DETAIL SPECIFICATION

FOR

MODEL F4U-1 AIRPLANE

CLASS VF

(SINGLE ENGINE)

(SINGLE-SEAT LANDPLANE)

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INTRODUCTION

1 a. 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-1 airplane and is a development of model XF4U-1 airplane.

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

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

1 d. The airplane shall be designed for catapulting as a landplane.

2 a. 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.

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

12 a. Trial Board and other recommendations resulting from trials of model XF4U-1 airplane which are applicable to this airplane, shall be considered a part of this specification and shall be subject to weight, performance and cost adjustment.

**12 b. The following changes authorized for model F4U-1 airplane contract NOa (s) 198, shall be considered a part of this specification: A, B, C, D, F, G, H, I, J, K, L, M, N, P, Q, R, S, T, U, W, X, Y, Z and AC. The substance of these changes has been incorporated in the body of this specification.

12c. In addition to the contract changes called out in the preceding paragraph, the following modifications shall also be considered a part of this specification:

(a) Redesign ailerons and flaps (42.3#)
(b) Provide greater rigidity for aileron controls (19.0#)
(c) Provide greater stiffness in wing structure to avoid gun resonance (45.7#)
(d) Redesign gun access doors (3.0#)
(e) Provide self-sealing fuel cells that are resistant to aromatic fuel (52.8#)

**12d. "The following design changes which have not been made contract changes are incorporated in this specification:

1. Filter-Windshield cleaning
AQ 2. Installation of recognition lights
AD 3. Sealed-beam landing light.
BA 4. Installation of ATA/ARA radio
BA 5. Installation of IFF radio
6. Manually operated wing hinge pin lock
AL 7. Deletion of check-off switch
8. Removal of blast tube covers
9. Roller and bulkhead installation in ammunition boxes
10. Elimination of AN Mk 5 discharger
11. Provision for parachute type life raft instead of Mk1 type A.
AO 12. Installation of oil dilution system.
BJ 13. Pneumatic tail wheel installation
BB 14. Pressurized oil tank.
BR 15. Elimination of aileron droop
16. Elevator bungee linked to tail wheel retracting mechanism
17. Sealing and ventilating of space around main fuel tank
18. Redesign of cowl flap operating mechanism
19. Provision for 160 gal. droppable fuel tank
AX 20. Revised rear view mirror
21. Gun heating and windshield defrosting provision
22. Bombrack Mk41-2 Government installed instead of Contractor installed
23. Fixed guns contractor installed instead of Government installed.
AS 24. Elimination of ring and post auxiliary sight
AN 25. Installation and boresighting of gun camera
26. Oxygen equipment Government installed instead of contractor installed
AY 27. Revised armor protection
28. Boresight alignment rods-Provision of
AE 29. Elimination of fire extinguisher system."

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:

Fighter (178 gals.)	"11142"#
Bomber (2-100# bombs, 178 gals.)	"11399"#
Fighter (363 gals.)	"12656"#

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

USEFUL LOAD			"2390"#
CREW		200	
GASOLINE (178 gals.)		1068	
OIL (12 gals.) (in tank)		90	
OIL (11.7 gals.) (in system)		88	
ARMAMENT		"767"	
Fixed gun installation and sight (6-.50 cal., 1200 rds. and sight)	"762.7"		
Provision for bombs	0		
Pyrotechnics	"0"		
Gun Camera installation	"4.5"		
EQUIPMENT		"177"	
Communicating (radio)	"122.5"		
Navigating	4.3		
Miscellaneous	"50.2"		

NOTE: For detail distribution of weights see Appendix II-A.

**104b. The useful load as a bomber with two - 100# bombs shall be "2647" lbs. (Fuel and oil load same as 104a).

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

USEFUL LOAD			"3904"#
CREW (1)		200	
GASOLINE (363 gals.)		2178	
OIL (20 gals.) (in tank)		150	
OIL (11.7 gals.) (in system)		88	
ARMAMENT		"1111"	
Fixed gun installation (6-.50 Cal., 2350 rds. and sight)	"1106.5"		
Provision for bombs	0		
Pyrotechnics	"0"		
Gun Camera installation	4.5		
EQUIPMENT (SAME AS 104a ABOVE)		"177"	

**105a. The Weight Empty as a carrier landplane is estimated to be as follows:

Weight Empty			8752.4
Wing Group			2121.7
Center section		1088.0	
Intermediate panel-		0.0	
Outer panel		872.2	
Tips		6.6	
Ailerons		57.6	
Flaps		97.3	
Tail group			164.2
Stabilizer		67.6	
Elevator		55.1	
Fin		13.9	
Rudder		27.6	
Body group			1433.6
Fuselage		757.5	
Alighting gear		676.1	
Main alighting gear	581.1		
Auxiliary alighting gear	95.0		
Engine section group			307.4
Power plant group			3767.7
Engine (as installed)		2459.2	
Engine accessories		278.9	
Power plant controls		45.1	
Propellers		493.7	
Starting system		60.8	
Cooling system		0.0	
Lubricating system		143.2	
Tank	21.5		
Piping etc.	121.7		
Fuel system		286.8	
Tanks and protection	176.7		
Piping etc.	110.1		
Fixed Equipment group			957.8
Instruments		48.6	
Surface controls		139.9	
Hydraulic system		121.6	
Electrical		187.6	
Armament provision		336.0	
Furnishings		83.9	
Auxiliary gear		40.2	
Hoisting gear	0.0		
Arresting gear	40.2		

** 106a. Unit Weights:

Weight of wing group per sq. ft. gross wing area (314 sq. ft.)--"6.76"
Weight of tail group per sq. ft. net tail area (79.9 sq. ft.)---"2.05"
Weight of lubricating system per gallon capacity (20 gals. oil)-"6.66"
Weight of fuel system per gallon capacity (maximum)(363 gals.)--"0.79"

107a. The normal power rating for the Pratt & Whitney Model R-2800-8 two-stage, two speed engine is estimated to be 1675 HP from sea level to 500 ft. altitude at 2550RPM, 1625 HP at 2550 RPM at 15000 ft. altitude and 1550 HP at 2550 RPM at 21,500 ft. altitude with three blade propeller. For take-off the engine is rated at 2000 HP at 2700 RPM. The gear ratio is 2 to 1.

107b. For military rating see paragraph 503a.

108a. Areas: (in accordance with Appendix XV).

Total wing area including 37.7 sq. ft. fuselage and including ailerons 314 sq. ft.

Control surface areas:

Ailerons (2 at 9.05)	18.1
Total stabilizer area (including 4.7 sq. ft. of fuselage area and 2.7 sq. ft. elevator balance.)	36.0
Total elevator area aft of hinge including .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 .86 sq. ft. below the rudder	9.0
Total rudder area aft of hinge (.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)
Fighter (178 gals.)	"35.48"	"7.19"
Bomber (178 gals. and bombs)	"36.30"	"7.36"
Fighter (363 gals. maximum)	"40.31"	"8.17"

112a. The airfoil section shall be NACA-23018 for wing root and NACA-23009 for wing tip section.

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

		FIGHTER (NORMAL)	BOMBER	FIGHTER OVERLOAD
Fuel, gals.		178	178	363
Gross Weight, lbs.		11,142	11,399	12,656
High speed at sea level, mph	For Normal Engine Rating	311	301	310
High speed at 7,400 ft., mph		336	324	333
High speed at 8,250 ft., mph		333	321	330
High speed at 20,000 ft., mph		378	363	373
High speed at 21,100 ft., mph		375	359	370
High speed at maximum engine rated alt., 21,500 ft. mph		376	361	372
High speed at airplane critical altitude, 24,350 ft., mph		388	373	383
High speed at airplane critical altitude, 22,900 ft., mph	For Military Engine Rating	388	373	383
Stalling speed at sea level with full load, mph	Without Power	82.4	83.3	87.8
Stalling speed at sea level with full load, mph	*With Power	74.1	75.1	79.0
Stalling speed at sea level with full load less fuel, mph		70.5	71.5	71.9
Stalling speed at sea level with full load less 1/2 fuel, mph		72.3	73.2	75.5
Initial rate of climb at sea level, ft/min.		2890	2760	2400
Time to climb to 10,000 ft., min.		3.65	3.87	4.47
Time to climb to 20,000 ft., min.		8.06	8.59	9.99
Service ceiling, ft.		36,200	35,450	33,350
Endurance at high speed, hrs.	At 21,500 ft.	.86	.86	1.76
Endurance at 90% high speed, hrs.		1.40	1.39	2.98
Endurance at 75% high speed, hrs.		2.61	2.60	5.38
Endurance at 60% high speed, hrs.		3.76	3.71	7.37

Continued.

		FIGHTER NORMAL *	BOMBER *	FIGHTER OVERLOAD
Maximum endurance, hrs.	At 5,500 ft.	5.05	5.05	10.3
Maximum range, miles	At 5,500 ft.	965	900	1850
Average speed for max. range, mph	At 5,500 ft.	191	178	179.5
Average speed for max. endurance, mph	At 5,500 ft.	191	178	179.5
Take-off distance in calm, ft.		482	507	664
Take-off distance in 15-kn. wind, ft.		313	332	447
Take-off distance in 25-kn. wind, ft.		217	232	318

* Approximately 400 BHP (2200 RPM at 17" hg manifold pressure)

NOTES:

1. The airplane critical altitude is defined as the altitude at which the engine in the airplane delivers rated horsepower at full throttle and rated rpm.
2. The above performance is based on rated engine powers as given in paragraph 503a of SD-261-1-1B, with critical altitudes from flight test data, and with the propeller specified in paragraph 551b.

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

Span: Wings (monoplane)	40' 11.73"
Span: Wings folded	17' 0.61"
Height, over cabin thrust line level (approx.)	11' 4.04"
Height, over tail thrust line level (approx.)	15' 3.85"
Height over propeller, three-point position	15' 0.21"
Height to top of hoisting sling (approx.)	11' 10.14"
Length (maximum)	33' 4.13"
Length from hoisting sling to the most aft part of tail thrust line level, rudder neutral, elevator down.	24' 6.89"
L.E.W. to c.g. (empty) 23.6% M.A.C. (wheels down)	25.8"
L.E.W. to c.g. (Fighter) (wheels down)	32.3"
L.E.W. to c.g. (Fighter-Overload) (wheels down)	32.34"
Center of gravity, normal loading condition: (wheels down)	
Horizontal location, % M.A.C.	30.6%
Vertical location, below thrust line	9.06"
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°12'
Angle between lines joining c.g. and points of contact of wheels (front elevation)	78°16'
Ground angle	12°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	51.76"
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"
Tail wheel tire	~~18.5" x 4.5"~~ 12½" x 4½"
Diameter of propeller (3blades) (nominal dia.13'3")	13' 4"
High lift device:	
Type of wing flap	NACA Slotted
Span of wing flaps (% of wing span):	46%
Flap chord aft of hinge, average (% wing chord)	21%
Flap angle, maximum (degrees)	50°

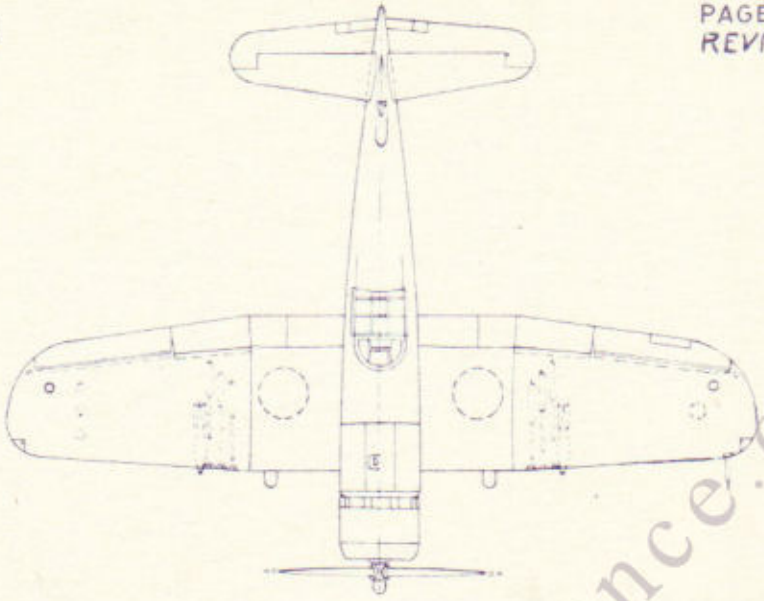
**Aileron droop, degrees	none
Propeller clearance, normal loading condition:	
Thrust line level	9.1"
Three-point attitude	25.93"

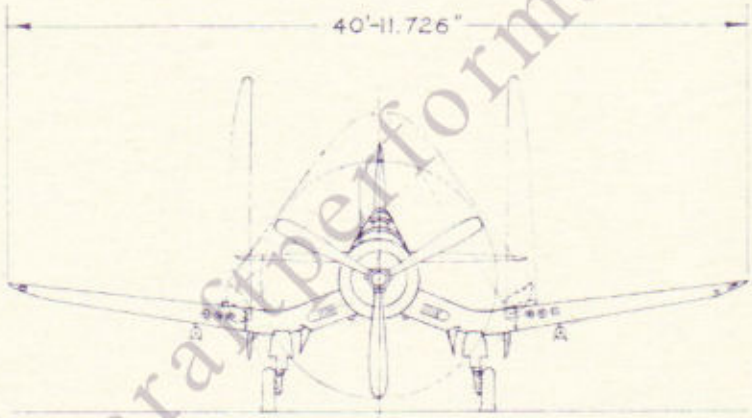
** 117a. Angular movements for full movement of controls on each side of neutral: (as limited by the stops in the pilot's cockpit).

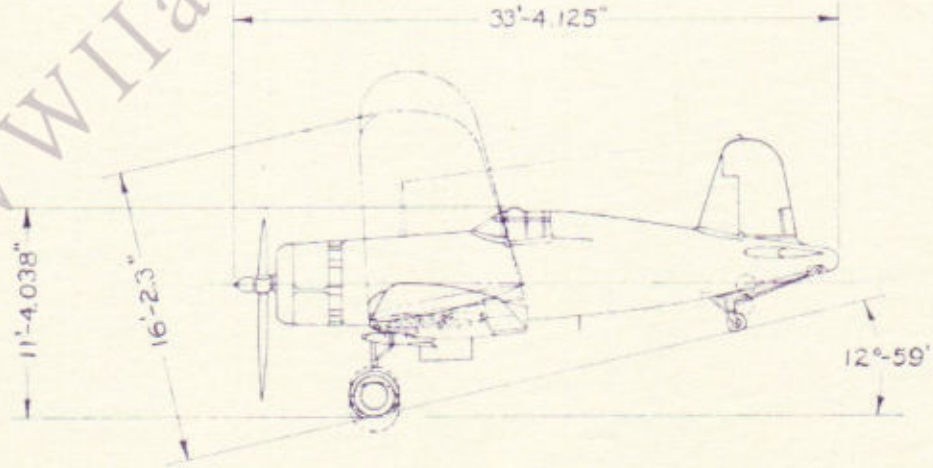
Rudder	25° right 25° left
Rudder pedal	4.4" aft, 4.4" forward
Elevator	24° above, 16° below
Elevator control	6-1/2" forward, 11-1/4" aft
Aileron (normal)	19° up, 14° down
Aileron control	10-1/4" right, 10-1/4" left
Rudder tab control	7-1/2 turns for 40° of tab
Elevator tab control	4.66 turns for 30° of tab
Aileron tab control	5-1/2 turns for 30° of tab
Rudder tab	20° right, 20° left
Elevator tab	10° up, 20° down
Aileron tab	15° up, 15° down
Flaps	50°
Flap control	power operated

SD 261-1-1B

REPORT NO. 6195
PAGE 9a
REVISED 4-1-43







MODEL F4U-1

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SCALE-FEET

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