

CONFIDENTIAL

SUBJECT: MAXIMUM SPEED OF F4U-1 AIRPLANE #02334  
("CLEANED-UP" VERSION) ON WAR EMERGENCY  
POWER RATINGS

DATE: Feb. 8, 1943

NO: EM 7516

TO: Mr. C. J. McCarthy

cc: Messrs. Beisel  
Shoemaker  
Clark  
Baker (2)

Files: F4U-1 Performance  
F4U-1 Engine  
EM Numerical

1. Two speed runs were made on F4U-1 #02334 on January 31, 1943, with the airplane operating on war emergency power and in the following condition:

- (a) Water injection equipment installed to obtain war emergency power rating. Pratt & Whitney estimate rating (without ram) to be 2000 bhp/2700 rpm/19000 feet and limit manifold pressure to 58 in.Hg. The estimated ram is approximately 2800 feet which results in an estimated airplane critical altitude of 21800 feet.
- (b) Equipped with a 4-blade 13.0 ft. propeller (Hamilton Standard No. 6501A-0) with 0.4 gear ratio instead of a 3-blade 13.25 ft. propeller (Hamilton Standard No. 6443A-21) with 0.5 gear ratio.
- (c) Gross weight of the airplane was 11400 pounds with 230 gallons of gas as compared to the normal F4U-1 weight of approximately 11100 pounds with 178 gallons of gas. Time did not permit making the weight reduction changes.
- (d) The airplane was "cleaned-up" aerodynamically. Considerable effort was made to reduce the drag by either removing drag-producing items or fairing them, sealing doors and plates against air leakage, and using filler to obtain smooth surfaces. Six guns were installed with blast tubes open, and the radio mast and antenna were in place.

2. The two speed runs (Flight No. 4) made on war emergency power yielded the following results:

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	Run #1	Run #2
Indicated Airspeed, knots	261.5	284
V <sub>o</sub> 1/2, m.p.h.	295	298
Pressure Altitude, ft.	23825	23340
Engine, r.p.m.	2696	2696
Manifold pressure, in.Hg.	51.9	54.0
Throttle Setting	Full	Full
Atmospheric Temperature, °C	-32.5	-30.2
NACA Standard Air Temperature, °C	-32.2	-30.2
Carburetor Air Temperature, °C	28	30
B.hp. (from torquemeter)	1715	1740
True Airspeed, m.p.h.	431	428

3. For a limiting manifold pressure of 58.0 in.Hg. (see paragraph 1) and an engine r.p.m. of 2700, the above data indicate that an approximate rating of 1875 b.hp./2700 r.p.m./21400 feet with ram is obtainable. This rating is low on power and altitude as compared to the Pratt & Whitney estimate of 2000 b.hp./2700 r.p.m./19000 2800 (VSA estimated ram). Data obtained on normal F4U-1 flight tests indicate the estimated ram is reasonable.

4. On this rating of 1875 b.hp./2700 r.p.m./21400 feet, the estimated maximum speed of the airplane is 432 m.p.h. under standard conditions. On the rating of 2000 b.hp./2700 r.p.m./21800 feet the estimated maximum speed is 442 m.p.h.

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Aerodynamics Section

(Jarrett)/d



FEB 9 1943

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**SUBJECT:** FACTORS RESPONSIBLE FOR INCREASE IN MAXIMUM SPEED OF F4U-1 AIRPLANE #02334 ("CLEANED-up" VERSION) OVER STANDARD F4U-1

**DATE:** 2/8/43  
**NO:** EM 7520

**TO:** Mr. C. J. McCarthy

**cc:** Messrs. Beisel  
Shoemaker  
Clark  
Baker (2)

**File:** F4U-1 Performance  
F4U-1 Engine  
EM Numerical

Reference (a) EM 7516 dated February 8, 1943

1. As given in reference (a), the maximum speed of F4U-1 airplane #02334 (special "cleaned-up" version) is estimated to be 442 m.p.h. on 2000 bhp/2700 rpm/19000 ft. (ram), the Pratt & Whitney estimated rating. On 1875 bhp/2700 rpm/21400 ft., the expected rating on the basis of our flight tests to date, the estimated maximum speed is 432 m.p.h.

2. The maximum speed of a standard F4U-1 from our flight test to date is 394 m.p.h. on normal power rating, 1650 bhp/2700 rpm/25000 ft. (with ram). The estimated maximum speed of a standard F4U-1 on military rating (1650 bhp/2700 rpm/25300 ft. (with ram)) is 404 m.p.h. The powers and speeds and the factors responsible for the increase in maximum speed of F4U-1 airplane #02334 over the standard F4U-1 follow:

<u>Brake Horsepowers &amp; Speeds</u>			
F4U-1 Airplane #02334, max. speed on war emergency rating	432	1875 bhp/2700 rpm/21400'	442 2000 bhp/2700 rpm/21800'
Standard F4U-1, maximum speed* on military rating	404	1650 bhp/2700 rpm/25300'	404 1650 bhp/2700 rpm/25300'
<u>Δ V max. Breakdown</u>	<u>Δ V max., mph</u>		<u>Δ V max., mph</u>
Δ Altitude	25300' to 21400'	-14	25300' to 21800' -13
Δ Brake horsepower	1650 to 1875 bhp	+18	1650 to 2000 bhp +26
Δ Propulsive efficiency	Δ 3.6%	+ 5	Δ 3.6% + 5
Δ Jet horsepower	Δ 30 hp	+ 3	Δ 44 hp + 4
Δ Drag*	Δ k <sub>x</sub> = -.0020	+16	Δ k <sub>x</sub> = -.0020 +16
	Δ m.p.h. =	+28	+38
		404	404
Maximum speed, F4U-1 #02334, m.p.h.		432	442

\*See next paragraph for detailed drag breakdown.

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3. The detailed drag improvement of airplane #02334 over a standard production F4U-1 is shown in Column A. Column B shows what might be obtained by practical drag improvements (improved design and workmanship) to a standard production F4U-1.

	<u>A</u> <u>ΔV mph</u>	<u>B</u> <u>ΔV mph</u>
(1) Fair arresting hook cut-out	+ 0.6	+ 0.6 (a)
(2) Fair fuselage access doors	+ 0.6	+ 0.2
(3) Remove catapult hooks	+ 2.4	+ 2.4 (a)
(4) Fair wing irregularities	+ 4.5	+ 2.2
(5) Remove wing walkways	+ 6.4	+ 6.4
(6) Smoother surface (entire airplane)	+ 1.6	+ 1.2 (b)
(7) Free air therm. and additional channel	- 0.4	---
	+ 15.7	+ 13.0
(8) Remove radio antenna		+ 1.6
(9) Redesign of raised cabin		+ 0.8
		+ 15.4

(a) Assuming use as a land-based airplane.

(b) Dependent on amount of filler and type of camouflage paint.

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