

OR CHANGES TO

Unclassified

5-27-46

MEMORANDUM REPORT ON

WRW/mac/47

Wright Field, Dayton, Ohio

Date 28 September 1943

P-47D Airplane, AAF No. 42-74616

SUBJECT: Comparative Propeller Tests

SECTION Flight

Contract No. _____

SERIAL No. Eng-47-1649-A

Expenditure Order No. 590-147

Purchase Order No. _____

A. Purpose

1. To report results of performance tests conducted at Wright Field on the P-47D Airplane, AAF No. 42-74616.

B. Factual Data and Results

1. Airplane equipped with a Pratt and Whitney R-2800-21 turbo super-charged engine with an A-17 turbo regulator and a hollow steel four blade A. O. Smith propeller with extended trailing edges, blade design No. XL3M17611. All power figures at 2700 rpm based on a power curve drawn from torque meter data obtained on a P-47B with the same engine. Cruise power figures based on a power curve No. T-771, dated 14 July 1941.

2. Configuration was normal with all flights at a gross weight at take-off of 13,200 pounds with c.g. at 27.44% m.a.c., gear up. Total useful load included 300 gallons of fuel, 28 gallons of oil, 525 pounds of ballast in the ammunition boxes, and the pilot. All radio equipment installed; four, 50 cal. M.G. in each wing, wing flaps neutral, carburetor cold, and gear up.

3. High speeds in level flight at 2700 rpm with mixture auto-rich, cowl flaps closed, and oil and intercooler flaps neutral.

Altitude Ft.	True Speed MPH	Intake Manifold Pressure "Hg.	Exhaust Back Pressure "Hg.	Brake Horsepower	Turbo RPM
5,500	329.5	53.5	32.4	2000	14,400
*27,000	417.0	52.2	30.4	2000	18,250
27,800	415.0	50.6	29.5	1950	18,250

*Critical Altitude for 18,250 limiting turbo speed.

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4. Cruising Speed at 12,250 feet with mixture as specified, cowl flaps closed, and oil and intercooler shutters neutral.

Intake Manifold Pressure "Hg.	Mixture Setting	Engine RPM	True Speed MPH
52.0	A.R.	2700	355.0
35.0	A.R.	2400	298.5
32.0	A.R.-	2250	284.0
33.0	A.L.	2050	277.0
32.1	A.L.	1750	238.0
32.0	A.L.	1900	253.2
25.0	A.L.	1900	213.0

5. Climb performance at 2700 rpm with mixture auto-rich and cowl, oil, and intercooler flaps wide open.

Altitude Ft.	Rate of Climb Ft./Min.	Intake Manifold Pressure "Hg.	Brake Horsepower	True Speed MPH
0	2305	52.4	2000	164.0
5,000	2215	52.6	2000	176.5
10,000	2120	52.2	2000	191.0
15,000	2020	52.0	2000	206.5
20,000	1900	52.1	2000	224.5
*23,800	1805	52.6	2000	240.0
25,000	1635	50.2	1915	243.5
30,000	1040	41.9	1620	256.5
35,000	505	34.0	1370	---
S/C 39,000	100	28.0	1205	---
A/C 40,000	0	26.6	1170	---

*Critical altitude in climb for 18,250 limiting turbo speed.

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6. Airspeed indicator error with Manning-Bowman type D-1 pitot head located 41-1/2" inboard left wing tip, 26-3/8" ahead of the leading edge, and approximately 3/4" above the chord line.

Indicated Airspeed MPH	Water Column Airspeed MPH	Calibrated Airspeed MPH	Installation Error MPH
140	140	144.5	-4.5
180	179.5	186.5	-7.0
220	218.5	228.0	-8.5
240	239.5	248.0	-8.5
260	259.5	269.0	-9.5
280	280.0	290.5	-10.5
300	299.5	312.0	-12.5
320	319.5	333.5	-14.0

C. Discussion

1. This airplane caught fire in the air and was grounded before comparative tests with other propellers could be conducted. One flight only was made with the hub cuffs removed from the A. O. Smith propeller. Results showed an increase of approximately 1 mph throughout the 12,000' cruising range.

2. Fire in the P-47D, Number 42-74616, resulted from a loose coupling on the left exhaust manifold adjacent to the turbo. The fire wall around the manifolds offered partial protection, however, the heat was intense enough to partially melt down the bulk head over the turbo, the left rudder pulley was burnt badly, the gasket on the air duct from the turbo to the carburetor was burnt away, and the fuselage skin and formers were warped from the break to the tail wheel.

3. Two thermocouples were installed on this airplane for the purpose of investigating temperatures in the fuselage resulting from the standard turbo installation; one was suspended approximately 2" ahead of the tail wheel, and the other adjacent to the push-pull rod directly over the turbo. The highest temperatures obtained under all flight conditions with the thermocouples in these positions were as follows:

Tail wheel temperatures of 150°C were obtained at take-off with the tail wheel in the down position. Under all other flight conditions the maximum tail wheel and push-pull rod temperatures were 50° and 60° respectively.

For further investigation the push pull rod thermocouple was moved to a position on the bulkhead over the turbo adjacent to the right rudder cable pulley. When the break occurred, this thermocouple read 150°C even though the broken manifold was on the other side of the fuselage.

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The pilot closed the turbo at the sign of smoke, but fully opened the turbo several times in order to investigate the cause. It is believed that this greatly increased the damage first done to the airplane.

Any simultaneous occurrence of smoke with high thermocouple temperatures and zero tachometer readings with subsequent drop in manifold pressure should immediately warn the pilot to close the turbo and to leave it in the "off" position.

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