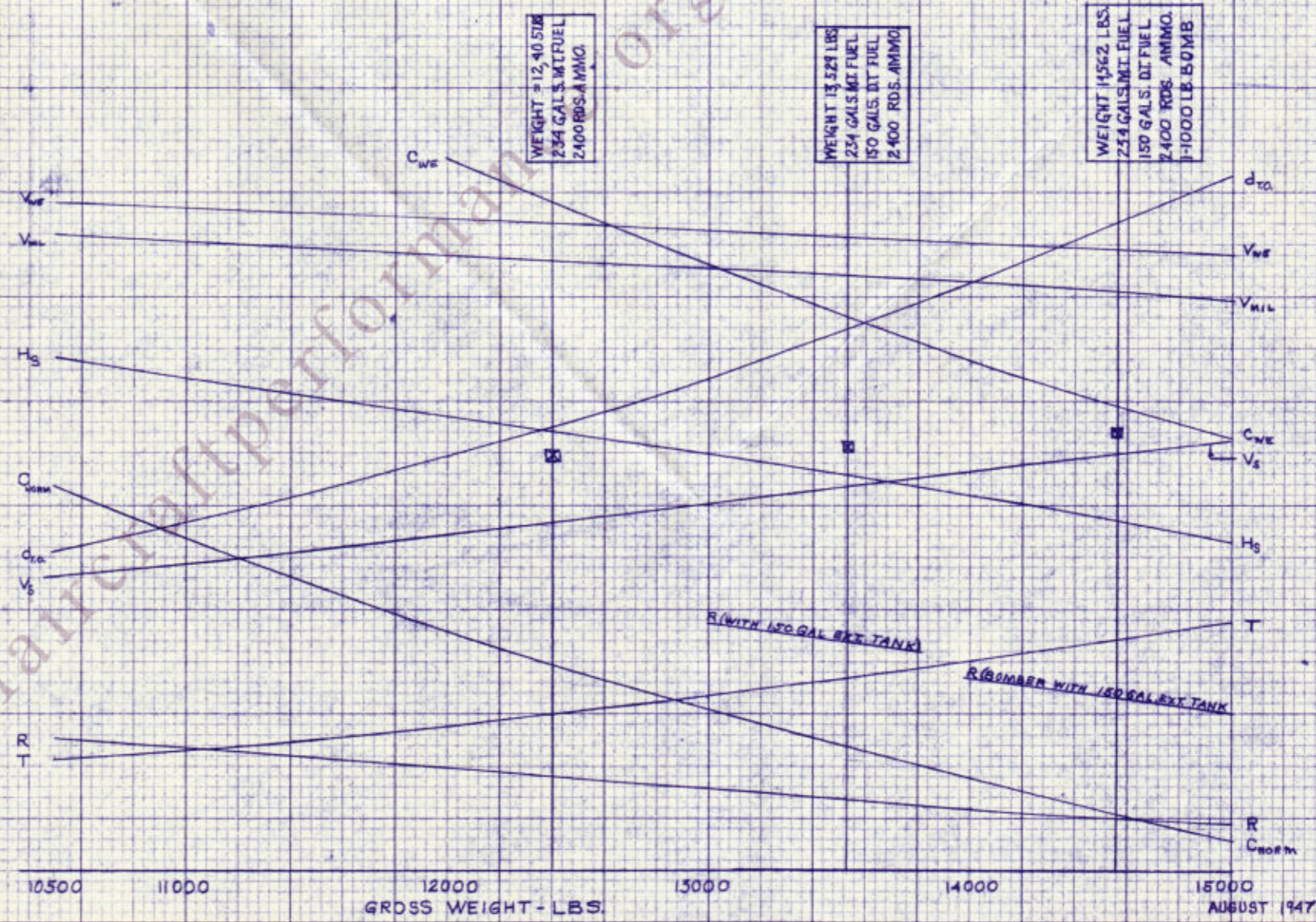
C - RATE OF CLIMB AT SL.
T - TIME TO CLIMB TO 20,000 FT.
 V_{MAX} - MIL @ AIRPLANE CRIT. ALT. 29,200 FT.
 V_{MAX} - WEP @ AIRPLANE CRIT. ALT. 26,200 FT.
R - RANGE @ 7000 FT.

H_S - SERVICE CEILING
 d_{TO} - TAKE-OFF DISTANCE
IN 25 KN WIND - FLAPS
DOWN
CG - C.G. LOCATION - WHEELS UP
 V_S - STALLING SPEED - KNOTS

VARIATION OF PERFORMANCE WITH GROSS WEIGHT.
ENGINE R-2600-18 W PROPPELLER HS 6501A 4-BLDS. 45 G.R. 13'2" DIA.

C	T	V_{MAX}	R	H_S	d_{TO}	V_S	C.G.
FT./MIN	MIN	KNOTS	NAUT. MILES	FEET	FEET	KNOTS	%MAC
4600		410			600		
4400		400			550	110	
4200	26	390			500	105	
4000	24	380		46000	450	100	
3800	22	370		44000	400	95	
3600	20	360		42000	350	90	32
3400	18	350		40000	300	85	31
3200	16	340	2000	38000	250	80	30
3000	14	330	1800	36000	200	75	
2800	12	320	1600	34000		70	
2600	10	310	1400	32000		65	
2400	8	300	1200	30000		60	
2200	6	290	1000				
2000	4	280	800				
1800	2	270	600				

DELTA PERFORMANCE DUE TO CHANGE IN DRAG CONDITION AT ANY WEIGHT		
	ADDITION OF 150 GAL. DROP TANK	ADDITION OF 150 GAL. DROP TANK AND 1000 LB. BOMB
Δ SERVICE CEILING	-600	-1700
Δ RATE OF CLIMB	-40	-110
ΔV_{MAX}	-14	-31
Δ TIME TO CLIMB TO 20,000 FT.	+0.2	+0.7



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**116a. The principal dimensions of the airplane are as follows:

Span: Wings (monoplane)	40'11.73"
Span: Wings folded	17'0.5"
Height; over cabin thrust line level (approx.)	11'4.4"
Height, over tail thrust line level (approx.)	14'9.3"
Height over propeller, three-point position	14'9.46"
Height to top of hoisting sling (approx.) (three-point position)	12'11.51"
Height, wings folded, three-point position	16'3.64"
Length (maximum)(approx.)	33'8.3"
Length from hoisting sling to the most aft part of tail thrust line level, rudder neutral, elevator down:(approx.)	24'0"
L.E.W. to c.g. (empty) 23.9% M.A.C (Wheels Down)	26.1"
L.E.W. to c.g. (fighter) (wheels down)	31.6"
L.E.W. to c.g. (fighter) (Long Range) (Wheels Down)	31.8"
Center of gravity, normal loading condition: (Wheels down)	
Horizontal location, %M A.C.	29.7%
Vertical location, below thrust line	8.2"
L.E.Wing to Rudder hinge line	20' 7.5"
L.E.Wing to elevator hinge line	23' 7.09"
Angle of line through c.g., and point of contact of wheels with normal to thrust line (approx.)	19° 24'
Angle between lines joining c.g., and points of contact of wheels (front elevation)	86°48'
Ground Angle	10° 59'
Dihedral (outer panel)	8.5°
Sweepback (leading edge outer panels)	4°10'
Chord at root section	105"
Chord at construction tip section	71.38"
Mean aerodynamic chord, inches	94.0"
Wing section and thickness; at root section (%Chord)	18%
at construction tip section (%chord)	9%
average - frontal area divided by wing area	16%
Geometric aspect ratio of the following:	
Wing cellule	5.35
Horizontal tail surfaces	4.70
Vertical tail surfaces	1.24
Aileron span	7'6"
Aileron chord, mean (aft of hinge)	14.3"
Wing incidence, at root section	2°
Clearance of wing at lowest point above ground, thrust line level	49.26"
Tail Span	16'6"
Stabilizer, incidence	1.25°
Wheel tread	12'1"
Wheel size	32" x 8"
Tire and tube size (main wheels)	32" x 8"

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**116a. (Continued)

Tail wheel tire	12.5" x 4.5"
Diameter of propeller (4 blades)(nominal dia. 13'0")	13' 2"
High lift device:	
Type of wing flap	NACA Slotted
Span of wing flaps (% of wing span):	46%
Flap chord aft of hinge, average (% of wing chord):	21%
Flap angle, maximum (degrees)	50°
Aileron droop, degrees	None
Propeller clearance, normal loading condition:	
Thrust line level	7.53"
Three-point attitude	22.7"

**117a. Angular movements for full movement of controls on each side of neutral: (as limited by the stops in the pilot's cockpit)

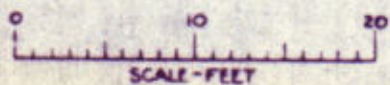
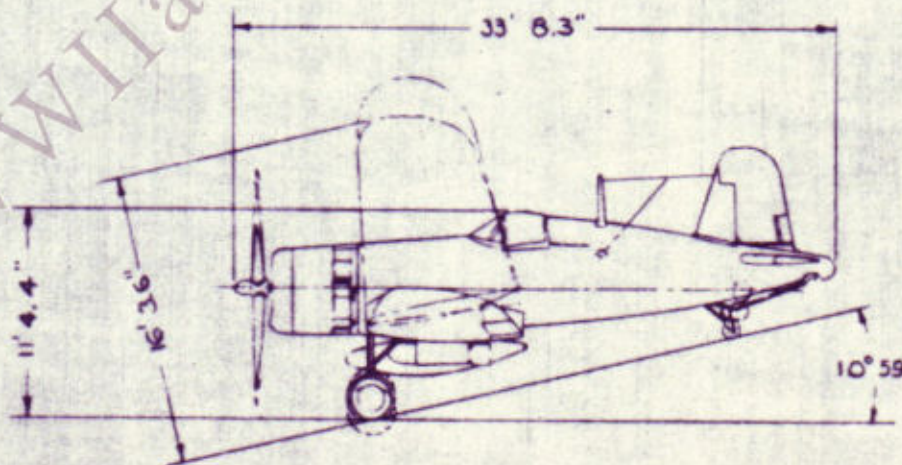
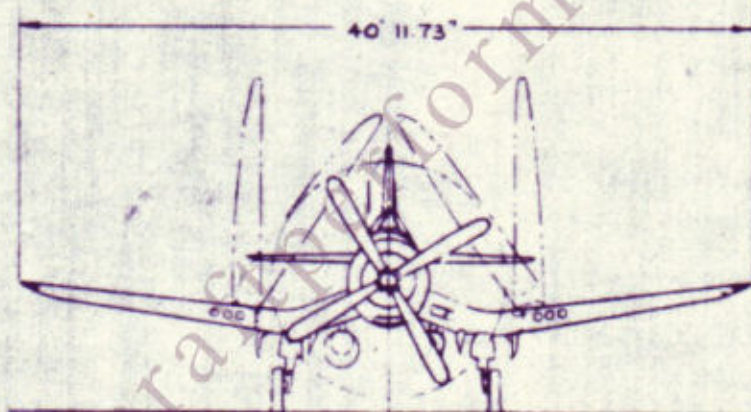
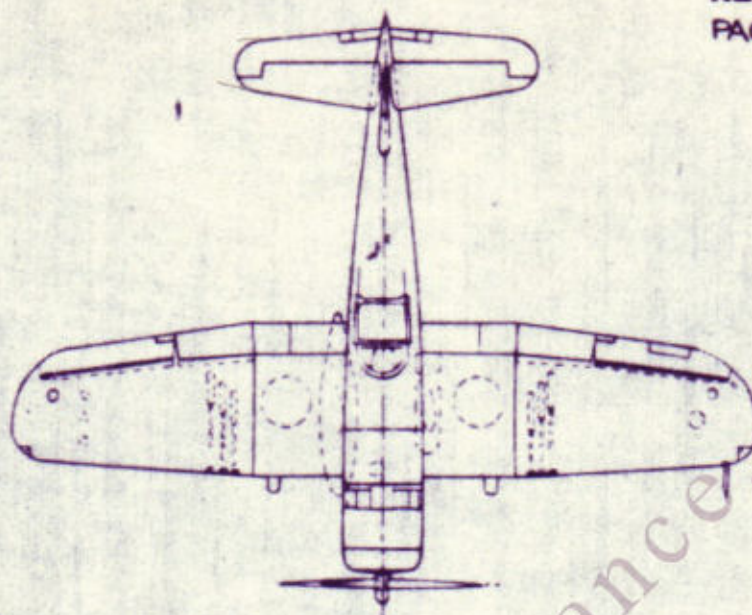
Rudder	25° right 25° left
Rudder pedal	4.4" aft, 4.4" forward
Elevator	23-1/2° above, 17° below
Elevator control	8" forward, 10" aft
Aileron	19° up, 14° down
Aileron control	9" right, 9" left
Rudder tab control	7-1/4 turns for 40° of tab
Aileron tab control	5-1/2 turns for 30° of tab
Elevator tab control	4.66 turns for 30° of tab
Rudder tab	18° right, 18° left
Elevator tab	10° up, 20° down
Aileron tab	15° up, 15° down
Flaps	50°
Flap control	Power operated

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