CONFIDENTIAL

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P-40N-1

PROOF DEPARTMENT
ARMY AIR FORCES PROVING GROUND COMMAND
EGLIN FIELD, FLORIDA

FINAL REPORT

ON

TEST OF OPERATIONAL SUITABILITY OF P-40N-1 AIRPLANE

Serial No.: 4-43-12 No. of Pages: 6 Date: 7 June 1943.

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APPROVED:

GRANDISON GARDNER,
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1. OBJECT:

To determine the operational suitability of the P-40N-1 airplane.

2. INTRODUCTION:

This test was requested in a letter from the Director of Military Requirements, Headquarters Army Air Forces, Washington, D. C., dated 9 April 1942, to the Commanding Officer, Proving Ground Command, Eglin Field, Florida, subject: "Directives." The test was started April 8, 1943, and terminated April 30, 1943.

a. Description.

(1) Two (2) P-40N-1's, A.C. Serial Nos. 42-104429 and 42-104430 were tested at this station. These aircraft were powered by the Allison V-1710-81 capable of delivering one thousand three hundred sixty (1,360) horsepower at sea level with the War Emergency Rating, or one thousand one hundred twenty-five (1,125) horsepower at fourteen thousand six hundred (14,600) feet with Military Rating.

(2) Although the armament installation provides for six (6) .50 caliber guns, two (2) guns are removed for lightness and only the four (4) guns normally provided and shipped were installed in the airplane. These were used during the tests. One thousand one hundred rounds of .50 caliber ammunition are carried. The two (2) outboard guns are armed with two hundred sixty-five (265) rounds each and the two (2) inboard guns (originally the center guns) are armed with two hundred eighty-five (285) rounds. A rack is provided for a single bomb beneath the fuselage in lieu of belly tank.

(3) The internal fuel capacity is one hundred twenty (120) gallons, carried in two (2) self-sealing tanks of fifty-four (54) and sixty-six (66) gallons respectively. The external fuel capacity is normally seventy-five (75) gallons carried in one (1) belly tank. The maximum oil capacity is thirteen (13) gallons. (All gallons U. S.) The belly rack is designed to carry the seventy-five (75) gallon jettisonable fuel tank, or one (1) bomb of optional weight between one hundred (100) pounds and five hundred (500) pounds. (Reports from India state that a one thousand (1,000) pound bomb was carried.)

(4) The airplane has been stripped mainly of two (2) .50 caliber guns, one (1) front gas tank, starter motor, gyro compass, artifical horizon, climb indicator, suction gauge, and the carburetor temperature gauge. A smaller battery has been substituted.

(5) Under these conditions the gross weight is seven thousand five hundred (7,500) pounds, with no external bombs or gas tanks.

3. CONCLUSIONS.--It is concluded that:

a. In speed, maneuverability, and rate of climb up to approximately twenty thousand (20,000) feet the P-40N-1 is the best of the P-40 series tested to date. While the P-40N-1 is the superior in performance of the P-40 series, it is generally inferior to all other current types of fighters tested at this station.

b. The P-40N-1 is of a design which is believed to have reached its limit in performance unless major changes in control surface design, wing form, structure and horsepower are made.

c. The fire power of four (4) present slow firing .50 caliber machine guns is considered insufficient for the majority of combat missions where heavily armored enemy aircraft are encountered, or for most ground strafing missions.

d. The engine of the P-40N-1 is unsatisfactory in the following respects:

(1) After successive flights at or above twenty-three thousand (23,000) to twenty-five thousand (25,000) feet, the engine develops progressive ignition trouble, which lowers the practical operational ceiling of the aircraft.

(2) Engine operation is unsatisfactory above thirty thousand (30,000) feet at other than full throttle and nearly full R.P.M. conditions. (Believed due to carburetion.) This precludes formation flying at these altitudes.

e. The clear vision panel obstructs vision and is deemed unnecessary because the entire canopy may be rolled back if visibility is restricted. If there are areas where the panel is needed, it could readily be installed on the front left panel at a modification center.

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f. Take-off time is increased due to hand cranking.

g. Cooling shutters can not be moved to "full closed" or "full open" position at cruising and faster speeds.

h. New wheel and flap indicators are satisfactory.

4. RECOMMENDATIONS.—It is recommended that:

a. Six (6) .50 caliber machine guns be installed.

b. A minimum of one hundred thirty (130) U. S. gallons of internal self-sealing fuel tankage be provided.

c. The Material Command study and correct the ignition and other engine trouble encountered at altitude with the V-1710-81 Allison engine.

d. A more stable remote type electric compass be installed to compensate for removal of directional gyro.

e. A landing gear retracting handle similar to the P-51 type be installed.

f. Gas gauges be incorporated into one (1) gauge on instrument panel similar to the P-39NO installation.

g. The switches for control of the fuel pump, battery, and generator be combined into the ignition switch.

h. Electric type toggle switch primer replace hand primer pump.

i. Wing and tail light switch be combined.

j. All circuit breakers be of push button type, normally closed and placed in an out of the way position, such as under throttle quadrant.

k. Coolant flap operation be made automatic.

l. Flap handle be of vertical movement type similar to P-51.

5. RECORD OF TEST:

This test was conducted in accordance with the test program, S.T. No. 4-43-12, this headquarters, dated 8 April 1943, a copy of which is attached. (Inclosure 1.)

6. DISCUSSION:

a. Performance.--Tables for Speed, Time of Climb, and Range Endurance are attached. (Inclosure 2.)

b. Maneuverability and Combat Performance.

(1) Turning Circle.--The P-40N-1 has the best turning circle of the current type U. S. fighters. The next best is the P-39NO, followed by the P-51A.

(2) Aileron Roll.--Slightly better than the P-40E and P-40F, due to lighter weight.

(3) Dive.--Comparable only to the P-40 series; slightly faster initally than the P-40E and the P-40F. Outdived by other types. Large rudder forces are required to keep ship in trim in dives.

(4) Zoom.--Zoomed slightly better than the P-40L, much better than the P-40E and P-40F. Outzoomed by all other current types of American fighters.

(5) Acrobatics.--Normal acrobatics may be performed, but require excessive strength on controls due to high stick and rudder force.

(6) Ceiling.--Operational ceiling limited to twenty-five thousand (25,000) feet due to ignition trouble. Service ceiling undetermined at this station due to ignition difficulty. Ultimate ceiling likewise undetermined.

c. Flying Characteristics and General Performance.--Stripped of some armament, gas tanks, instruments, accessories, etc. The P-40N-1 has the best performance of the P-40 series from sea level to approximately twenty thousand (20,000) feet. Here the P-40L with two (2) stage blowers takes over in performance. Handling characteristics are similar to the P-40E and P-40F. Rate of climb, speed, and turn are improved.

d. Cockpit Arrangement.--Slight improvement over the P-40F series.

e. Pilot Comfort.--Similar to the P-40F series. Drafty cockpit.

f. Visibility.--No essential change from P-40F series.

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g. Armor.--Satisfactory.

h. Vulnerability of Vital Installation.--Same as other P-40 series.

i. Instrument Flying.--Impractical for more than ten minutes due to lack of stable compass. Otherwise same as the P-40E.

j. Speed of Servicing.--Slightly improved over P-40F due to less gas and four (4) guns.

k. Gun Camera.--Satisfactory. Located in leading edge of right wheel well housing.

l. Oxygen Installation and Supply.--Satisfactory. Demand System Indicator is located satisfactorily in easy view of pilot.

m. Maintenance.--Same as P-40 series with Allison type engines installed.

n. Emergency Exit.--Satisfactory.

o. Radio.--Weight could be reduced by using a one (1) channel VHF radio.

p. Armament.--Six (6) fifty .50 caliber guns are required for the majority of combat missions. The four (4) guns now carried are insufficient in firepower.

q. Gun Platform.--Not satisfactory due to change in rudder trim with speed.

r. View over Nose for Shooting.--Average fifty (50) mils, less than the P-40F, due to carburetor air intake scoop on top of engine cowl.

7. INCLOSURES:

Incl 1 - Test Program.
Incl 2 - Tables for Speed, Time of Climb, and Range Endurance.

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C O N F I D E N T I A L

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PROOF DEPARTMENT
ARMY AIR FORCES PROVING GROUND COMMAND
Eglin Field, Florida.

8 April 1943.

SUBJECT: Program for Test of Tactical Suitability of P-40N1 (S.T. 4-43-12).

TO: Commanding Officer, Army Air Forces Proving Ground Group, Eglin Field, Florida.

1. GENERAL:

a. Three (3) standard P-40N1's have been furnished this station for test.

b. This is a 1-AA PRIORITY tactical suitability service test.

c. This test was requested in a letter from the Director of Military Requirements, Headquarters Army Air Forces, Washington, D. C., dated 9 April 1942, to the Commanding Officer, Proving Ground Command, Eglin Field, Florida.

d. Major L. B. Meng is designated as the Tactical Combat Section Project Officer for this test.

e. Major William A. Sheppard has been appointed Group Test Officer.

f. At the conclusion of this test which should be completed in a period of twenty-four (24) days, the Commanding Officer of the Army Air Forces Proving Ground Group will be informed by the Chief of the Proof Department as to the disposition of the test articles.

2. OBJECT:

To determine the tactical suitability of the P-40N1 airplane.

3. METHOD OF CONDUCTING TEST:

a. Phase I.

(1) All flight instruments will be calibrated and all engine instruments will be checked for accuracy.

(2) Calibration speed runs will be flown with each of the subject aircraft over the speed range at a minimum of six (6) different speeds.

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(3) (a) Trial speed runs will be made with each of the subject aircraft at maximum cruising power, normal rated power and war emergency power at each five-thousand (5,000) foot (pressure altitude) level, from sea level to the service ceiling of the subject aircraft.

(b) Trial speed runs will be made at twelve-thousand (12,000) foot altitude at war emergency power.

(4) (a) Trial climbs will be made with each of the subject aircraft from the start of the take-off run and the time taken at each five-thousand (5,000) foot level (pressure altitude) up to the service ceiling of the subject aircraft at war emergency and normal rated power. This will be done without belly tanks, and at normal rated power with belly tanks installed.

(b) Trial climbs at war emergency power at authorized stripped weight will be made. (Contents or materials removed will be stated.)

(5) Trial flights will be made to determine the operational ceiling (five-hundred (500) feet per minute, rate of climb), the service ceiling (one-hundred (100) feet per minute, rate of climb), and the ultimate ceiling.

(6) A trial climb will be made as in paragraph (3) above, with the largest available formation of the subject aircraft, the airplanes to take-off individually from the same runway and join formation in the air.

(7) The subject aircraft will be flown in mock combat against all available contemporary fighter types to determine their comparative turning and combat characteristics. This will be done at twelve-thousand (12,000) and twenty-five-thousand (25,000) feet. If one (1) aircraft takes over from the other in combat performance, the altitude at which this occurs will be stated.

(8) The rate of aileron roll at all speeds will be tested from left to right and right to left. (Also checked in flight against contemporary types.)

(9) Rate of zoom from level flight and dive will be tested by comparison with contemporary types.

(10) The rate of acceleration in dives will be studied by comparison with contemporary types.

(11) The flight characteristics at maximum allowable diving speeds will be checked.

(12) Trial flights will be made to determine the range of the subject aircraft at normal rated power.

(a) Trial flights will be made to determine the range of the subject aircraft at maximum cruising power.

(b) Trial flights will be made to determine the maximum range of the subject aircraft and how it is obtained.

(c) Trial flights will be made to determine minimum manifold pressure and r.p.m. settings for minimum fuel consumption at best altitude for maximum range (information for pilots running low on gas trying to reach base).

(13) Trial flights will be made for the purpose of studying the stability of the subject aircraft while firing the guns or cannon from ground level to service ceiling.

(14) Night Flying.

(a) Night flights will be made to determine the suitability of the subject aircraft for night flying.

(b) Aircraft will be examined on ground at night with engines running to determine distance exhaust flare may be seen.

(c) Guns will be fired at night to determine extent that gun flash blinds pilot.

(15) The length of take-off and landing run will be tested and decision of length of runway necessary will be made. Five-hundred (500) feet will be added to this figure as a safety margin.

(16) Test will be conducted to determine length of time for aircraft to be air-borne. Pilots out of plane with engines off and cold.

(17) All pilots engaged in flight tests of the subject aircraft will submit their flight data cards to the Test Officer and report on the following subjects:

(a) Flying characteristics of the subject aircraft during taxiing, take-off, climb, level flight, acrobatics, dives, and landings.

(b) Ease, speed, and adequacy of the trimming devices.

(c) The suitability of the subject aircraft for instrument flight.

(d) The visibility and field of view from the cockpit.

(e) The simplicity of the cockpit arrangement.

(f) The adequacy of the oxygen supply.

(g) The adequacy and arrangement of the instruments.

(h) Pilot comfort under all simulated combat conditions.

b. Phase II.

The subject aircraft will be studied carefully on the ground to determine:

(1) The adequacy of its armament.

(2) The adequacy of the armor plate protection for the pilot.

(3) The protection or vulnerability of vital installations.

(4) The means and size of the emergency exit.

(5) The accessibility of the oxygen supply.

(6) The accessibility of the radio.

(7) Time and number of men required to completely service the subject aircraft with fuel, oil, coolant, oxygen, and ammunition.

c. Phase III.

When the test has been completed and a draft of the final report has been prepared, all the officers involved in the test will meet in the office of the Tactical Combat Section, Proof Department, to discuss and approve the final report.

4. RECORDS:

a. A table will be kept which will describe all maintenance difficulties encountered during the test, corrective action taken, and the approximate time required to complete the corrective action. This table will also contain the man hours required to complete the routine twenty-five (25) hour and fifty (50) hour inspections and any particular part or accessory that consistently malfunctions will be noted.

b. All flight test data reports will be collected by the Test Officer and turned over to the Project Officer as often as practicable.

5. REPORTS:

a. A final report covering all phases of the test, with conclusions and

recommendations, will be submitted by the Project Officer to the Chief of the Proof Department, through the Chiefs of the Testing Branch and Tactical Combat Section as soon as possible after the completion of the test.

b. Any consistent failures or malfunctions of any equipment will be reported to the Chief of the Testing Branch as soon as possible after they are discovered.

c. A daily report will be submitted to the Project Officer on status of aircraft and number of hours flown.

By command of Brigadier General GARDNER:

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Chief, Proof Department.

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Major, Air Corps,
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J. C. GUTHRIE,
Lt. Colonel, Air Corps,
Chief, Testing Branch.

RANGE & ENDURANCE

A combat radius of action of one hundred twenty (120) miles was estimated for the P-40N-1 under the following given conditions. A check flight closely substantiated the estimated radius:

1. Internal fuel capacity of one hundred thirteen (113) gallons.

2. Warm-up and take-off on main tank (approximately twenty (20) gallons allowed).

3. Climb to fifteen thousand (15,000) feet and fly out to combat area on auxiliary belly tank. Jettison belly tank upon arrival.

4. Engage in twenty (20) minutes combat at War Emergency Power at fifteen thousand (15,000) feet.

5. Return from combat at two hundred seventy-five (275) M.P.H. true air speed at fifteen thousand (15,000) feet (2300 R.P.M., 29 inches of mercury); fifteen (15) gallons reserve to remain after landing.

Successive flights made throughout the power and altitude range gave fuel consumption data which agreed with those given in T.O. No. 01-25CK-1.

Table I

Type Plane: P-40M-1 A.C. No.: Group No.: 24 Date: 4-10-43 Time: Pressure Alt. -29.92

AIR SPEED							TIME OF CLIMB									Ind. Rate of climb Ft/Min.
Alt.	I.A.S.	F.A.T.	M.P.	R.P.M.	C.I.A.S	T.A.S	Alt.	Time	I.A.S.	F.A.T.	T.A.S	M.P.	R.P.M.	Turbo	Carb. Temp.	
0	227	+1	30.7	2280	243	244	0	0				56	3000			
	250	+21	38.3	2600	266	267	5000	2:10								
	275	+21	44.5	3000	291	292	10000	3:50								
	298	+21	57	3000	316	317	15000	5:45								
5,000	229	+15	30.7	2280	245	266	20000	9:00								
	251	+15	38.3	2600	267	290	25000	13:25								
	266	+15	44.5	3000	282	307	30000	19:30								
	292	+15	55	3000	308	334										
10,000	234	+ 7	30.7	2280	251	295										
	253	+ 7	38.3	2600	269	316										
	265	+ 7	44.5	3000	281	330										
	293	+ 7	55.5	3000	309	364										
12,000	234	+ 2	30.7	2280	250	303										
	248	+ 2	38.3	2600	264	319										
	262	+ 2	44.5	3000	278	336										
	273	+ 2	50	3000	289	349										
15,000	222	- 3	30.7	2280	239	304										
	247	- 3	38.3	2600	264	335										
	256	- 3	42.0	2800	272.5	345										
	262	- 4	45.5	3000	280	355										
20,000	214	-14	27.0	2280	232	320										
	227	-14	31.5	2600	244	336										
	234	-13	34.5	2800	251	344										
	238	-13	38.0	3000	255	350										

Table II

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~~Type Plane:~~ ~~P-40N-1~~ ~~A.C. No.:~~ Group No.: 24 Date: 4-15-43 Time: Pressure Alt. -29.92

AIR SPEED

Alt.	I.A.S.	F.A.T.	M.P.	R.P.M.	C.I.A.S.	T.A.S.
~~25,000~~	186	-26	22.0	2280	203	303
	197	-26	25.3	2600	215	320
	201	-26	28.0	2800	218	325
	204	-26	30.0	3000	222	331

Alt.	Time	I.A.S.	F.A.T.	T.A.S.	M.P.	R.P.M.	Turbo	Carb. Temp.	Ind.Rate of climb Ft/Min.

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Table III

Type Plane: P-40N-1 A.C. No.: Group No.: 23 Date: 4-15-43 Time: Pressure Alt. -29.92

AIR SPEED

Alt.	I.A.S.	F.A.T.	M.P.	R.P.M.	C.I.A.S.	T.A.S.
0	228	+19	30.7	2280	240	241
	257	+19	38.3	2600	269	270
	291	+19	44.5	3000	307	308
	308	+19	57	3000	324	325
2,000	234	+15	30.7	2280	246	267
	255	+15	38.3	2600	267	290
	271	+15	44.5	3000	284	308
	298	+15	56.5	3000	314	340
10,000	234	+ 3	30.7	2280	246	287
	252	+ 3	38.3	2600	264	308
	268	+ 3	44.5	3000	280	326
	225	+ 3	55.5	3000	310	360
12,000	231	0	30.7	2280	243	293
	254	0	38.3	2600	266	320
	267	0	44.5	3000	280	337
	282	0	52	3000	296	355
15,000	223	- 3	30.7	2280	235	299
	249	- 3	38.3	2600	261	332
	260	- 3	44.5	3000	272	345
	264	- 3	46.5	3000	276	350
20,000	212	-13	28.5	2280	224	310
	227	-12	33	2600	239	330
	234	-11	36	2800	246	340
	240	-11	38	3000	252	347

TIME OF CLIMB

Alt.	Time	I.A.S.	F.A.T.	T.A.S.	M.P.	R.P.M.	Turbo	Carb. Temp.	Ind. Rate of climb Ft/Min.
0	0	150	+15		38.3	2600			
5,000	3:30	150	+13						
10,000	6:00	150	+ 4						
15,000	8:25	140	- 4						
20,000	11:15	135	-14						
25,000	15:30	130	-24						
30,000	22:10	125	-38						
31,600	25:00	115							

Speeds are corrected for instrument error, position error, compressibility error but not reduced to a "standard day".

Table IV

Type Plane: P-40N-1 A.C. No.: 43-104429 Group No.: 23 Date 4-8-43 Time: Pressure Alt. -29.92

AIR SPEED

Alt.	I.A.S.	F.A.T.	M.P.	R.P.M.	C.I.A.S.	T.A.S.
0	218	+17	30.7	2250	230	230
5,000	222	+13	30.7	2250	234	253
10,000	224	+ 4	30.7	2250	236	275
15,000	219	- 4	30.7	2250	231	283
20,000	206	-11	28.5	2250	215	302
25,000	185	-19	22.0	2250	196	297

TIME TO CLIMB

Alt.	Time	I.A.S.	F.A.T.	T.A.S.	M.P.	R.P.M.	Turbo	Ind.Rate Carb.of Temp.	Climb Ft/Min.
0	0	150	+20		38.3	2600			
5,000	3:35	145	+16						
10,000	6:45	140	+ 8						
15,000	9:55	140	+ 1						
20,000	13:15	135	- 7						
25,000	19:10	130	-14						
30,000	25:05	115	-28						

Climb made with belly tank.

Speeds are corrected for instrument error, position error, compressibility error but not reduced to a "standard day". and thermometer

Table V

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Type Plane: P-40N-1 A.C. No.: Group No.: 23 Date: 4-15-43 Time: Pressure Alt. -29.92

AIR SPEED

Alt.	I.A.S.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25,000	197	-31	[illegible]	[illegible]	208	307
	212	-31	27.6	2600	224	331
	218	-31	30.0	2600	23[illegible]	339
	223	-31	32.0	3000	235	347
30,000	185	-38	22.8	2600	196	318
	188	-38	24.2	2600	199	324
	192	-38	24.8	2900	205	332
	195	-38	26	3000	207	336

RATE OF CLIMB

Alt.	Time	I.A.S.	P.A.T.	T.A.S.	A.T.	R.P.M.	Turbo	Carb. Temp.	Ind. Rate of Climb Ft/Min.