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IN83/44177
VP6F-5
PTR 2125

INTRODUCTION - Performance tests on an F6F-5 airplane were requested by reference (a) in accordance with the program established for the periodic performance check of each 1000th F6F-3 airplane by reference (b). The model designation -3 has been changed to -5 because of an accumulation of modifications, some of which are discussed later in this report.

PURPOSE - The purpose of these tests was to check the performance of the first F6F-5 airplane submitted, particularly on a comparative basis with an F6F-3 production model in view of the aforementioned modifications.

METHOD OF TEST - After receiving the subject airplane at NAS, Patuxent River, on 12 May 1944, necessary instrumentation, torquemeter installation, and calibration of instruments were made in preparation for flight testing.

DISCUSSION - The engine installed in this airplane was a Pratt and Whitney R-2800-10W. All tests were conducted with the airplane as a representative overload fighter, equipped for combat power usage, at a gross weight of 12,420 lbs. The following useful load items are included in this gross weight:

- (a) Full fuel load of 250 gallons
- (b) Full oil load of 16 gallons
- (c) Full anti-detonant load of 10 gallons for combat power requirements - (60% alcohol, 40% water mixture)
- (d) Six fixed .50 caliber machine guns with full ammunition of 2400 rounds.

The following modifications made on the F6F-3 resulted in the model designation change to F6F-5:

- (a) Revised cowling - An attempt has been made to increase the airplane speed by making the engine cowling and adjacent skin panels flush wherever practicable in order to produce smooth air flow over these parts.

- (b) Reflector panel - A night fighter instrument board reflection panel with red lights has been installed in lieu of the former fluorescent lighted instrument board.
- (c) Pitot tube static line - The airspeed static line has been relocated, being open to the atmosphere at the right side of the fuselage below the external power source connection.
- (d) Aileron spring tab - Aileron spring tabs have been installed in an effort to decrease aileron forces.
- (e) New finish - A polished wax finish upon a semi-gloss sea blue paint is used in lieu of the present finish as well as the replacement of the wing walkway by Goodyear "Gripstead" No. 80.
- (f) New windshield - The armor glass plate now constitutes the front windshield. Previously, the armor glass plate was placed directly behind a curved plexiglass windshield, and as a result, dirt and dust particles would collect between the two and obscure visibility. The plexiglass and armor plate, being in close proximity, also had the undesirable feature of "fogging-up" between adjacent surfaces.

Enclosure (1) contains photographs of the airplane as flown during the tests. More detailed information regarding the configuration of the subject airplane during these tests follows:

- (a) The shell ejection chutes on the underside of both wing panels were open.
- (b) The six .50 caliber gun barrel openings were sealed over with tape. There were no blast tube fairings.
- (c) The pitot tube was located on the underside of the right wing leading edge near the wing tip.

- (d) A faired bomb rack was supported beneath the right wing panel-inboard.
- (e) An outside air temperature gage of the electrical resistance type was installed for test purposes on the topside of the right wing panel.
- (f) An aerial mast was located behind the pilot's cabin. The aerial extended from the right side of the fuselage, aft of the cockpit hood, to the mast and thence to the rudder.
- (g) I. F. F. antenna was located on top of the fuselage behind the aerial mast.

During the early stages of the test program, it became apparent that the engine was not developing rated power in high blower with an "auto-rich" mixture. A speedletter report on the military powers actually developed in high and low blowers using an "auto-rich" mixture and a comparison of military powers obtained in high blower using both an "auto-rich" and "auto-lean" mixture was submitted in reference (c).

It is to be noted in reference (c) that the trouble encountered at the outset of the tests appeared to be one of carburetion. For this reason, performance data in military and normal power operation with both "auto-rich" and "auto-lean" mixtures are included in this report. Performance curves forming enclosure (2) indicate a considerable increase in military power developed by the use of the "auto-lean" mixture in high blower but no measurable difference in power in low and neutral blowers as a result of changing mixtures. On the other hand, an increase in normal power output was indicated in both high and low blowers by the use of an "auto-lean" mixture. Manifold pressures were also noticeably higher.

The performance curve of Horsepower Available at Altitude in enclosure (2) indicates a decided loss in neutral blower power below engine rated while operating at engine rated manifold pressure for both normal and military operation, with no difference noted between "auto-rich" and "auto-lean" mixture settings. Whether this loss of power can be attributed to

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malfunctioning of the carburetor is questionable. Excessive carbon deposits extending aft along the fuselage from the exhaust stacks after each flight might justify, in part, the assumption that the carburetor regulation was faulty in this power range. Maximum head temperatures on cylinder No. 13 in "auto-lean" operation for the neutral blower runs at no time exceeded 175°C and 170°C for military and normal powers respectively. The carburetor air temperatures at no time exceeded 35°C during these runs.

Cylinder head temperatures observed on cylinder No. 13 during the subject test were satisfactory in "auto-lean" operation at normal and military powers. However, the possibilities of continuous "auto-lean" operation at these powers cannot be ascertained on the basis of this one lone cylinder since a subsequent temperature survey on a similar model F6F-5 airplane, No. 58200, showed No. 13 cylinder to be one of the coolest running cylinders, being considerably below the limit when other heads were well above in certain conditions.

The fact that military and normal powers were low in neutral blower is also manifest upon inspection of the Rate of Climb performance curves in enclosure (2). Since it was known that full rated powers were not being developed in all blowers, climbs were conducted in "steps" for each blower. These individual climbs were made through an altitude band which was known to be of considerable distance below and above a preestimated critical altitude for respective blowers. Data collected from the three separate blower climbs were then correlated to represent one continuous climb from sea level to absolute ceiling. The Time to climb to service ceiling is computed only for the "auto-lean" operation.

RESULTS - Enclosure (2) contains charts which show graphically the performance obtained during the tests, using both "auto-lean" and "auto-rich" operation. Due to faulty adjustment of the auxiliary stage regulator, it was possible to exceed the military rated manifold pressure of 53.5" Hg. in low blower. However, manifold pressures in excess of rated are purposely not shown on the plot of manifold pressure at altitude contained in enclosure (2). BHP developed was determined on the basis of

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torquemeter readings.

The performance of the airplane in "auto-lean" operation is summarized below. Comparative performance values on a production model F6F-3 were obtained from reference (d).

Model.....	F6F-5	F6F-3
Airplane number.....	58310	40164
Loading.....	Overload Fighter	Overload Fighter
Gross weight - lbs.....	12,420	12,243
Military Power Performance:		
Airplane critical alt.ft.....	23,100	23,200
Maximum speed at airplane critical alt. MPH.....	391.0	379.5
Service ceiling-ft.....	37,100	37,000
Maximum rate of climb at sea level- FPM.....	2,660	2,900
Normal Power Performance:		
Airplane critical alt. ft.....	24,100	24,550
Maximum speed at airplane critical alt. MPH.....	386.5	375.
Service ceiling-ft.....	36,500	36,400
Maximum rate of climb at sea level- FPM.....	2020	2330
Take-off Performance:		
Distance, no wind - ft.....	755	715
Distance, 25 knot wind - ft.....	355	335
Speed - MPH.....	86.5	86.0
Airplane configuration.....	Full flaps	Full flaps
Engine data @ Take-off:		
Speed - RPM.....	2700	2700
CAT - °C.....	24	--
BHP (torquemeter).....	1850	--

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Stalling Speed:

Clean - power on - MPH.....	96.0	97.0
Clean - power off - MPH.....	98.0	98.5
Landing condition - power on - MPH.	79.0	79.5
Landing condition - power off - MPH	84.5	85.5

CONCLUSIONS - The substantial increase in airplane speed of the F6F-5 airplane over that of the F6F-3 production model can be attributed largely to the improved aerodynamic cleanness of the -5 model as a result of the new surface finish and modified engine cowl.

The drastic reduction in neutral blower power output below rated power had a detrimental effect on airplane performance at low altitude. Consequently, a comparison of speeds and climbing rates of the F6F-5 with those of the F6F-3 at these altitudes is significant.

Lighter aileron control forces and a decided all-round improvement in lateral flight handling characteristics were experienced through the use of the "spring tab" aileron boosters. There was no apparent lessening of previously good, low speed, aileron control - no reversals were encountered down to the stall. Rudder control forces were objectionably high as on previous model F6F-3 airplanes.

Relocation of the pitot tube static line has decidedly increased the accuracy of the airspeed readings in the high speed range, with a consequent lowering of altitude position error. In the low speed range, however, airspeed readings become increasingly inaccurate as the stall is approached, but the indicator used was the sensitive type, reading in miles per hour, and of questionable accuracy in the low speed range. Enclosure (2) contains an airspeed calibration for the airplane which indicates the degree of accuracy obtained by the use of the new static line installation with a sensitive type airspeed indicator.

Cockpit noise was objectionable in this airplane. However, the general cockpit layout and the new windshield are highly commended.

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RECOMMENDATIONS - Immediate investigation should be made to determine the reason (or reasons) for the drastic loss in neutral blower power output when operating at military and normal rated manifold pressures. As previously mentioned, a change from "auto-rich" to an "auto-lean" mixture made no appreciable difference in power developed in neutral blower.

In the future, the thermocouple installation for observing cylinder head temperature should be placed on either cylinder No. 2 or No. 4 since a complete temperature survey on F6F-5 airplane, No. 58200, indicated these two cylinders to be the most critical.

Encls: (HV)

1. Photographs PTR Nos. 7748, 7750, 7751, 7752, 7753, 8013, 8015, 8016, 8017, 8019, 8020, 9669, 9670, 9671, 9674, 9673, 9672, 9536, 9534.
2. Performance Curves PTR Nos. 9906, 9907, 9908.
3. Carburetor Flow Test.



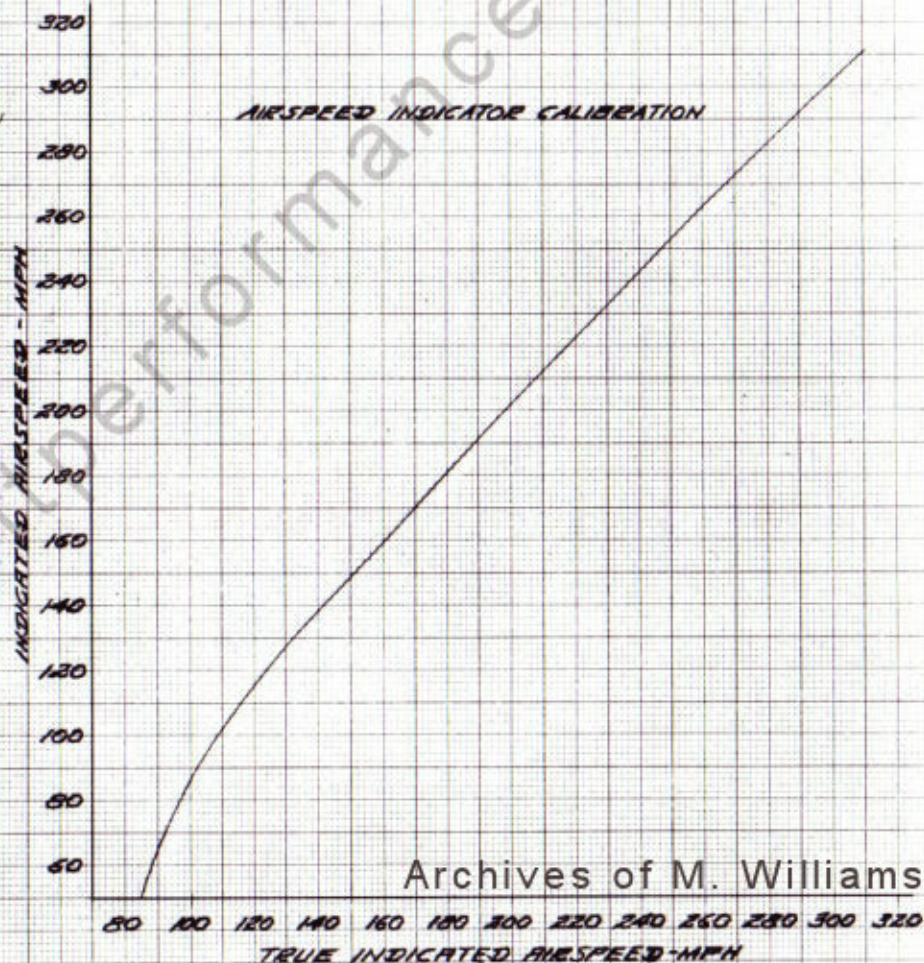
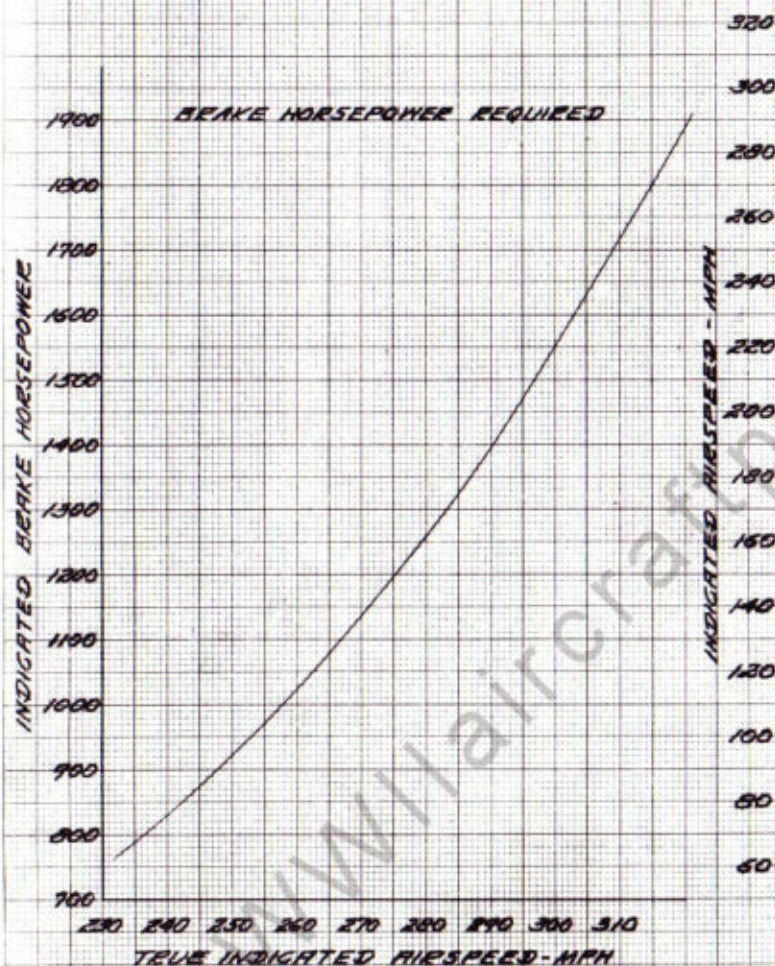
PTR 2125 - Model F6F-5 No. 58310
Left Side View

Photo PTR 7748
5-25-44

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OFFICIAL NAVY PHOTOGRAPH
NOT TO BE USED FOR PUBLICATION

MODEL FGF-5, AIRPLANE NO. 58310
 PERFORMANCE CHARACTERISTICS
 OVERLOAD FIGHTER GROSS WEIGHT = 12,420 LBS.

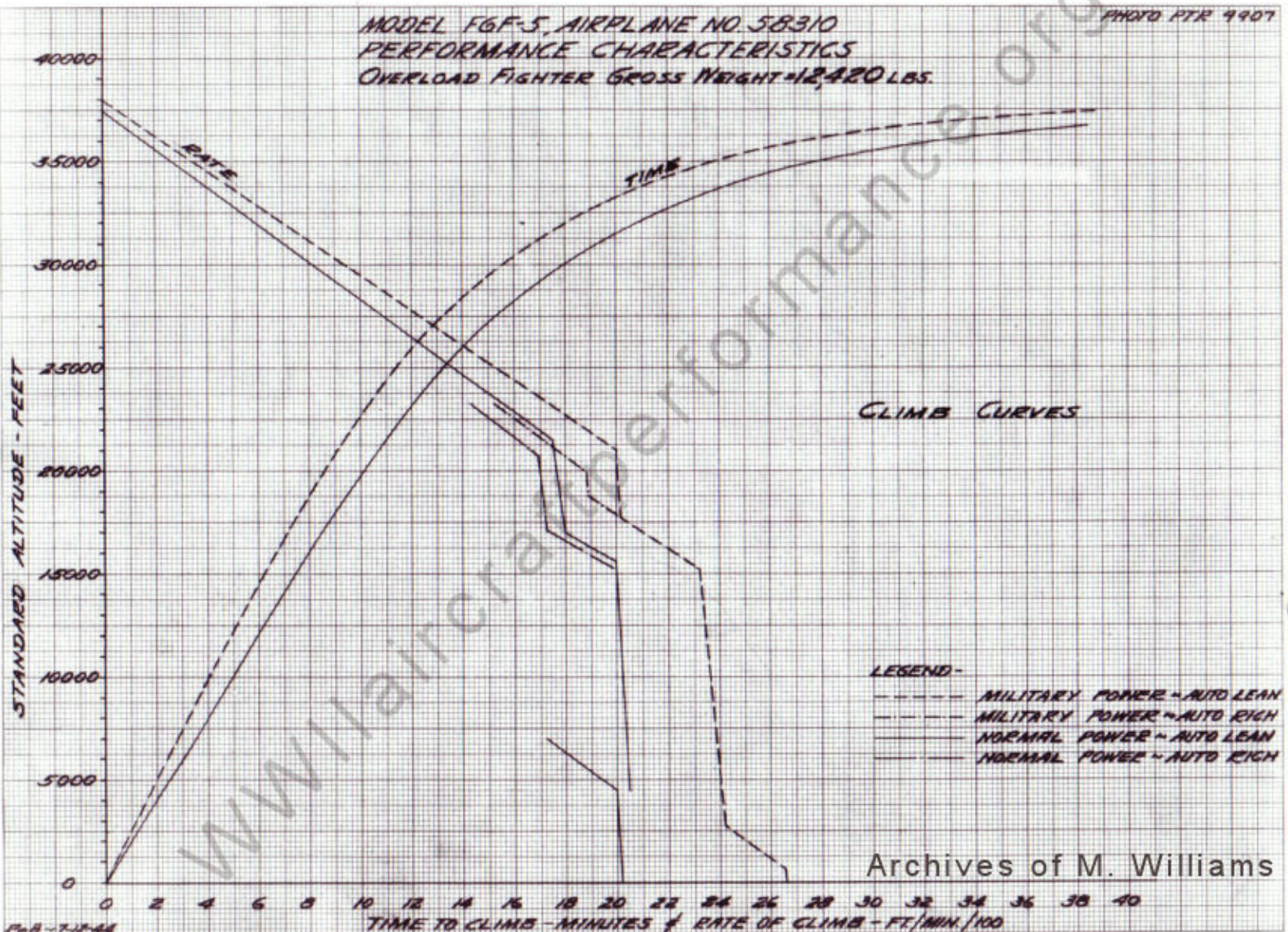
PHOTO PTR 9906



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MODEL F6F-5, AIRPLANE NO. 58310
 PERFORMANCE CHARACTERISTICS
 OVERLOAD FIGHTER GROSS WEIGHT = 12,420 LBS.

PHOTO PTR 9907



MODEL F6F-5, AIRPLANE NO. 58310
PERFORMANCE CHARACTERISTICS
OVERLOAD FIGHTER GROSS WEIGHT=12,120 LBS.

LEGEND -

- MILITARY POWER-AUTO LEAN
- MILITARY POWER-AUTO RICH
- NORMAL POWER-AUTO LEAN
- NORMAL POWER-AUTO RICH
- COMBAT POWER-HIGH BLUNDER

