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AVIATION INTELLIGENCE BRANCH
NAVY DEPARTMENT
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TECHNICAL AVIATION INTELLIGENCE BRIEF #3
(November 4, 1942)

DISTRIBUTION - All Ships and Units concerned with aircraft

PERFORMANCE AND CHARACTERISTICS TRIALS
JAPANESE FIGHTER

HISTORY

A Japanese aircraft was sighted, on its back, on Adutan Island, Alaska July 10, 1942. It is believed that the aircraft was forced down about June 4, 1942 as a result of the oil scavenger line having been severed by a bullet. Salvage was successfully accomplished under extremely difficult circumstances. The aircraft arrived at the Naval Air Station, San Diego, August 12th, where it was rebuilt by Naval personnel. Flight tests were conducted under the cognizance of the Test Section of Naval Air Station, Anacostia, and of the Bureau of Aeronautics.

Preliminary tests were conducted at the Naval Air Station, San Diego, between 28 September and 15 October, 1942. During the progress of these tests information was released as it was obtained, for promulgation to the Fleet. The following summary of results is submitted after final analysis of the data obtained, and supersedes the previous informal releases.

Considering the circumstances under which the airplane was recovered and operated, it is obvious that the Zero is a very serviceable and dependable airplane. An excellent job of reconditioning was done by the Naval Air Station, San Diego, and no major difficulties were encountered other than failure of radio and brakes to function. The latter are inherently deficient in design and capacity. The preliminary program was delayed by continuous efforts to improve brake operation, and by discovery that the alternate air intake was partially open which required repeating certain performance tests.

All performance tests were made with the airplane ballasted for its full armament and maximum internal fuel load. The engine power output was determined by a propeller and governor setting which permitted a maximum RPM in take off, climb, and

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level flight of 2550 to 2575, and an automatic power regulator which limited manifold pressure to 35 in. Hg. The performance results given below are somewhat at variance with preliminary figures due to further tests with improved instruments, reduction to standard conditions, and corrections for compressibility. It is probable that the airplane in the original condition was somewhat faster than is indicated here, due to the lack of a flush fit at wheel well fairings and cabin enclosure in the overhauled plane, and the addition of non-specular paint.

No information was available as to the power characteristics of the engine. It has a piston displacement of 1880 cu.in. and is believed to develop approximately 900 H.P. The settings found on the propeller governor and manifold pressure regulator were retained as being correct for rated power. However, the propeller stops were shifted in order to obtain the maximum RPM at take off and in climb at low altitudes. The pitch range of the propeller is comparatively small, and it is assumed that the Japanese use the higher pitch settings originally found in order to make available a more economical engine speed for cruising. The manifold pressure regulator has an emergency shift which raises its regulating figure from 35" to 38". The latter figure was used only for brief comparisons as the engine appeared to be definitely rough at this power. Further tests will be made at a time when an engine failure will be less critical to the test program. The engine operation was otherwise smooth and satisfactory. Cooling appeared to be unusually good. A critical altitude of 13000 feet is obtained with a single stage, single speed blower. Manual regulation of the mixture was necessary, although it is understated that the carburetor is fitted with an automatic mixture control feature which was not operative.

DESCRIPTION OF AIRCRAFT

DESIGNATION: Translation of the nameplate indicates that the aircraft is a:

Zero Type I Carrier Fighter Model 2

MANUFACTURER: Mitsubishi Heavy Industries Corporation, Nagoya works. Date of manufacture February 1942.

GENERAL: All metal low-wing monoplane, flush riveted with clean smooth exterior. Great emphasis has been given to saving weight wherever possible. Wing is integral with the fuselage, no leakproof tanks or armor, and wings fold only at tips. Landing gear, flaps, and brakes are hydraulically operated. Visibility is excellent with no difficulty seeing astern. Cockpit is not much more cramped than a Spitfire, except that the

longest pedal position is quite short and knees stick up rather high. Arrestor hook retracts into lower part of fuselage. Flotation bag in rear of fuselage - watertight compartments in wings, outboard of cannons.

DIMENSIONS: Span 39'-5", Length 29'-6 5/8", Wing area 248 sq. ft.

WEIGHTS: Empty 3718 lbs., Gross 5555 lbs. (without external tank).

ENGINE: Nakajima "Sakae" MKI, 14 cylinder, twin-row, air-cooled, rated at approximately 900 h.p.. Fuel 92 octane. Diameter 44". Weight approximately 1250 lbs.

PROPELLER: 3 bladed constant speed, all metal.

ARMAMENT: 2 x 7.7 mm guns (500 rounds each) synchronized to fire through propeller, (muzzle velocity 2400 ft. per second; 2 x 20 mm guns (30 rounds each) mounted in wings, muzzle velocity 2000 ft. per second. Electric reflector sight. Provision for two bomb racks on wings. Weight of guns and ammunition 344.5 lbs.

INSTRUMENTS: Completely equipped, including two-way radio (4596 KCS); radio compass (Fairchild); oxygen with altitude regulator.

FUEL CAPACITY (U.S. gallons): Wings 103 gals. Fuselage 38 gals. External 87 gals.

OIL CAPACITY (U.S. gallons): 15 gals.

PERFORMANCE

Maximum speeds and rates of climb are given below.

<u>Maximum speed</u>			Sea level	270	(m.p.h.)
"	"	"	5000 feet	287	"
"	"	"	10,000 "	305	"
"	"	"	* 15,000 "	326	"
"	"	"	20,000 "	321.5	"
"	"	"	25,000 "	315	"
"	"	"	30,000 "	306	"
<u>Rate of climb</u>			Sea level	2750	(ft/min)
"	"	"	15,000 feet	2360	"
"	"	"	20,000 "	1910	"
"	"	"	30,000 "	850	"

* Critical altitude.

SERVICE CEILING: 38,500 feet.

RANGE: (with built-in tankage) at 10,000' - 223 m.p.h. (fixed high pitch) - 1108 miles. Propeller setting is for rated power takeoff and climb, and resulted in part throttle operation in fixed high pitch. Improved range may be obtained with higher blade angles and lower engine speeds.

CHARACTERISTICS

STABILITY: (a) Longitudinal stability is positive throughout. The elevator control is light and effective, and has very desirable control movement characteristics.

(b) Directional stability is positive and control is light. There is no rudder trim tab and a moderate pedal force is carried in climb.

(c) Lateral stability is positive in cruise condition and close to neutral in landing condition. Ailerons are abnormally large and the rate of roll at low speeds is extremely high. However the ailerons forces increase excessively with airspeed, and above 200 kts. indicated the airplane is very difficult to roll. At speeds above 250 kts. it is almost impossible to maneuver the airplane laterally. At moderate to high speeds the rate of roll to the right is definitely lower than to the left, due to relative control forces.

COMPARISON WITH F4F-4: The Zero is superior to the F4F-4 in speed and climb at all altitudes above 1000 feet, and is superior in service ceiling and range. Close to sea level, with the F4F-4 in neutral blower, the two planes are equal in level speed. In dive the two planes are equal with the exception that the Zero's engine cuts out in pushovers. There is no comparison between the turning circles of the two airplanes due to the relative wing loadings and resultant low stalling speed of the Zero. In view of the foregoing, the F4F-4 type in combat with the Zero is basically dependent on mutual support, internal protection, and pull-outs or turns at high speeds where minimum radius is limited by structural or physiological effects of acceleration (assuming that the allowable acceleration on the F4F is greater than that for the Zero). However advantage should be taken where possible, of the superiority of the F4F in pushovers and rolls at high speed, or any combination of the two.

COMPARISON WITH F4U-1: The Zero is far inferior to the F4U-1 in level and diving speeds at all altitudes. It is inferior in climb at sea level, and inferior above 20000 feet. Between 5000 and 19000 feet the situation varies. With slightly more than normal fighter load, which may be distributed to give equal range and gun power, the Zero is slightly superior in average maximum rate of climb. This superiority becomes negligible at altitudes where carburetor air temperatures in the F4U are down to normal; close to the blower shift points it is more

marked. However, the Zero cannot stay with the P4U in high speed climbs. The superiority of the P4U at 30000 feet is very marked and will persist at considerably higher levels. Attention is called to the fact that in the foregoing condition of loading all fuel in the P4U-1 is protected. In combat with the Zero, the P4U should take full advantage of its speed, and its ability to pushover and roll at high speed if surprised. Due to its much higher wing loading, the P4U should avoid any attempt to turn with the Zero unless at high speed, and may expect the latter to outclimb him at moderate altitudes and low airspeeds. In this case the P4U should continue to climb at high airspeeds and on headings which will open the distance and prevent the Zero from reaching a favorable position for diving attack. After reaching 19000-20000 feet the P4U will have superior performance in climb and may choose its own position for attack.

ATTACHMENTS: Performance chart, nine views Zero in flight and on ground at San Diego, also cutaway drawing of Zero.

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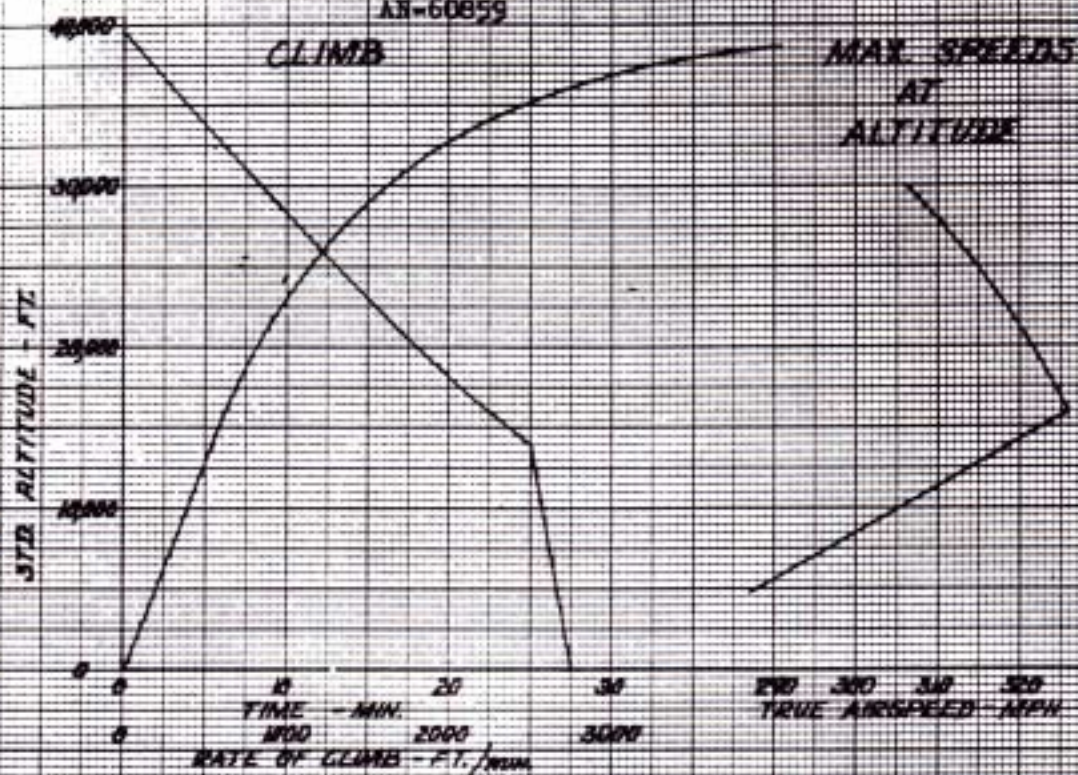
PERFORMANCE CHARACTERISTICS

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JAPANESE ZERO FIGHTER

GROSS WT. = 5555 LBS.

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AIRSPEED INDICATOR CALIBRATION

