DETAIL SPECIFICATION
FOR
MODEL F4F-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 carrier, to be known as Model F4F-4 Airplane, which airplane shall be similar to Model F4F-4 Airplane manufactured under Contract 75736.

1b. 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.

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

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

2a. General Specification for the Design and Construction of Airplanes for the United States Navy, No. SD-24-D, dated 1 September 1935, and changes to date of invitation to bid, 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.

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** 12a. ** This specification includes the following contract changes, issued to date of 5 February 1942, for the Model F4F-3 and F4F-4 airplanes on Contract 75736: A, B, C, D, F(b)(c)(d)(e)(g)(h), H(a)(d), I, L, N, N-1, N-2, N-3, N-4, N-5(a), N-6, N-8, N-9, N-10, N-11, N-12, N-13, and N-15; on Contract 95340: A, B, D, F, H, I and Pending Changes noted in Appendix XXXIV.

12b. Trial Board and other recommendations resulting from trials of Model F4F-4 Airplane on Contract 75736, that are applicable to this airplane, shall be considered a part of this specification. The guaranteed weight empty shall be adjusted by any increase or decrease in weight due to Trial Board changes.

17a. No deviation from this specification shall be permitted unless approved by the Bureau of Aeronautics.

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Archives of Michael Williams

GRUMMAN AIRCRAFT ENGINEERING CORPORATION
PART I

CHARACTERISTICS

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

** 102a. The gross weights are estimated to be as follows: (with armor plate and fuel and oil protection)

- Fighter (110 gals.) 7426#
- Bomber (2-100# class bombs)(110 gals.) 7424#
- Fighter (144 gals. maximum) 7972#

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

USEFUL LOAD

CREW 200#
GASOLINE (110 gals.) 660#
OIL (9 gals.) 68#
ARMAMENT 554.2#
  Fixed gun installation (4-.50 cal. guns) (800 rds.) 528.7#
  Provision for bombs 0#
  Pyrotechnics 11.8#
  Gun camera 13.7#
EQUIPMENT 164.9#
  Communicating 113.2#
  Navigating 4.5#
  Miscellaneous 47.2#

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

** 104b. The useful load as a bomber with 2-100# class bombs, 2-.50 cal. guns (400 rounds) and 110 gallons of fuel shall be 1644.6 pounds.

** 104c. The useful load as a fighter with 144 gallons of fuel (maximum), 11 gallons oil (maximum) and six .50 cal. guns (1440 rounds shall be 2193.6 pounds.
** 105a. The weight empty as a carrier landplane in the combat condition is estimated to be as follows:

**WEIGHT EMPTY**

**Wing Group**
- Wings: 1030
- Ailerons: 38
- Flaps: 43
- Fuselage carry-through structure: 70

**Tail Group**
- Stabilizer: 65
- Elevator: 47
- Fin: 15
- Rudder: 23

**Body Group**
- Fuselage, less engine section: 517
- Allighting gear - land type: 351
- Main allighting gear: 286
- Retracting mechanism: 33
- Auxiliary allighting gear: 32

**Engine Section Group**
- Engine (as installed): 1568
- Engine accessories: 242
- Power plant controls: 25
- Propeller: 315.5
- Starting system: 43
- Lubricating system: 35
- Tanks (11 gals.): 10
- Piping, etc.: 25
- Fuel system: 264.5
- Tanks (144 gals.) (with fuel tank protection): 200
- Piping, fittings, electric pump, etc.: 64.5

**Fixed Equipment**
- Instruments: 61
- Surface controls: 161.5
- Furnishings: 195.9
- Electrical equipment: 143
- Hoisting gear (provision only): 1
- Arresting hook installation: 29
- Armor plate: 162.5

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**106a. Unit weights:**
- Weight of wing group per sq. ft. net wing area (222 sq. ft.): 5.32
- Weight of tail group per sq. ft. net tail area (70 sq. ft.): 2.11
- Weight of lubricating system per gallon capacity (11 gals. oil): 3.18
- Weight of fuel system per gallon capacity (144 gals.) (maximum): 1.94
107a. The horsepower ratings for the Pratt and Whitney R-1330-86 engine shall be as specified in paragraph 503a.

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

Total wing area including 37.6 sq. ft. of fuselage and stub and ailerons

Control surface areas:
- Ailerons (2 at 6.63)
- Total stabilizer area (including 1.8 sq.ft. fuselage and 4.96 sq.ft. elevator balance)
- Total elevator area aft of hinge (including 2.32 sq.ft. of tabs)
- Total fin area (including 2.36 sq.ft. rudder balance)
- Total rudder area aft of hinge (including 0.56 sq.ft. of tab)
- Total vertical tail area
- Total horizontal tail area
- Total flap area (2 at 14.85 sq.ft.)

260

280.25

30.43

30.2

18.62

13.2

9.38

22.58

49.05

29.70

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

| Fighter (110 gals.) | 28.56 | 7.43 |
| Fighter (144 gals. maximum) | 30.66 | 7.97 |

112a. The airflow section for the wings shall be NACA 23015 at fuselage tapered to NACA 23009 at tips.
The performance is estimated to be as follows; (to be submitted by the contractor and to be consistent with guarantees)

<table>
<thead>
<tr>
<th></th>
<th>Normal Fighter</th>
<th>Bomber</th>
<th>Overload Fighter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel (gals.)</td>
<td>110</td>
<td>110</td>
<td>144</td>
</tr>
<tr>
<td>Gross weight (lbs.)</td>
<td>7426</td>
<td>7424</td>
<td>7972</td>
</tr>
<tr>
<td>High speed at sea level (MPH)</td>
<td>275.0</td>
<td>255.1</td>
<td>274.4</td>
</tr>
<tr>
<td>High speed at 2500 ft. (MPH)*</td>
<td>291.8</td>
<td>271.8</td>
<td>281.1</td>
</tr>
<tr>
<td>High speed at 4000 ft. (MPH)*</td>
<td>283.1</td>
<td>273.0</td>
<td>282.7</td>
</tr>
<tr>
<td>High speed at 12,000 ft. (MPH)*</td>
<td>303.2</td>
<td>293.2</td>
<td>302.4</td>
</tr>
<tr>
<td>High speed at 14,000 ft. (MPH)*</td>
<td>304.5</td>
<td>294.3</td>
<td>303.8</td>
</tr>
<tr>
<td>High speed at max. engine rated alt. 19,000 ft. (MPH)</td>
<td>317.0</td>
<td>307.1</td>
<td>315.0</td>
</tr>
<tr>
<td>High speed at airplane critical alt. 19,400 ft. (MPH)</td>
<td>318.0</td>
<td>308.2</td>
<td>316.1</td>
</tr>
<tr>
<td>Stalling speed at sea level with full load and without power (MPH)</td>
<td>78.4</td>
<td>78.5</td>
<td>81.3</td>
</tr>
<tr>
<td>Stalling speed at sea level with full load less fuel (MPH) without power</td>
<td>75.0</td>
<td>74.9</td>
<td>75.8</td>
</tr>
<tr>
<td>Stalling speed at sea level less 1/2 fuel with out power</td>
<td>76.7</td>
<td>76.6</td>
<td>79.1</td>
</tr>
<tr>
<td>Initial rate of climb at sea level (ft./min.)</td>
<td>1920</td>
<td>1810</td>
<td>1690</td>
</tr>
<tr>
<td>Time of climb to 10,000 ft. (min.)</td>
<td>5.7</td>
<td>6.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Time of climb to 20,000 ft. (min.)</td>
<td>12.7</td>
<td>13.1</td>
<td>14.7</td>
</tr>
<tr>
<td>Service ceiling (ft.)</td>
<td>34800</td>
<td>34600</td>
<td>33600</td>
</tr>
<tr>
<td>Endurance at high speed (hr.)</td>
<td>.9</td>
<td>.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Endurance at 90% high speed (hr.)</td>
<td>1.4</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Endurance at 75% high. speed (hr.)</td>
<td>2.7</td>
<td>2.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Endurance at 60% high speed (hr.)</td>
<td>3.9</td>
<td>3.8</td>
<td>5.0</td>
</tr>
<tr>
<td>Maximum endurance (feet)</td>
<td>4.2</td>
<td>4.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Maximum range (mi.)</td>
<td>765</td>
<td>706</td>
<td>925</td>
</tr>
<tr>
<td>Average speed for maximum range (MPH)</td>
<td>190.5</td>
<td>186.0</td>
<td>192.0</td>
</tr>
<tr>
<td>Average speed for maximum endurance (MPH)</td>
<td>162.5</td>
<td>164.0</td>
<td>163.7</td>
</tr>
<tr>
<td>Take-off distance in calm (ft.)</td>
<td>605</td>
<td>605</td>
<td>710</td>
</tr>
<tr>
<td>Take-off distance in 15-knot wind (ft.)</td>
<td>378</td>
<td>378</td>
<td>450</td>
</tr>
<tr>
<td>Take-off distance in 25-knot wind (ft.)</td>
<td>256</td>
<td>256</td>
<td>310</td>
</tr>
</tbody>
</table>

*The high speed values necessary for a plot of high speed vs. altitude up to the maximum engine rated altitude shall be given. If less than four high speed values in addition to the speed at sea level and at maximum engine rated altitude are required for such a plot, high speed values at altitudes above the airplane critical altitude shall be given. The airplane critical altitude is defined as the altitude at which the engine in the airplane delivers rated horsepower at full throttle.

NOTE: The above performance is based on the results of flight tests conducted on the first F4F-4 Airplane with the assumption that the engine in this first airplane developed the power rating of paragraph 505a. The above performance is with all external armament and radio equipment in place for each condition of loading.
The principal dimensions of the airplane are as follows:

- **Span:** Wings (monoplane) 33' 0"
- **Span:** Wings folded 14' 6"
- **Height, over cabin thrust line level (approx.):** 9' 10"
- **Height, over propeller, three-point position:** 11' 9"
- **Height, over tail thrust line level (approx.):** 11' 11"
- **Height to top of hoisting sling (approx.):** 9' 11"
- **Length (maximum):** 28' 10-5/8"
- **Length from hoisting sling to furthest aft part of tail, thrust line level, rudder neutral, elevator down:** 20' 7"
- **L.E.W. to c.g. (empty) (wheels up):** 20.48"
- **L.E.W. to c.g. (bomber) (wheels up):** 27.17"
- **L.E.W. to c.g. (fighter - overload) (wheels up):** 25.57"
- **Center of gravity, normal loading condition:**
  - Vertical location, above thrust line: 2.03"
  - Horizontal distance from rudder hinge line: 18' 2.2"
  - Horizontal distance from elevator hinge line: 18' 3.3"
- **Angle of line through c.g. and point of contact of wheels with normal to thrust line (approx.):** 17°
- **Angle between line joining c.g. and points of contact of wheels (front elevation):** 58° 30'
- **Ground angle:** 12° 20'
- **Dihedral (outer panel):** 5°
- **Sweepback (leading edge):** None
- **Chord at root section:** 98"
- **Chord at construction tip section:** 84.14"
- **Mean aerodynamic chord, inches:** 61.44"
- **Wing section and thickness, at root section (% chord):** 15% (NACA 23015)
- **Wing section and thickness, at construction tip section (% chord):** 9% (NACA 23009)
- **Average - (frontal area divided by wing area):** 0.1073
- **Effective aspect ratio of the following:**
  - Wing cells: 5.56
  - Horizontal tail surfaces: 3.8
  - Vertical tail surfaces: 1.21
  - Aileron span (approx.): 51"-0"
  - Aileron chord, mean: 1" 3'-29/32"
  - Wing incidence at root section: 0°
  - Clearance of wing at root above ground thrust line level (approx): 3' 10-1/2"
  - Tail span: 15' 8"
  - Stabilizer, incidence: 1-1/2°
  - Wheel tread: 6' 4-31/32"
  - Wheel size: 26" x 6"
  - Tail wheel tire: 6" x 2-1/2"
- **Diameter of propeller (3 blades):** 9' 9"
- **High lift device:**
  - Type of wing flap: Split
  - Span of wing flaps (% of wing span): 53%
  - Flap chord aft of hinge, average (% wing chord): 25%
  - Flap angle, maximum: 43°
  - Aileron droop: 0°
- **Propeller clearance, normal loading condition:**
  - Thrust line level: 8'-3/4"
Angular movement for full movement of control each side of neutral: (as limited by the stops in the pilot's cockpit)

Rudder
Rudder pedal
Elevators
Elevator control
Ailerons
Aileron control
Elevator tab control
Elevator tabs
Rudder tab control
Rudder tabs
Aileron tab control
Aileron tab (left hand only)

31 degrees right, 31 degrees left
3-3/4 inches forward, 3-7/8 inches aft
26 degrees above, 20 degrees below
7-7/16 inches forward, 12-3/32 inches aft
17 degrees above, 12-3/32 degrees below
8-15/16 inches right, 8-15/16 inches left
6-3/4 turns of handle for 16-3/4 degrees of tab movement
5°-54' up, 10°-51' down
8-1/2 turns of handle for 38-3/4 degrees of tab movement
28°-19' left, 16°-26' right
8/9 turns of handle for 40 degrees of tab movement
20 degrees up, 20 degrees down