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COMPARATIVE PERFORMANCE BETWEEN ZEKE 52  
AND THE P-38, P-51, P-47

By  
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COMPARATIVE PERFORMANCE BETWEEN ZEKE 52  
AND THE P-38, P-51, P-47

1. OBJECT:

To compare combat performance between the Japanese Zeke 52 and the P-38J, P-47N and P-51D type aircraft.

2. INTRODUCTION:

a. Description. The airplane tested was a standard Japanese Zeke 52 fighter, captured in a new condition. A description of the airplane is given in Inclosure 4, and photographs in Inclosure 5.

3. CONCLUSIONS:

a. The condition of the Zeke 52 during test was good, so that significant comparative combat results were obtained, but certain airframes discrepancies prevented obtaining maximum speed and climb performance.

b. The P-51D, P-38J-25 and P-47D-30 are greatly superior to the Zeke in maximum level flight speed at both 10,000 and 25,000 feet.

c. Due to advantages in speed, acceleration and high-speed climb, all three AAF fighters were able to maintain the offensive in individual combat with the Zeke 52, and to break off combat at will.

d. The Zeke 52 is greatly superior to all three AAF fighters in radius of turn and general maneuverability at low speeds.

4. RECOMMENDATIONS:

a. The pilots of AAF fighter aircraft (P-38, P-51 and P-47 types) should take advantage of high speed performance superiority when engaging the Zeke 52 in combat; speed should be kept well above 200 IAS during all combat; "hit and run" tactics should be used whenever possible, and following the Zeke through any continued turning maneuvers must be strictly avoided.

b. The latest operational Japanese fighters captured in serviceable condition should be made available to this command as soon as practicable for comparison tests with AAF fighters.

5. DISCUSSION:

a. Factors Affecting Test Results.

During initial engineering check flights, several items were encountered on the Zeke 52 that tended to detract from the maximum performance obtainable. For approximately three quarters of the test, maximum available manifold pressure in both high and low blower was five inches of mercury below specification. After complete ignition rewiring, specified power was available. Actual cause for power discrepancy was not determined. Power loss had been corrected before performance runs were made, and probably had little significant effect on comparative combat results.

Landing gear fairings and doors were not strong enough to stay properly closed at high speed, further detracting from performance. Other drag-producing items consisted of rough wing skin, and distorted airfoil section caused by poor gun fairings. It is felt that the condition of the airplane had little effect on general comparative combat test results; but probably caused a pessimistic picture of maximum speed and rate of climb results.

b. Performance.

Comparative level flight speed runs were made with the Zeke 52 against the P-51D-5, the P-38J-25, and the P-47D-30 at 10,000 and 25,000 feet. Maximum available power was used in the Zeke, and current war emergency ratings were used in the three AAF fighters. Speed differences between the Zeke and the AAF fighters were so great that comparative speed runs planned for the

remainder of the altitude ranges were omitted.

AIRPLANE	ALTITUDE	MP	RPM	RESULTS
P-51D-5	10,000 feet	62.5" Hg	3000	Approximately 80 mph true airspeed faster than Zeke 52.
P-38J-25	10,000 feet	60" Hg	3000	Approximately 60 mph true airspeed faster than Zeke 52.
P-47D-30	10,000 feet	64" Hg	2700	Approximately 70 mph true airspeed faster than Zeke 52.
Zeke 52	10,000 feet	38" Hg	2750	

AIRPLANE	ALTITUDE	MP	RPM	RESULTS
P-51D-5	25,000 feet	62" Hg	3000	Approximately 95 mph true airspeed faster than Zeke 52.
P-38J-25	25,000 feet	58" Hg	3000	Approximately 80 mph true airspeed faster than Zeke 52.
P-47D-30	25,000 feet	59" Hg	2700	Approximately 90 mph true airspeed faster than Zeke 52.
Zeke 52	25,000 feet	33.5" Hg	2750	

Individual level-flight maximum power speed runs were made with the Zeke 52 at 5000 foot pressure altitude increments from sea level to 30,000 feet. Considerable engine roughness, smoking, and RPM fluctuations were encountered, so that the resulting speeds are probably slightly lower than those obtainable with fully developed horsepower. True airspeeds, available manifold pressure, and free air temperature are plotted against pressure altitude in Inclosure 3. Speeds plotted are actual true airspeeds attained during trials, and are not reduced to standard conditions.

A full power climb was made from sea level to 30,000 feet. Time to climb, climbing IAS, and available manifold pressure are plotted against pressure altitude in Inclosure 3. After a complete climb at recommended airspeed, short check climbs were attempted at 10,000 and 25,000 feet, at 165 IAS and 143 IAS respectively. Results were very inconclusive. An increase in available manifold pressure of from 2.5" to 3.5" Hg was obtained at the higher climbing speed, so that rates of climb at both speeds were nearly the same (approximately 2500 ft/min at 10,000 feet, and 1100 ft/min at 25,000 feet). The reason for this manifold pressure difference was not determined.

#### c. General Combat Comparison.

The Zeke 52 was flown in comparative combat maneuvers against the P-51D-5, P-38J-25 and P-47D-30 at 10,000 and 25,000 feet. Maximum available power was used in the Zeke, and war emergency power, where available, was used in the three AAF fighters. Full military load was carried in all airplanes. The same pilot flew the Zeke throughout the trials. The three AAF fighters were flown by several combat experienced pilots.

Results of all comparisons were definite. The Zeke excelled in all turning circle comparisons (including climbing and diving spirals) and in general low speed maneuverability.

The three AAF fighters were superior to the Zeke in speed, level and dive acceleration, high speed climbs and zooms, and in high speed maneuverability.

Dog-fight comparisons with each AAF fighter were made under three different initial conditions. In the first condition, combat was begun from an approach or parallel course 500 feet apart. The other two combat comparisons were begun with either airplane 2,000 feet above and behind the other. In every case, the Zeke was forced on the defensive after combat started. All three AAF fighters could break away from the initial condition by shallow dives and high speed climbs out of range. After the first disengagement, AAF fighters could re-engage combat from an altitude advantage, and could make passes at will, breaking away as before. The Zeke was sufficiently maneuverable to turn into every pass and take a snap shot at the attacking aircraft. Only when the AAF fighters slowed down or turned after a pass could the Zeke get in a shot (other than head on defensive shooting). The Zeke could easily get in firing position and stay on the tail of AAF fighters through all low speed maneuvers.

The following comparison results were reported by participating pilots. Most results should be considered as qualitative rather than quantitative, although estimated numerical distances are included. In addition to the following, chandelles (with either airplane alternately leading) were executed. No additional significant data were obtained. The Zeke easily turned inside all AAF fighters through chandelles. Our fighters were unable to keep their sights on the Zeke when following in this maneuver.

d. Combat Comparison - Zeke 52 vs. P-51D-5. (Altitudes specified are at which maneuvers were started).

(1) Level Turning Circle.

- (a) 10,000 feet. In both right and left turns, the Zeke gained an advantage in less than one 360° turn.
- (b) 25,000 feet. Results were the same as those obtained at 10,000 feet.

(2) Level Flight Acceleration.

- (a) 10,000 feet. The run was begun from a line abreast formation at 200 IAS. At the end of one minute at full power, the P-51D had an estimated lead of 400 yards. After two minutes, the lead had increased to 1500 yards.
- (b) 25,000 feet. The run was begun from 190 IAS. Estimated lead for the P-51D was 300 yards after one minute and 1,000 yards after two minutes of full power.

(3) Dive Acceleration.

- (a) 10,000 feet. Dives were begun from level flight line abreast formation at 200 IAS, with full power applied as the dive was entered. The P-51D began to pull ahead immediately. The selected red line airspeed (325 IAS) of the Zeke was reached after 27 seconds. At this time, the P-51D had a lead of approximately 200 yards.
- (b) 25,000 feet. Results were much the same as at 10,000 feet. The Zeke reached 325 IAS after 20 seconds, and the P-51D was rapidly widening a lead begun shortly after the dive was entered.

(4) Aileron Roll.

At both altitudes, the rolling ability of the Zeke was slightly better than the P-51D below 220 IAS. At speeds above 220 IAS, the P-51D was superior, due to increasing control forces in the Zeke.

(5) Zoom from Level Flight.

- (a) 10,000 feet. In a full power zoom, begun from level flight, line abreast formation at 210 IAS, the P-51D was approximately 300 feet above and ahead of the Zeke when airspeed had decreased to 130 IAS.

(b) 25,000 feet. Results of a full power zoom begun from 185 IAS (Zeke cruising speed) were the same as those obtained at 10,000 feet.

(6) Zoom from Dive.

(a) 10,000 feet. The P-51 gained an advantage of approximately 500 feet above and ahead of the Zeke after a zoom from a shallow dive, applying full power when the nose passed through the horizon.

(b) 25,000 feet. Results were the same as those obtained at 10,000 feet.

(7) Spirals.

Climbing and diving spirals were executed at 10,000 and 25,000 feet, with either airplane alternately leading in a line astern formation. Results were the same at both altitudes. The Zeke could stay in range within the P-51D's turn during either a climbing or diving spiral. With the Zeke in the lead position at the start of a spiral, the P-51D could hold the initial advantage for only a short time.

(8) Combat.

Results were essentially the same for the two individual combat comparisons at 10,000 and at 25,000 feet. The following three initial conditions were checked:

(a) Head-On Approach. The two airplanes approached each other on the same level approximately 500 feet apart. As they came abreast each other, the Zeke immediately turned onto the P-51D's tail, but was unable to close range as the P-51D dove away. The P-51D was able to gain altitude after the dive and make repeated passes from above, for which the Zeke's only defense was turning to face the attack and firing a snap shot.

(b) Zeke 2,000 Feet Above and Directly Behind. When the Zeke started a pass from above, the P-51D could dive away out of range and use excess speed to climb to a favorable attack position. The P-51D's higher climbing airspeed and superior climbing ability aided in keeping out of range until in position for a pass. The Zeke was able to turn into each attack for a short burst, but never gained the initiative.

(c) P-51D 2,000 Feet Above and Directly Behind. The P-51D was able to climb for continued attacks after the first pass, and the only firing opportunity for the Zeke when attacked was to run into the P-51D for brief bursts.

e. Combat Comparison - Zeke 52 vs. P-38J-25.

(1) Level Turning Circle.

(a) 10,000 feet. In both right and left turns the Zeke was in firing position in approximately one turn.

(b) 25,000 feet. Results were very much the same as the 10,000 feet. Various combinations of dive recovery and maneuver flaps were used on the P-38J. No particular advantage was gained by using maneuver flaps, since the Zeke's superiority in turning was so great. The use of dive recovery flaps merely reduced speed and tended to cause buffeting at higher airspeed. The Zeke was still able to reach a good deflection shooting position in approximately one turn. In turns to the right the Zeke's turning ability was slightly decreased.

(2) Level Flight Acceleration.

(a) 10,000 feet. The run was begun from 200 IAS. One minute after the application of full power, the P-38J was approximately 300 yards ahead.

After two minutes, the distance between airplanes had increased to approximately 600 yards.

- (b) 25,000 feet. The P-38J was 250 yards ahead after one minute, and 500 yards ahead after two minutes.

(3) Dive Acceleration.

- (a) 10,000 feet. Dives were begun from level flight at 200 IAS. The P-38J began to accelerate away shortly after the dive was entered. At the end of 30 seconds (when the Zeke had reached maximum allowable IAS), the P-38J was approximately 200 yards ahead.
- (b) 25,000 feet. Dives were begun from the same speed as those made at 10,000 feet. The P-38J assumed a very slight initial lead, and at the end of 30 seconds was 75 yards ahead.

(4) Aileron Roll.

At both altitudes, the Zeke could out roll the P-38J slightly at low airspeeds (although the P-38J used aileron boost). The two airplanes were approximately equal at 200 to 220 IAS. At higher airspeeds, the rolling ability of the P-38J became increasingly superior.

(5) Zoom from Level Flight.

- (a) 10,000 feet. At the end of a full power zoom from 200 IAS in level flight, the P-38J was approximately 200 feet higher than the Zeke.
- (b) 25,000 feet. At the end of the zoom, the P-38J was approximately 300 feet higher than the Zeke.

(6) Zoom from Dive.

Zooms from a dive, with full power, at 310 IAS, had approximately the same results at both altitudes. When IAS had decreased to 130 mph, the P-38J was an estimated 300 feet above and ahead of the Zeke.

(7) Spirals.

Climbing and diving spirals were executed at 10,000 feet only. As expected, the Zeke could easily stay in firing position when trailing, and could reach firing position in 1 1/2 turns after starting in the lead position.

(8) Combat.

Individual combat comparisons had the same results at 10,000 and 25,000 feet, although the superiority of the P-38J was slightly less pronounced at 10,000 feet.

- (a) Head On Approach. The P-38J was able to break from a head on pass into either a high speed climb (200 IAS) or into a 25° dive, and be out of range before the Zeke could turn 180° and fire. It was possible to make passes at will, breaking out of range after each pass. The Zeke had an opportunity to fire only head on snap shots.
- (b) Zeke 2,000 Feet Above and Directly Behind. When the Zeke started to tail attack, the P-38J could draw out of range in a shallow dive. After diving well away, the P-38J could gain sufficient altitude in a high speed climb to start making passes at will. In almost every case, the Zeke could turn rapidly enough to get head on shots during the P-38J's attack.
- (c) P-38J 2,000 Feet Above and Directly Behind. The P-38J started a tail attack. The Zeke turned, so that the P-38J could hold firing lead for only three seconds. Over running, the P-38J made a high speed climb to

begin another pass. Attacks at will were possible after the first pass, and conditions were the same as in the previous two conditions.

f. Combat Comparison - Zeke 52 vs. P-47D-30.

(1) Level Turning Circle.

At both 10,000 and 25,000 feet, the Zeke could out turn the P-47D in 1/2 to 3/4 of a turn.

(2) Level Flight Acceleration.

(a) 10,000 feet. Beginning from level flight cruise at 200 IAS, the P-47D accelerated rapidly away from the Zeke when full power was applied. After one minute, the P-47D was approximately 500 yards ahead; after two minutes, this lead had increased to approximately 800 yards.

(b) 25,000 feet. Beginning from 190 IAS, the P-47D was approximately 400 yards ahead after one minute, and approximately 800 yards ahead after two minutes of full power.

(3) Dive Acceleration.

(a) 10,000 feet. The P-47D was approximately 100 yards ahead 30 seconds after the beginning of the dive.

(b) 25,000 feet. The P-47D was approximately 300 yards ahead 30 seconds after the beginning of the dive.

(4) Aileron Roll.

At both altitudes, the rate of roll of the Zeke was greater than that of the P-47D from 180 IAS to 250 IAS. The airplanes were approximately equal to 250 IAS; at higher speeds, the P-47D's rate of roll became increasingly superior to the Zeke.

(5) Zoom from Level Flight.

(a) 10,000 feet. The P-47D was approximately 400 feet above and ahead of the Zeke after a full power zoom from level flight.

(b) 25,000 feet. The P-47D was approximately 500 feet above and ahead of the Zeke at the end of the zoom.

(6) Zoom from Dive.

(a) 10,000 feet. After a zoom from 310 IAS to 130 IAS, the P-47D was approximately 600 feet above and far ahead of the Zeke.

(b) 25,000 feet. Results were approximately the same as those obtained at 10,000 feet.

(7) Spirals.

In climbing and diving spirals at 10,000 and 25,000 feet, the Zeke could easily stay in range inside the turn, if starting the spiral 100 to 200 yards astern the P-47D. With the P-47D following in the spiral, the Zeke could avoid fire by out turning the P-47D after 180° of either a climbing or diving spiral.

(8) Combat.

Results of individual combat trials were the same at both altitudes.

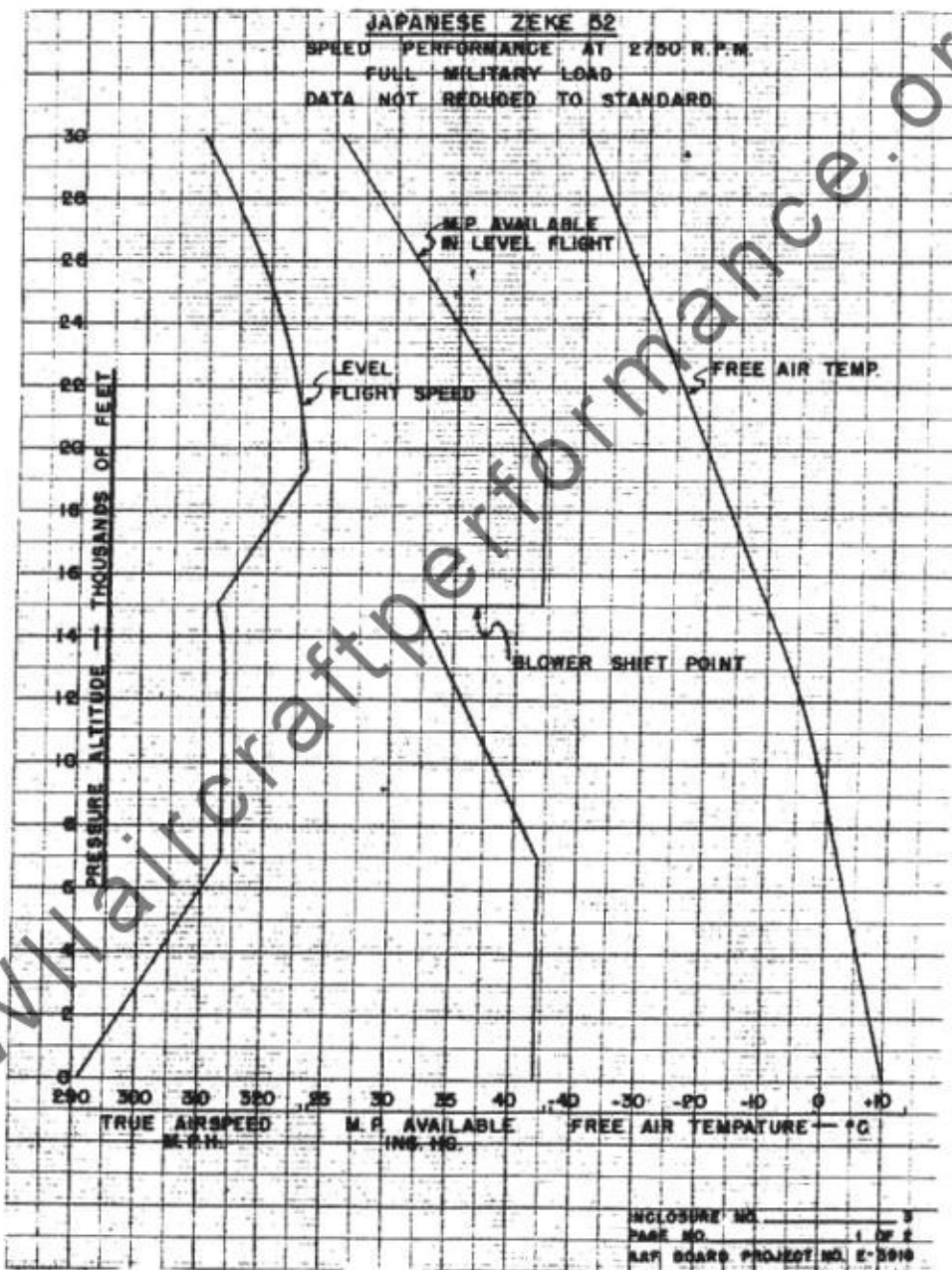
- (a) Head On Approach. The P-47D could break away by a shallow dive straight through on its original course, and then climb at high speed when out of range. If the P-47D attempted to break off in either a climbing or diving turn, the Zeke could turn in to position for a tail shot.
- (b) Zeke 2,000 Feet Above and Directly Behind. The P-47D could dive away without being fired on after the Zeke had started a diving tail attack. If the P-47D tried to turn to face the attack, the Zeke could easily reach and maintain a good tail shot position. The safest tactics for the P-47D consisted again of diving out of range and climbing at high speed to a head on attack position.
- (c) P-47D 2,000 Feet Above and Directly Behind. When the P-47D dove on the Zeke, it was possible to get sufficient firing lead for about a two second burst. If the pass were not broken at this point, the Zeke had an opportunity for a following shot as the P-47D turned. As in other initial positions, the best maneuver consisted of a short burst at the beginning of the pass, followed by a straight, fast dive out of range and a high speed climb to a new attack position. The Zeke could always exchange head on snap shots during attacks begun from a distance, but could not get any good tail shots if the P-47D did not turn.

g. General Characteristics.

- (1) Taxiing. With the seat in the full "up" position, and canopy open, visibility is fairly good, and a minimum of "S"ing is necessary during taxiing. The brakes are considered fair by American standards, but may not be truly representative of the Japanese installation, since they were relined with American material prior to test. The airplane has no parking brake, making engine runup very tiring.
- (2) Take-Off. Torque at take-off is not excessive, and can easily be compensated for with the rudder. Rudder control becomes effective very early in take-off run. Average take-off IAS during tests was 70 to 80 mph, with a take-off ground ran of approximately 800 feet for no wind conditions at 2750 RPM and 42" Hg.
- (3) Flight Characteristics. At low speeds (below 180 IAS), stick forces are light and controls positive. As airspeeds increase, forces become heavier; and at speeds above 250 IAS, controls are very stiff. Rudder trim is insufficient for climb, and the constant rudder force required during long climbs is tiring. Stability is positive about all axes for all normal flight conditions. Rudder control at low speeds is entirely adequate. Forward visibility in flight is good, but rearward visibility in the test airplane is poor due to canopy plexi-glass distortion. Blind spots exist to the rear and to the low front quarters. The Zeke is comparable to the AT-6 type airplane in its suitability as a gun platform and for instrument flying. No gun sight was installed, but gunnery visibility was apparently good.
- (4) Landing. The airplane is stable with wheels and flaps down, and is very easy to land. In the landing approach, which is at a moderate angle, visibility is good. The split flaps are adequate, and a gliding speed of 90 to 100 IAS results in ample landing "flare". Control forces are light, but positive at landing speed. Any ground looping tendency is easily counteracted with rudder alone. The low limiting airspeeds on landing gear and flap operation are annoying, and the hydraulic system is unnecessarily complicated.
- (5) Miscellaneous. The Zeke's high rate of turn, general maneuverability, and good flight characteristics are its most desirable combat features. Poor performance, weak armament, high control forces at high speed, and excessive vulnerability make it an undesirable combat airplane. The airplane is of very light construction by American standards, and does not have protective armor or self-sealing fuel tanks. These features make it extremely vulnerable as a fighter airplane.



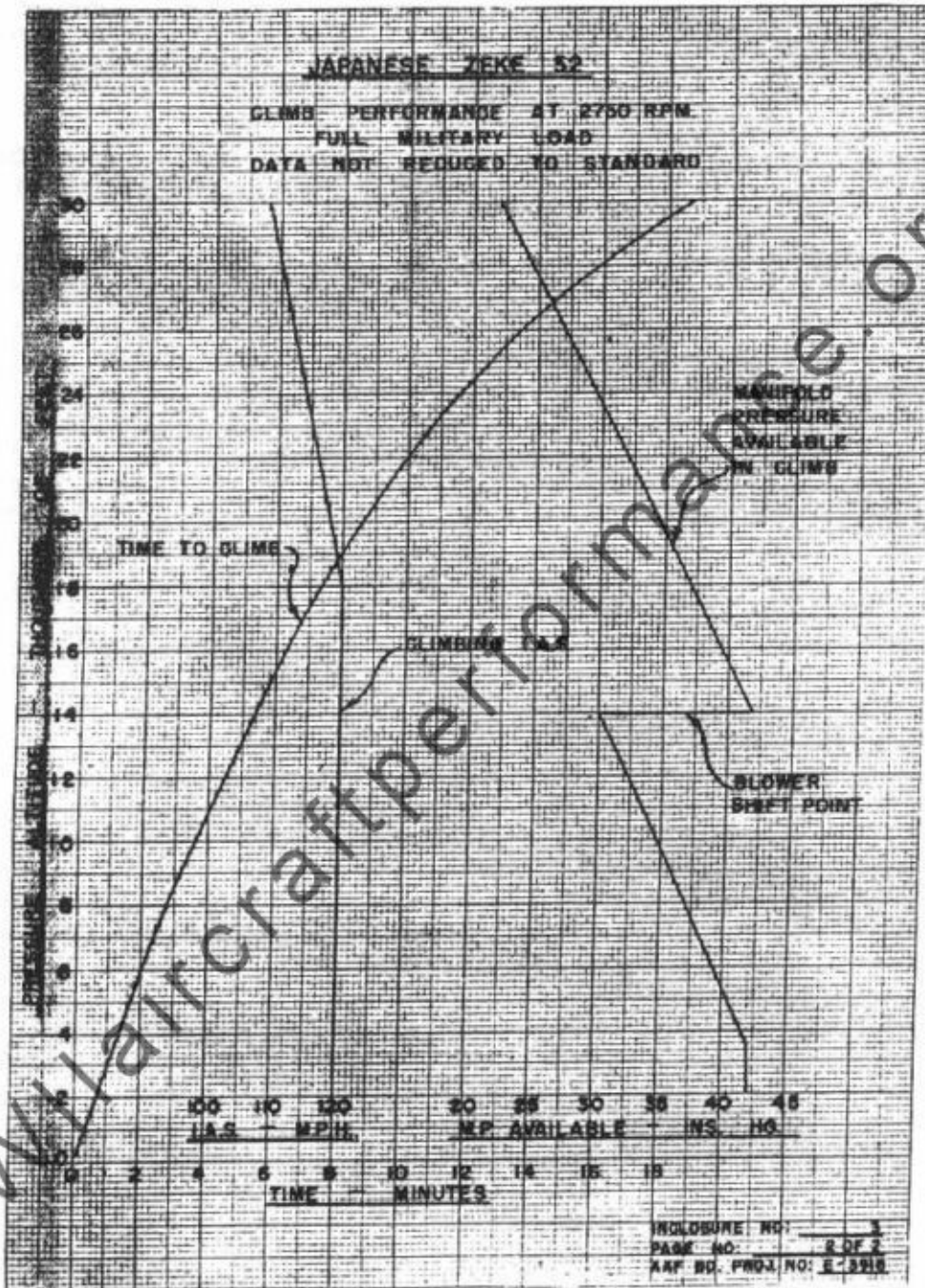
The cockpit is somewhat cramped, but not too uncomfortable for a small pilot. There is insufficient leg room for comfortable operation of brakes and rudder. Arrangement of cockpit controls is moderately good, except for the gear and flap operating levers. These are on the right side, and are difficult to operate. The combination automatic and manual carburetor mixture control is confusing, and it did not operate satisfactorily during test. No cockpit heater was installed, but the airplane is not uncomfortably cold for short periods at altitude. The cold air vent is adequate for low altitudes.



Inclosure 3

JAPANESE ZEKE 52

CLIMB PERFORMANCE AT 2750 RPM  
 FULL MILITARY LOAD  
 DATA NOT REDUCED TO STANDARD



Inclosure 3

## DESCRIPTION OF ZEKE 52

The Japanese Zeke 52 airplane is an all metal low wing single-seat fighter airplane of conventional appearance. It is powered with a Nakajima Sakae 31A twin row radial engine, fitted with a single stage, two speed, gear driven supercharger. This engine drives a geared, three bladed, constant speed, hydromatic propeller, similar to the American Hamilton type. Wings and fixed tail surfaces are full cantilever, and all control surfaces are of fabric covered metal construction.

Split type flaps and conventional landing gear are hydraulically operated. The gear retracts inward, wheel wells being covered in flight by landing gear strut fairing and small wheel doors. The tail wheel retracts upward.

Since the entire wing skin is of very light gauge, and cannot be safely used at the root for a step, entrance to the cockpit is facilitated by retracting steps and hand holds. The cockpit inclosure is of the multipanel, sliding hatch type.

Armament consists of two fixed synchronized 7.65mm machine guns forward of and directly chargeable from the cockpit, and one 20mm fixed automatic cannon in each wing.

The gross weight and wing loading of the Zeke 52 are low compared with current American fighters. Full military load gross weight, as determined during test, was 5,860 pounds. The airplane has no protective armor plate, and no provision for leak proofing of internal fuel tanks (which carry a total of 155 gallons). No shackle was installed on the test airplane for a bomb or for external fuel.



Zeke 52 - three-quarter front view.

Inclosure 4