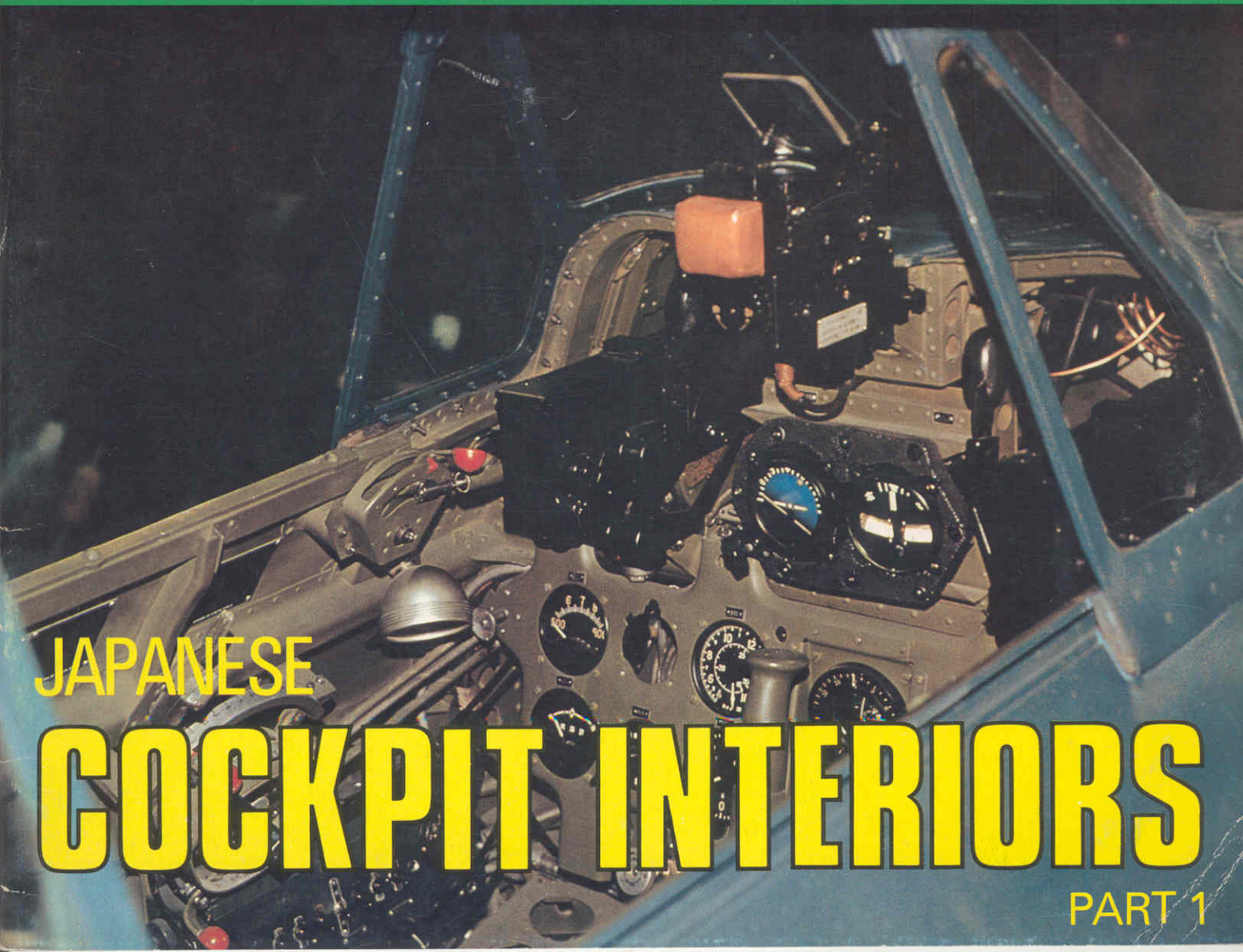


\$3.95

# MONOGRAM

## Close-Up 14



JAPANESE

# COCKPIT INTERIORS

PART 1



Restored cockpit of the Mitsubishi A6M5 ZERO in the National Air and Space Museum.

In this first of two parts, author Robert C. Mikesh has given us a unique glimpse into wartime Japanese fighters, transports, bombers and other military hardware not seen previously. Mr. Mikesh, a pilot himself, has given us not only a historical point of view, but also that of a pilot with a concern for the convenience and flyability of the cockpits described. The technically minded will find interesting differences

—and many similarities—between Japanese and Allied equipment used during this wartime period. Dictated by their own experiences and proficiency, pilots will recognize and appreciate the relative merits of each cockpit. The discriminating model builder will find a goldmine of useful material with an awareness of detail needed for reproducing cockpit components and attaining accurate colors for recreating his miniature aircraft.

It is for all these searching eyes and also for the technical researcher of World War II Japanese aircraft that this material has been gathered. Interest remains high for this interior detail information, due largely to the scarcity of recorded data by good photography.

Consequently, this book contains the best available interior photographic record for ten of Japan's wartime aircraft. The coverage of each aircraft includes all known photographic material of reasonable quality pertaining to its interior. These photos stem from years of searching public and military photos files and from canvassing private collections. Part two, scheduled for publication at a later date, will delve into still more cockpit interiors and is

guaranteed to be equally as fascinating as this book.

Considerable material has been written on the technical aspects of these aircraft, therefore, only a brief introduction to each type is contained here. For simplification the widely used Allied code name for the aircraft is used throughout this book.

- Photographic Sources  
U.S. Army  
U.S. Marine Corps  
U.S. Navy collection in the National Archives  
Shigeo Hayashi  
Robert C. Mikesh  
Richard L. Seely
- All drawings are by the author.
- Back cover design: Japanese Hinomaru

Published 1976 by  
Monogram Aviation Publications  
625 Edgebrook Drive  
Boylston, Massachusetts 01505, U.S.A.

Library of Congress Catalog Card  
Number 76-6214  
ISBN No. 0-914144-14-6

Printed in Singapore by  
Dainippon Tien Wah Printing (Pte) Ltd.

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## AIRCRAFT INTERIOR COLORS

Much already has been written about the interior colors of Japanese aircraft but there will always remain an element of controversy on specifics since the "standard of application" necessarily was varied as the war progressed. Inconsistencies are found in the shades of colors used within interiors; however, essentially, cockpits were given a medium to olive green color or were left unpainted. Various subcontractors exhibited a wide range of greens, often resulting in the cockpit interior being a mix of several shades of green.

The ZERO now on exhibit in the National Air and Space Museum provided an excellent opportunity for documentation due to its sheltered existence. During the 1974 restoration original color samples were obtained from well-protected locations within the aircraft. These samples afforded comparison between Japanese

Army aircraft and other color samples previously referred to as standard for Japanese Navy aircraft. Accordingly, the following Munsell color notations were derived from the ZERO fighter:

Interior Green	10 Y 4/4
Exterior Green	10 G 3/2
(Camouflage, headrest, upper decking under canopy)	
Translucent green protective coating:	5 BG 3/6
(Color varies with thickness of coating.)	

Army cockpit components and interiors often were unpainted. This may be attributed to the fact that most inspected aircraft were late war production types suffering from manufacturing haste. Large aircraft of both services usually were unpainted, allowing reflective light to increase interior visibility. Subassemblies in crew locations often had protective paint but not enough to alter the overall effect of nonpainted aluminum.

The Japanese did develop a unique translucent green which was used in a manner similar to the Allied zinc chromate. Its appearance was similar to the current American "candy apple green." Application was inconsistent but usually the color was applied directly to a part prior to assembly within a subassembly. Thus, a fuselage ring former, made up of several parts, may have had only one part coated with this protective color. However, there are instances where an entire assembly was sprayed following completion.

Interior views of the NASM's ZERO illustrated within this Close-Up depict typical usage. Contrary to some published accounts, this translucent paint was not a deliberate cockpit color but merely a primer.

Instrument panels varied by aircraft type, being either interior green or flat black. Control knobs and handles did not follow any established standard and often were seen in red, yellow, brown, black and other varying shades.



## JAPANESE COCKPIT INTERIORS PART 1

Interior photographs of Japanese aircraft from original Japanese sources are virtually nonexistent. To what quantity and detail pictures on this subject were made is not known, but Japanese technical documentation was not as profusely illustrated as those of the U.S. military and aviation industry. What photography there was that related to Japan's war making ability was distributed in limited numbers and tightly controlled.

by Robert C. Mikes

After the surrender of Japan and before the arrival of Allied Occupation Forces, the Japanese order was given to destroy all documentation pertaining to war munitions. In the case of aviation data, the thoroughness of destruction seemed to vary by aircraft company. With few exceptions, however, the destruction of photographs was nearly complete throughout the aviation industry.

This, coupled with Japan's severe shortage of camera film and insufficient means for artificial lighting, accounts for the lack of coverage on aircraft interior details. The main source for detailed photographs were those taken by the U.S. Army's Technical Air Intelligence Unit. Many of these views are of derelicts left behind by the Japanese after they removed all servicable equipment. For U.S. intelligence gatherers these hulks were often the only available information about the inner workings of Japanese airplanes. They provided a means by which to measure the

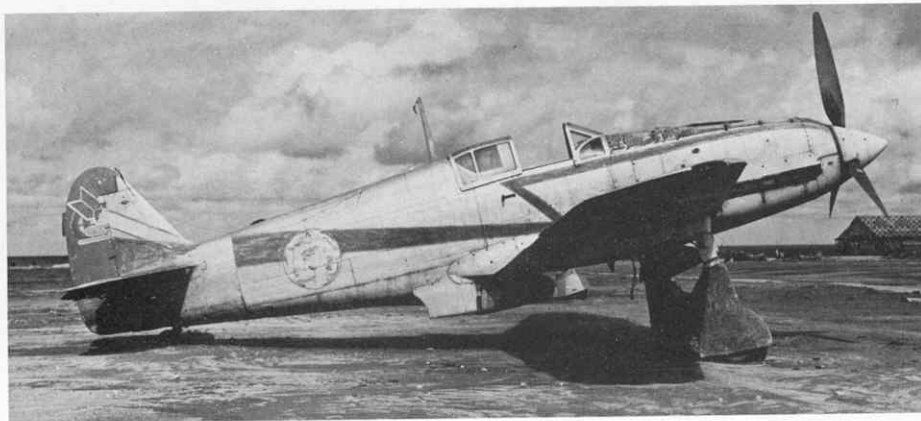
development of Japan's technology. The once highly guarded photographic coverage from which this book was developed may well be the only remaining documentation showing interior details of these particular Japanese aircraft.

A rare Japanese photo taken inside the pilot's compartment of a Mitsubishi Ki.21 SALLY. Only in aircraft having an abundance of natural light were pictures such as this possible.

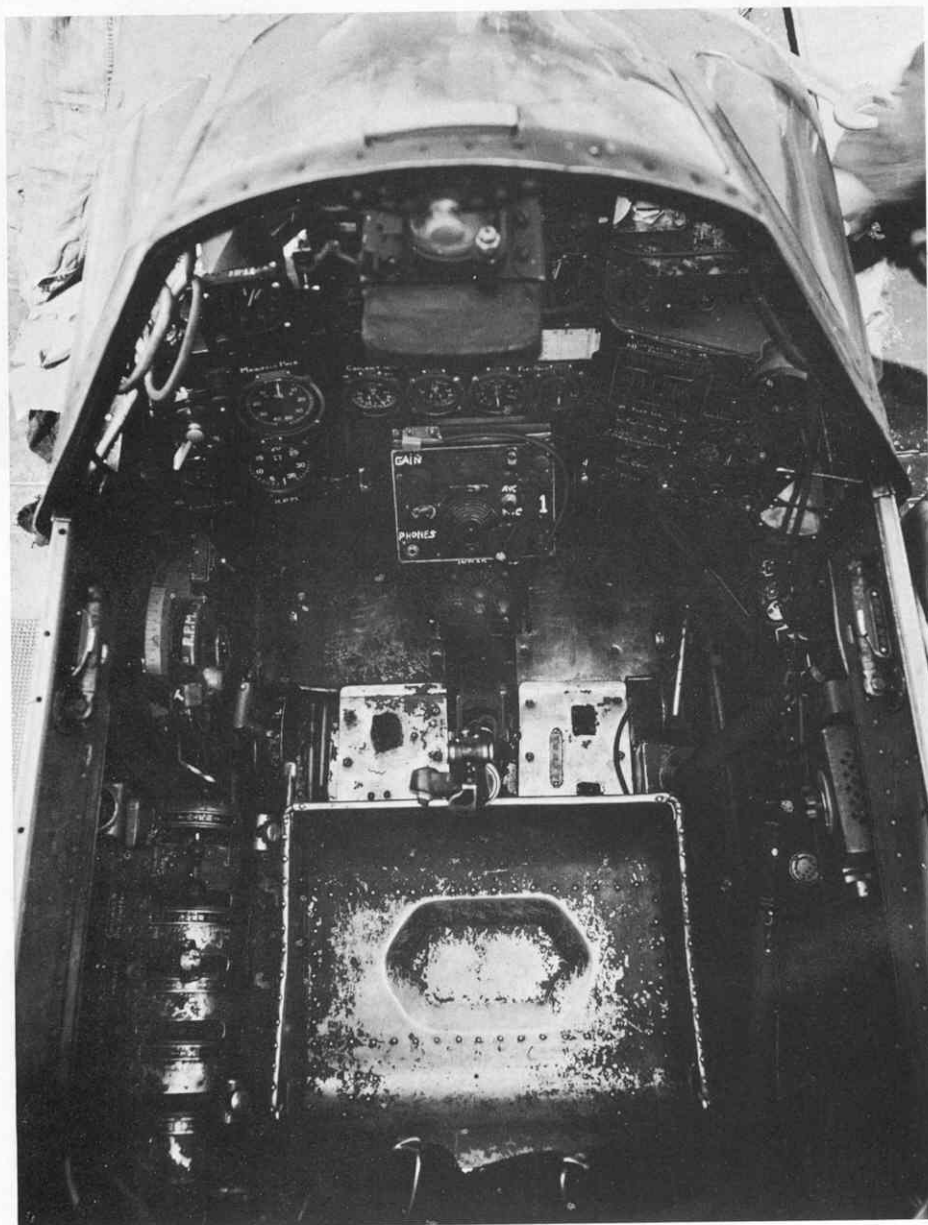
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# TONY, Kawasaki Ki-61 Hien



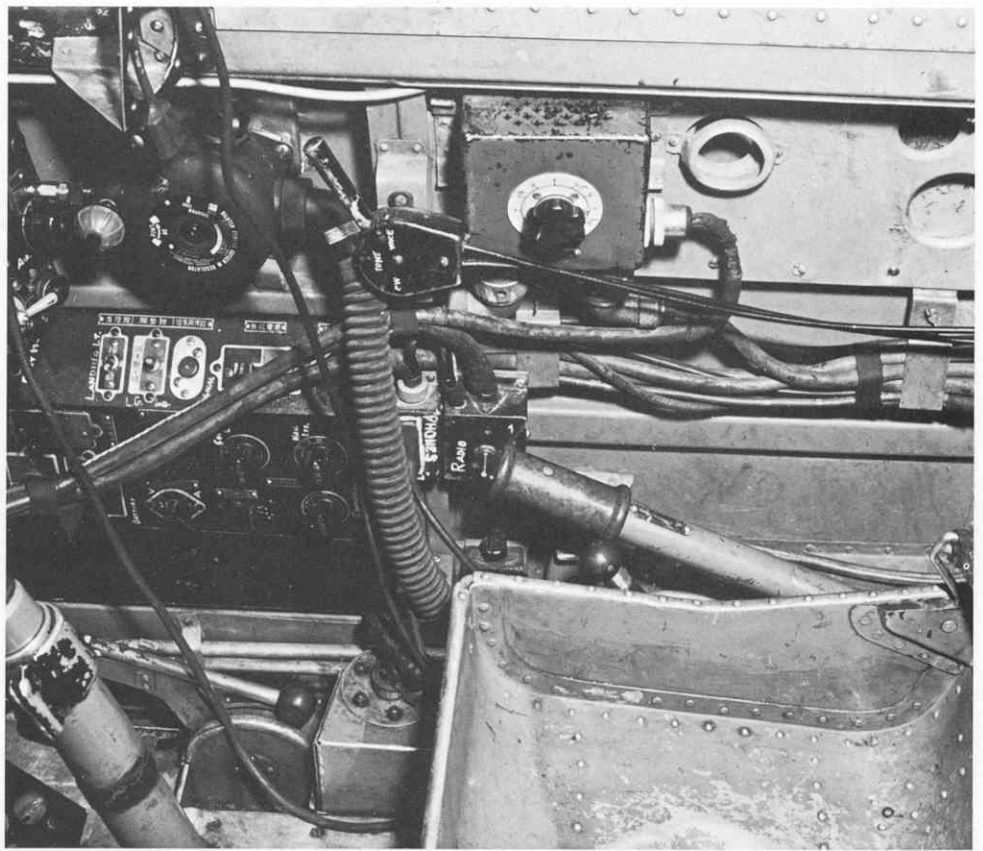
This TONY, officially known as the Kawasaki Army Type 3 Fighter, Ki.61 Model Ib, was photographed at Fukuoka, Kyushu, Japan at the end of the war. Components from three aircraft were combined in order to keep this particular fighter operational. Interior details shown here are of this model of TONY.



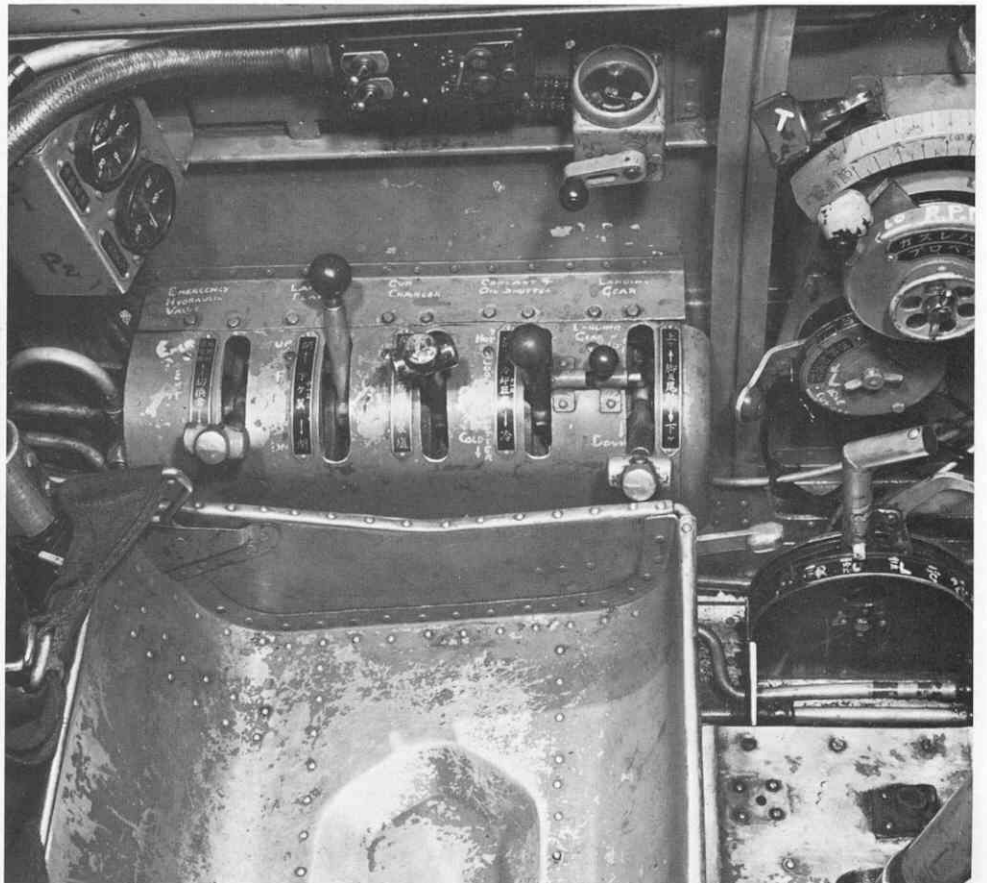
Best known as TONY, the Kawasaki Ki.61 was a well-designed fighter but problems with the Japanese-built DB 601 engine hampered its operational ability. Once most of the technical problems were solved, TONYs first entered combat in New Guinea in April 1943. Superior to the P-40 and easily outmaneuvering the P-38, TONYs soon met overwhelming numbers of F6Fs, F4Us and P-51s and were decidedly outclassed. Against superior odds they were forced to guerrilla-type tactics but retained their fame as Japan's toughest and best structurally protected fighter. They were frequently encountered by B-29 crews over the main islands of Japan.

Pilots newly assigned to TONYs would have been aware immediately of the increased complexities of this fighter in comparison with aircraft they had flown previously. Except for those pilots who had flown the early Kawasaki liquid-cooled biplanes, all others would have had experience only in air-cooled radial engine type aircraft. These required only minor cowl flap adjustments for proper engine cooling. With the liquid-cooled engine of TONY, pilots now were faced with critical coolant temperatures, inlet air duct monitoring and other advanced aircraft systems at a time which preceeded automatic controls. The cockpit arrangement of TONY was well layed out and all controls appeared to be in easy reach of the pilot. Those on the left control console would have required considerable head movement to visually check control positioning. The common centerline for the control handles on the pilot's left was a unique arrangement in cockpit design. Fore and aft movement of control handles was more conventional than the left and right movement as in the case of TONY. Two distinctly shaped knobs were placed alternately to aid pilot touch identification of the control handles. Before the landing gear handle could be repositioned, a slide detent knob had to be moved, thus avoiding inadvertent landing gear operation. The landing flap handle appears to be in an inconvenient location, intermixed with other controls and out of direct sight of the pilot during the landing approach.

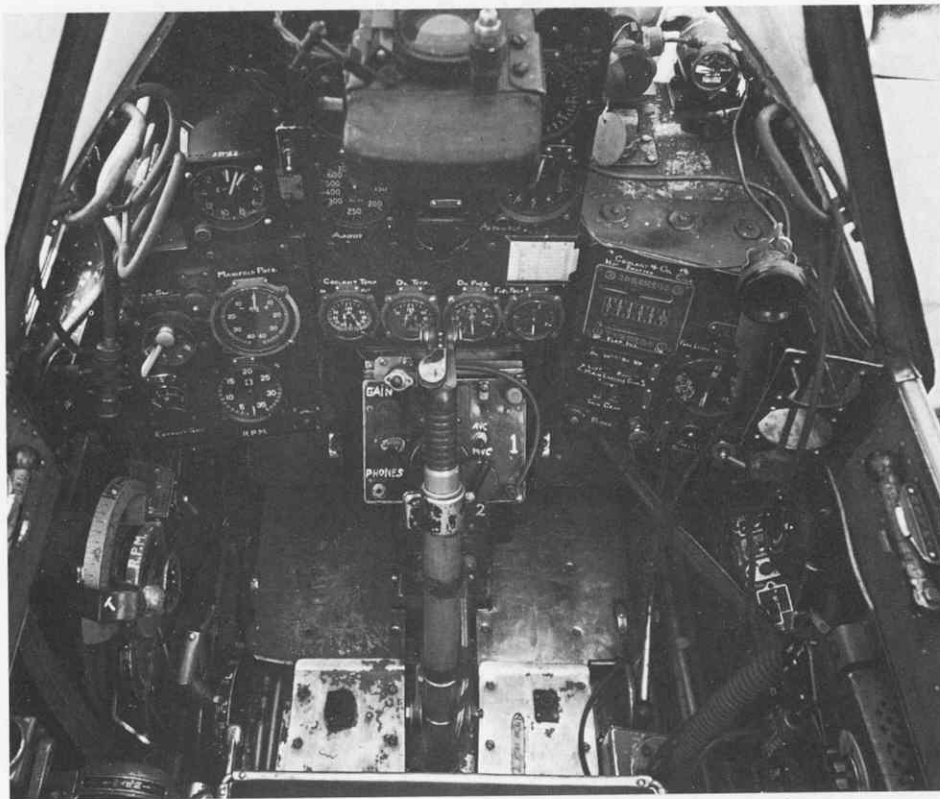
A unique feature in the cockpit of early model TONYs, namely the Ki.61-Is, was the small windows below the forward windshiled. These allowed natural light to cover the otherwise shadowed instrument panel. This feature may have been borrowed from the Bf 109E. Later models of both fighter types eliminated this feature.



The right side of the cockpit primarily contained electrical and radio equipment. This captured TONY was flown by American pilots for evaluation. For this purpose an American made oxygen system was installed and all switches and instruments were marked in English. The large handle to the right of the seat is an emergency hydraulic hand pump, while the knob just below it is for seat adjustment.



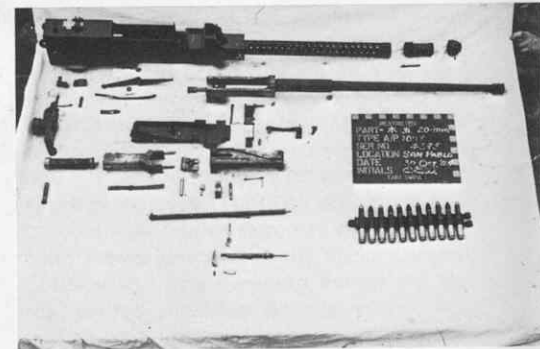
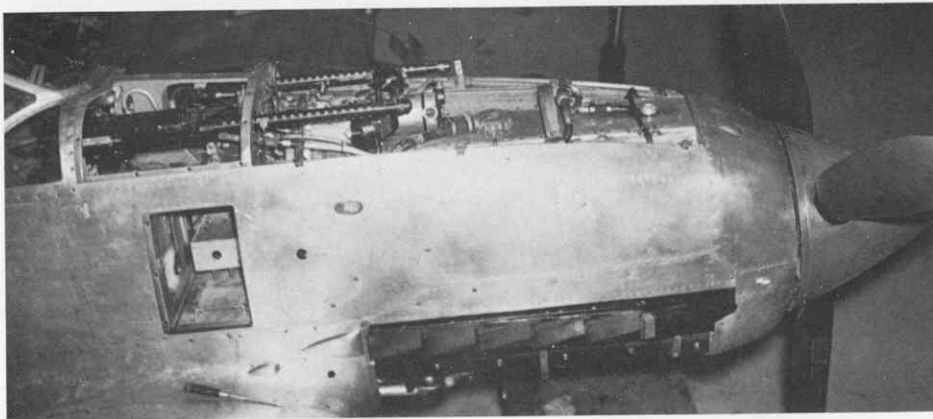
This view shows the left side of the cockpit of TONY. In the upper right hand corner is the throttle and propeller control, below which is the mixture control. The small crank at the top center was for elevator trim with a position indicator. Two pressure gauges above the rear control handle for "Emergency Hydraulic Valve" indicates there may have been two hydraulic pressure accumulators. One isolated by this control valve handle from the normal actuating system was to be used in the event of main system failure. Similar systems reserved this emergency pressure to handing gear extension only. An auxiliary hand operated pump operated all systems provided hydraulic lines were not severed.



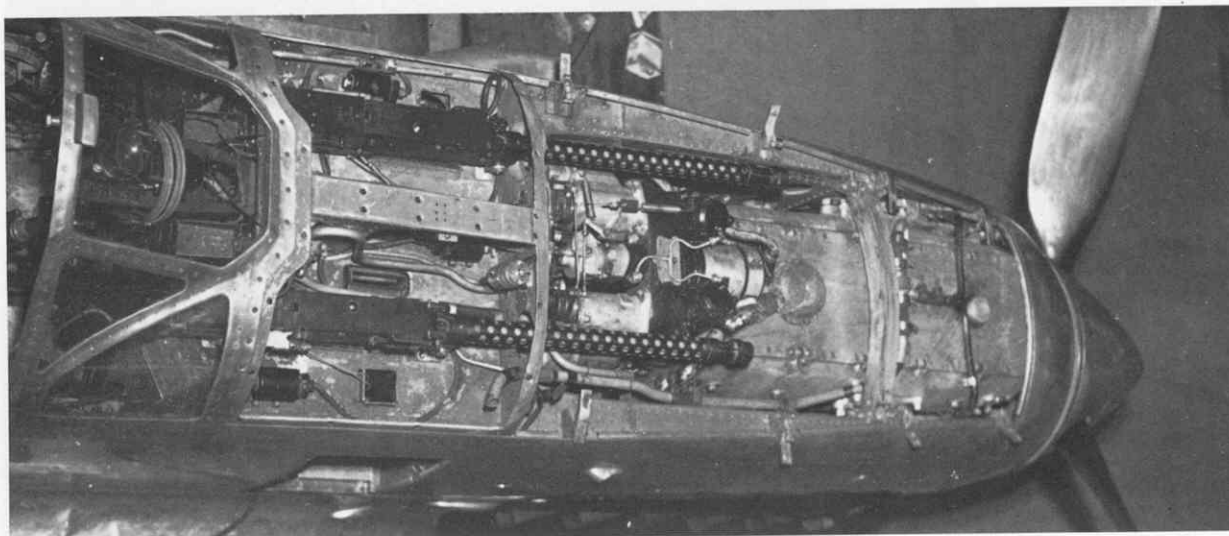
Flight instruments in the Kawasaki Ki.61-1 TONY were well grouped for the pilot to cross check. Noticeably absent were gyro-stabilized artificial horizon and heading indicator. Few fighters of that period carried gyro instruments as their tumble limits were exceeded easily, rendering them useless until righted and reset again after attaining level flight.

The hand-held microphone was an American installation as was most of the voice communication equipment which was used while being evaluated by Allied Forces.

Fuselage-mounted weapons were normally two 12.7 mm Type 1 machine guns as shown in these exposed views of a Ki.61-lb TONY. These were the Ho.103 that could fire 900 rounds per minute. The uniquely staggered installation of these two weapons allowed their respective ammunition boxes and chutes to overlap, thereby allowing double the quantity of ammunition than in conventional installations.



Late model TONYs carried two 20 mm Ho.5 cannon in the fuselage like this field stripped weapon acquired from a TONY at San Pablo, Luzon, on October 30, 1944.



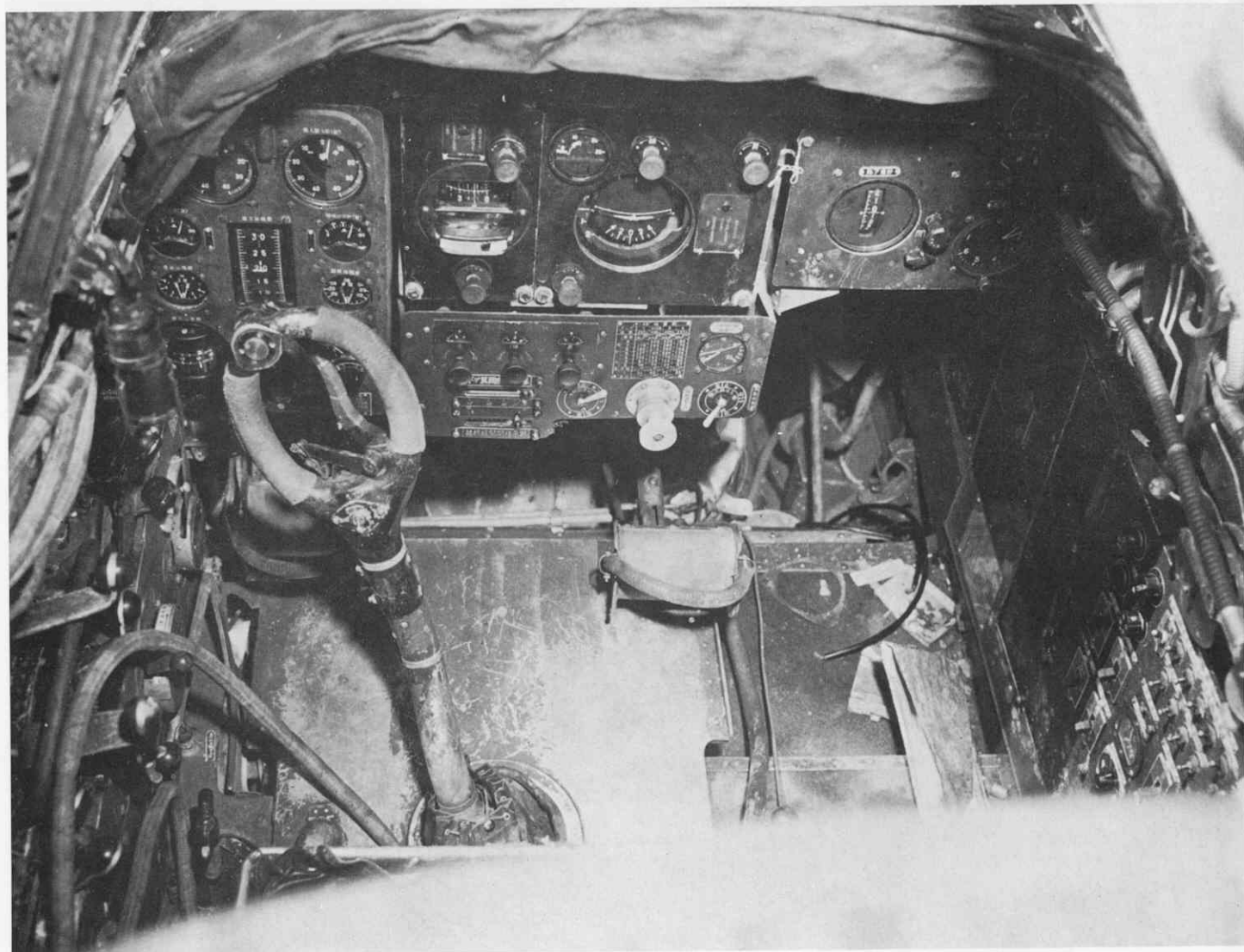


# LILY, Kawasaki Ki 48

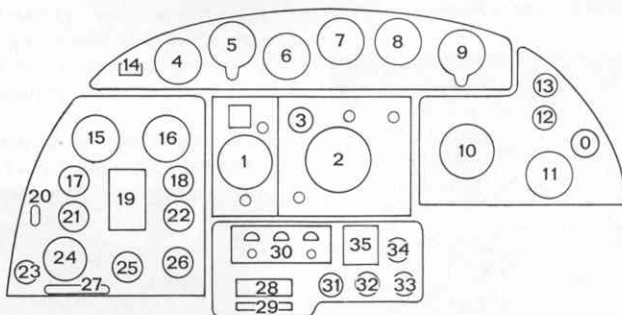
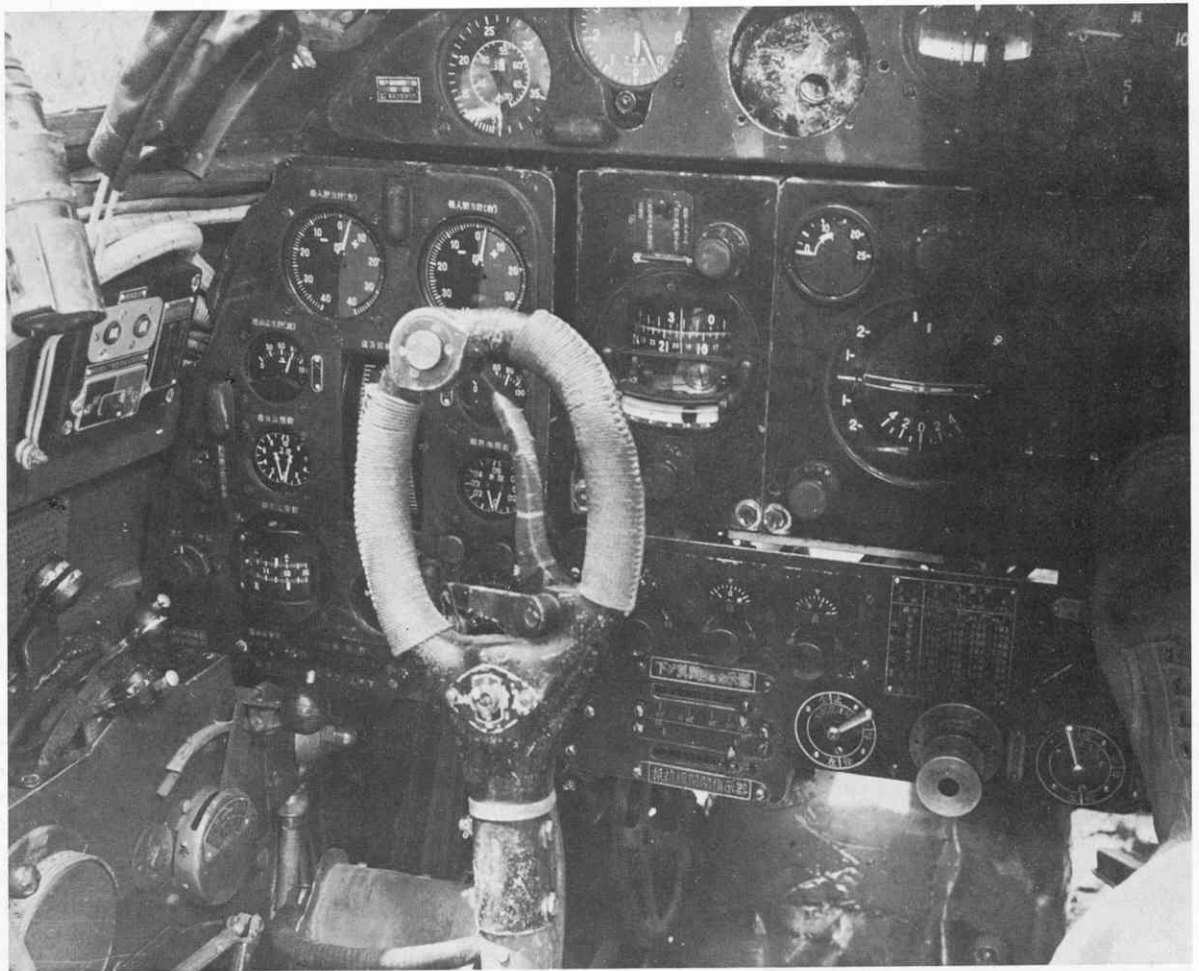


LILY, the Kawasaki Army Type 99 Twin-Engine Light Bomber, Ki.48 first emerged from production lines in mid-1940. It was a marked improvement over the fixed gear single-engine types it replaced in the war in China and in Manchuria, but when pitted against Allied types encountered in the Pacific, it was outclassed in speed and defensive armament. Its bomb load was very small, but because of the large number that were produced, they made good account for themselves throughout the island campaigns. They were known for frequent night harassment bombings and for hit and run air attacks.

This LILY (left) was photographed at Nan Yuan Field, Peiping, China, December 1945, after it was impressed into the Chinese Air Force. Two Chinese crewmen and two Americans look over the aircraft, while a Japanese mechanic (center) checks the engine.







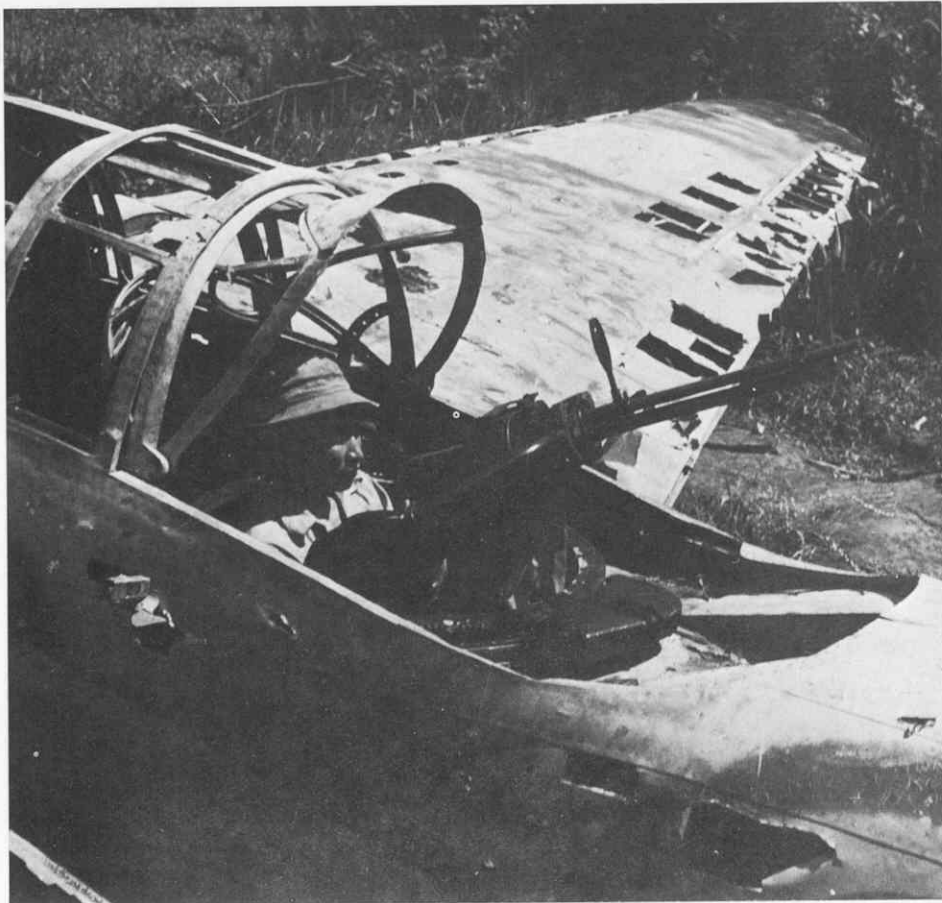
Kawasaki Ki.48 LILY Instrument Panel

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Automatic Pilot Turn Gyro Control Unit</li> <li>2. Automatic Pilot Bank-Climb Gyro Control Unit</li> <li>3. Automatic Pilot Vacuum Gauge</li> <li>4. Airspeed Indicator</li> <li>5. Altimeter</li> <li>6. (Removed)</li> <li>7. Turn and Bank Indicator</li> <li>8. Rate of Climb Indicator</li> <li>9. Clock</li> <li>10. Inclinator</li> <li>11. Accelerometer</li> <li>12. Voltmeter</li> <li>13. Airspeed Indicator</li> <li>14. Component Manufacturing Ident.</li> <li>15. Manifold Pressure Indicator, Left</li> <li>16. Manifold Pressure Indicator, Right</li> <li>17. Oil Temperature Gauge, Left</li> </ol> | <ol style="list-style-type: none"> <li>18. Oil Temperature Gauge, Right</li> <li>19. Engine Tachometer (Dual)</li> <li>20. Vacuum Instrument Pressure Control</li> <li>21. Oil Pressure Indicator (Dual)</li> <li>22. Fuel Pressure Indicator (Dual)</li> <li>23. Pitot Static Selector Valve</li> <li>24. Fuel-Air Ratio Gauge (Dual)</li> <li>25. R.P.M. Synchronizer</li> <li>26. Cylinder Head Temperature, L. &amp; R.</li> <li>27. Landing Gear Warning Lights</li> <li>28. Wing Flap Position Indicator</li> <li>29. Dive Brake Position Indicator</li> <li>30. Automatic Pilot Sensitivity Controls</li> <li>31. Instrument Vacuum Source Selector</li> <li>32. Engine Primer Fuel Pump</li> <li>33. Instrument Vacuum Source Selector</li> <li>34. Automatic Pilot Hydraulic Press.</li> <li>35. Ki.48 Fuel Quantity Chart</li> </ol> |
|--|--|

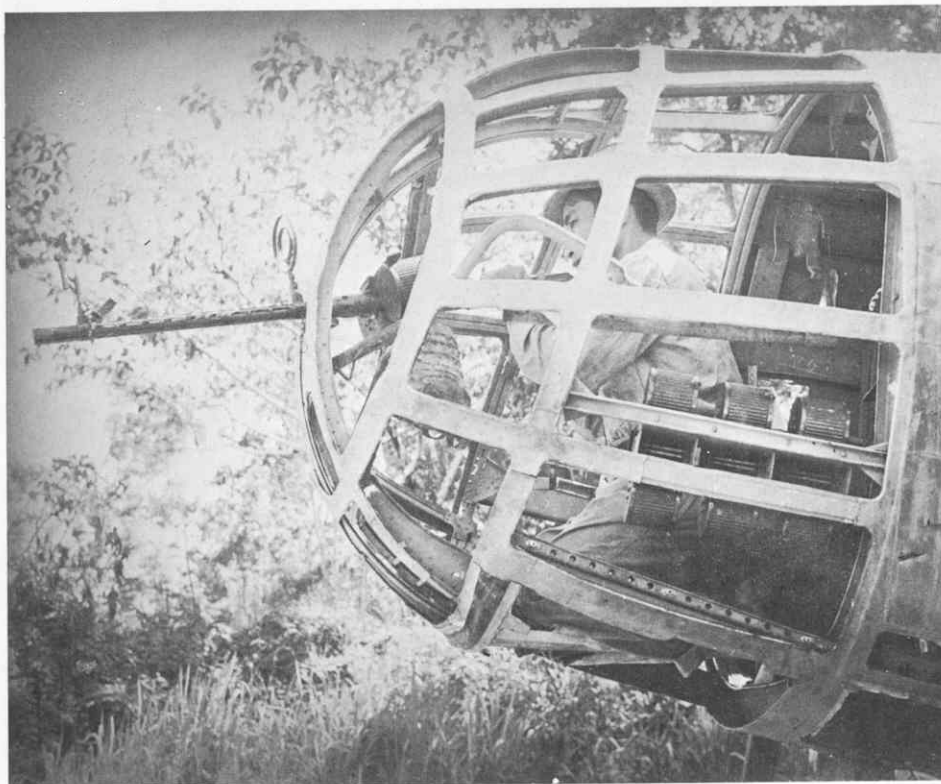
The Kawasaki Ki.48 LILY was a small bomber, yet the pilot was given a well organized, uncramped cockpit. He sat slightly to the left of center while the Bombardier/Gunner sat to his right rear. Access to the nose compartment for this crew member was through the crawl way at the lower right.

LILY was equipped with a hydraulically operated automatic pilot, very similar to the Jack & Heintz type found in the American built C-47 as shown on page 23. Controls for this automatic pilot unit are the small knobs near the directional and attitude gyro indicators in the center of the instrument panel. The three knobs immediately below are sensitivity controls for pitch, yaw, and roll of the aircraft.

Above the throttle quadrant on the left side is the armament panel. The top buttons are for bomb doors "open" and "close," while the lower toggle switch is for bombs "safe" and "armed."



A local islander simulates the rear gunner in this abandoned remains of a LILY light bomber (above). The nose gun position is demonstrated (below) in what appears to be the same aircraft. This gun mount can be raised and lowered on the movable forward round housing that is mounted on a circular track. Note the storage of additional magazines on the left side. At the right, in the nose position, a Japanese crewman prepares to launch a guided air-to-ground missile being tested.



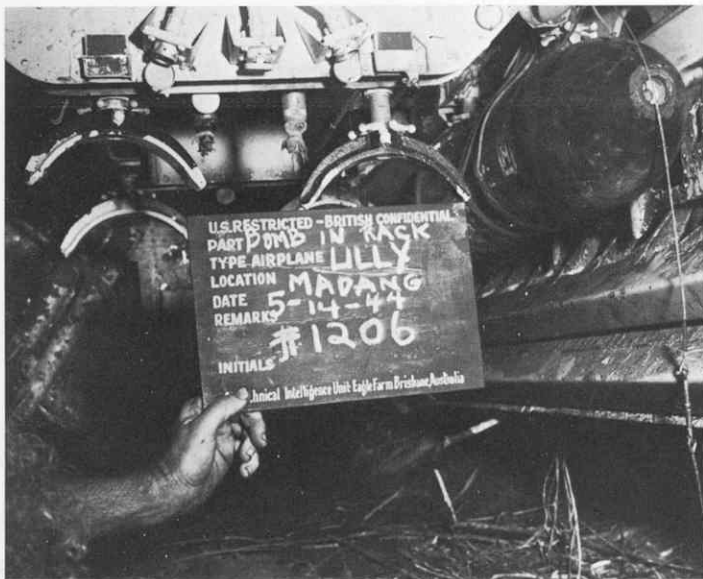
The Kawasaki Ki.48 LILY normally carried a crew of four. In addition to the one pilot was the Bombardier/Gunner in the forward section, a Navigator/Gunner who manned the ventral gun position, and a Radio Operator/Gunner to man the flexible dorsal gun. In later models of LILY this latter gun station changed from a 7.7 mm Type 89 machine gun to a 12.7 Type 1.

At left, the dorsal gun position is being demonstrated in the wreckage of a discarded LILY that was left behind by the Japanese. Note how the rear folding enclosure when slid forward forms a wind deflecting shield for the gunner.

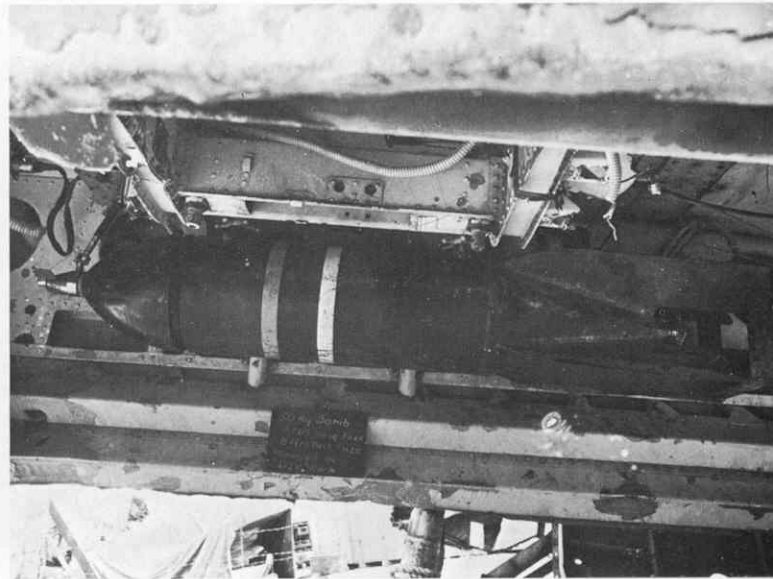
Improvements in LILY that were made after April 1942 gave the craft dive-bombing capabilities. These Ki.48-IIs had snow-fence type brakes under each wing which allowed dive angles up to 60 degrees.

As small twin-engine bombers, LILYs were a natural vehicle for testing new equipment. One program in which a LILY was used was for the air launching of Japan's experimental I-Go-1B, a radio controlled flying bomb. The picture below shows a crewman preparing to operate the launching and control equipment mounted on the nose section of a LILY. The war ended before the I-Go Weapons became operational.





Defused bomb still hangs in wreckage of a LILY that was found at Madang, New Guinea, in May 1944. Eight of these 50 kg bombs could be carried by LILY to equal her near 800 kg bomb load.



View of another Type 94, 50 kg bomb hanging in a rack of LILY. This type of bomb is painted black with a red band around the nose. The forward color band around the body of this bomb was yellow, with a white band behind to denote picric acid high explosive filling. Overall length not including fuse was 41 inches and weighed 110 lbs.

Bomb load capability of LILY was relatively small for its size. Normal load consisted of eight 50 kg general purpose bombs. Double that capacity was sometimes carried in the later model Ki.48-IIbs due to improvements in the aircraft, primarily increased horsepower.

The aircraft pictured at the right and lower right is the LILY from which the preceding cockpit pictures were made. It was not until very late in the war that a complete aircraft of this type fell into Allied hands for detailed study of all their components. This aircraft was photographed some time after April 1, 1945, for the pictures were taken by a Marine photographer on the south shore of the Motobu Peninsula on Okinawa.

This LILY carries the unit marking of the 90th Sentai or Group which was active throughout most of the South Pacific operation. Instead of assigning aircraft numbers, this unit used names of stars for identification. This example carries the name "Kesgyusei" or "Altar" on the tail. Of further marking interest is the placard printed on the fuselage just under the stabilizer in a manner similar to that which the Japanese Navy used to apply its aircraft identification placard. In this case however, it reads "Metal Paint" on the first block, followed by "Number (or Class) 2."



## JAPANESE FLYING SUITS

Since heating systems in military aircraft were not used, the Imperial Japanese Army placed considerable importance on the quality of its flying clothes. Active research in the way of field studies was carried out at various military installations and institutes throughout the 1930s. Few changes were made during the war except in those instances in which critical shortages made inferior substitutes necessary.

Factors given particular consideration were insulation value, wind resistance, weight, comfort in fit, and adaptability to the particular mechanical and space relationships within the airplane.

Four outfits of clothing were in standard use with the I.J.A.: the tropic, the summer, the winter, and the electrically heated series.

The tropic clothing consisted of a two-piece suit of very thin cotton, summer helmet, summer gloves, and summer boots. The tropic suit was issued in all areas south of the home islands.

Summer wear consisted of a two-piece, cotton-wool gabardine cloth, a cotton cloth-lined light weight leather helmet, leather gloves with a knit cotton insert, a silk scarf, and unlined short leather boots. When worn over a winter service uniform, this clothing was considered usable at a minimum temperature of  $-5^{\circ}\text{C}$ .

Winter clothing consisted of a cotton-wool suit lined with goat or rabbit fur, a wool hood worn around the head and face, a fur-lined helmet, a "turtleneck" scarf, goatskin gloves with two-piece cotton and wool inserts, and fur-lined leather boots. When worn over a winter service uniform and winter underwear, this clothing was considered usable at a minimum temperature of  $-30^{\circ}\text{C}$ .

Electrically heated clothing consisted of a one-piece electric suit liner worn beneath the winter suit, an electrically heated glove liner worn inside the wool-lined leather glove, and an electrically heated shoe insert worn inside the fur lined leather boot. The minimum usable temperature was considered to be  $-55^{\circ}\text{C}$ . Electrically heated suits were in standard use by the Japanese Army Air Force in 1928, at which time external wind-propelled generators were used as the source of power. In 1944 improved types of heating elements employing a chrome steel wire wound on a wool fiber core were introduced. The newer heating elements made the clothing quite resistant to wear.



All Japanese pilots were not commissioned officers. Those who were, often wore their swords with flying clothes, as this was part of the officer's uniform. These usually were carried on board the large size aircraft. Swords were of two general sizes: long and short; and although being symbolic, they were also considered a weapon should the officer crewmen be forced down into enemy territory. Both these pictures were taken at Hamamatsu Air Base, Japan in December 1944 showing the winter flying suit. The cotton-wool gabardine was brown 7.5 YR 4/2 (Munsell Code color) while the leather boots were 2.5 YR 4/4. Parachute harness webbing was forest green 10 G 3/4.





Crew member stands ready to board a Nakajima Ki.49 Donryu, HELEN at Hamamatsu Army Heavy Bomber Training Base, December 1944.

## Nakajima Ki.49 Donryu, HELEN



The wide opening hatch allows easy access into the cockpit of this HELEN which is stripped of all servicable parts.

The Nakajima Ki.49 "Donryu" HELEN became the replacement for the aging Mitsubishi Ki.21 SALLY which was being outmatched in the air war over China. What evolved in the design of HELEN was little more than a refinement of the already obsolete SALLY. Although more difficult to fly than the Ki.21, crewmen initially were satisfied with HELEN's combat survivability with the addition of armor plate, several more machine guns, and one 20 mm Ho.1 cannon used for the first time on a Japanese airplane. This advantage was short lived with the

rapid improvement of Allied fighters.

The first bomber of this type flew in August 1939 and production models begun replacing SALLYs two years later. Production rates were disappointingly slow but they did appear in small numbers early in the Pacific War with initial attacks being made against Northern Australia, New Britain and New Guinea. HELENs remained the Army's mainstay as a heavy bomber until late 1944 when their numbers diminished and many of those remaining were launched in Kamakize missions in

the defense of the Philippines.

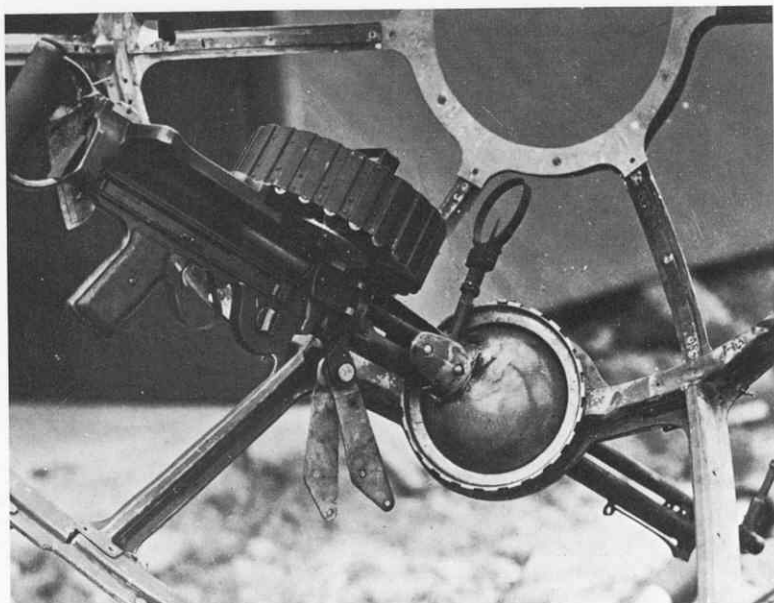
Normal load for HELEN's large bomb bay was seldom more than 2,000 pounds. Bomb bay doors parted in the center and consisted of two sections that folded in the middle when opened. This system must have had its problems for in the above left picture of HELEN, the inside section of these doors have been removed and the bomb bay remains half exposed as the outer sections are nearly closed.

Clamshell-type cockpit enclosures of this type shown above undoubtedly gave in-flight problems of inadvertent opening as did similar, yet stronger latch-type fasteners of the Martin B-26 and Douglas A-26. Both American types received major modifications for even stronger and more positive latching methods far in excess of that shown here.

The forward nose section contains an off center flexible gun mount and a flat panel bomb aiming window. This entire nose assembly can be rotated by a hand crank at the operator's left to place this flat window section in the proper position for the bomb sight, or to move the flexible-mounted machine gun into the best position for firing.



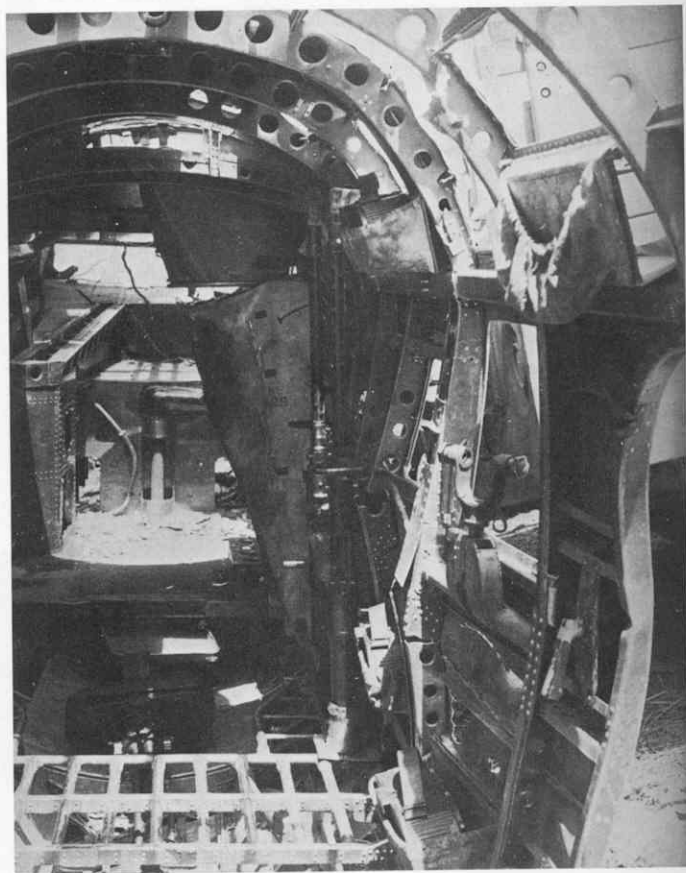
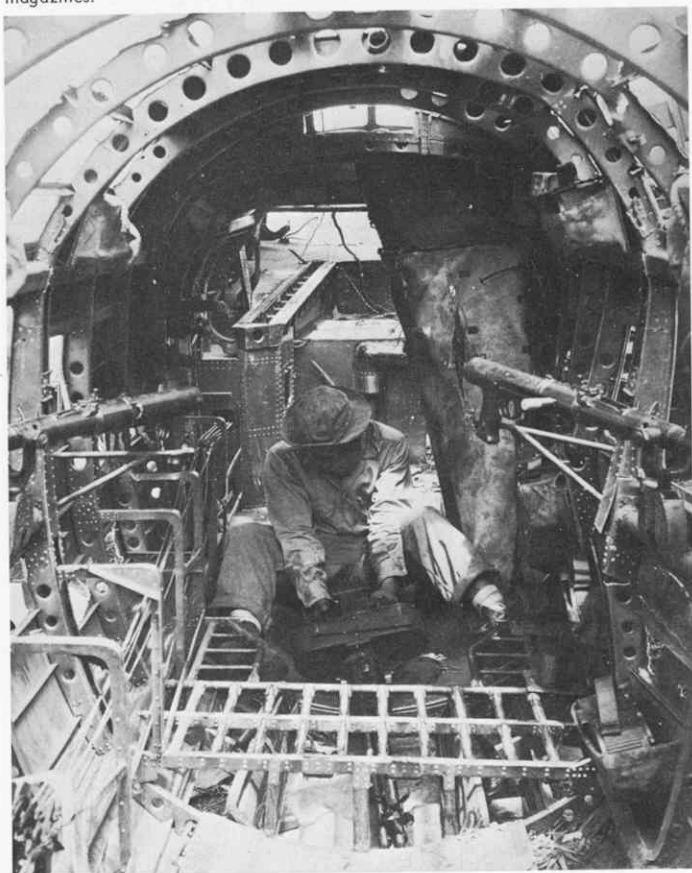
A wrecked HELEN found in New Guinea, May 1944, reveals full fuselage width bomb bay.



Nakajima Ki.49 HELEN gun stations. Mounted in the nose receptacle at upper left is a 7.7 mm Lewis type machine gun. This nose enclosure can be rotated to place the gun in the best firing position. At right, a 7.92 mm machine gun is demonstrated in the port waist position.



With two waist guns secured in place, the firing position of the ventral gun is shown. Note the stowed upright positions of the weapons in the picture at the lower right, and the canvas bags, some containing spare ammunition magazines.



## Nakajima Ki.44 Shoki, TOJO

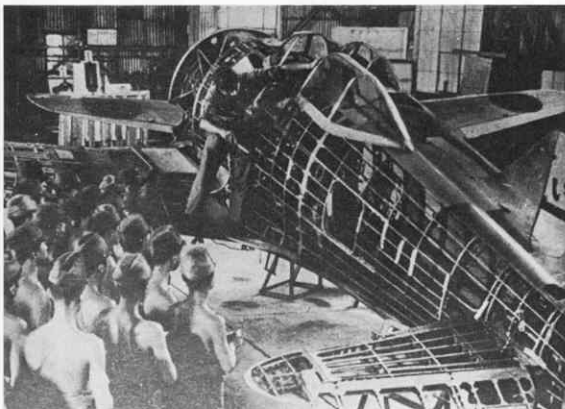
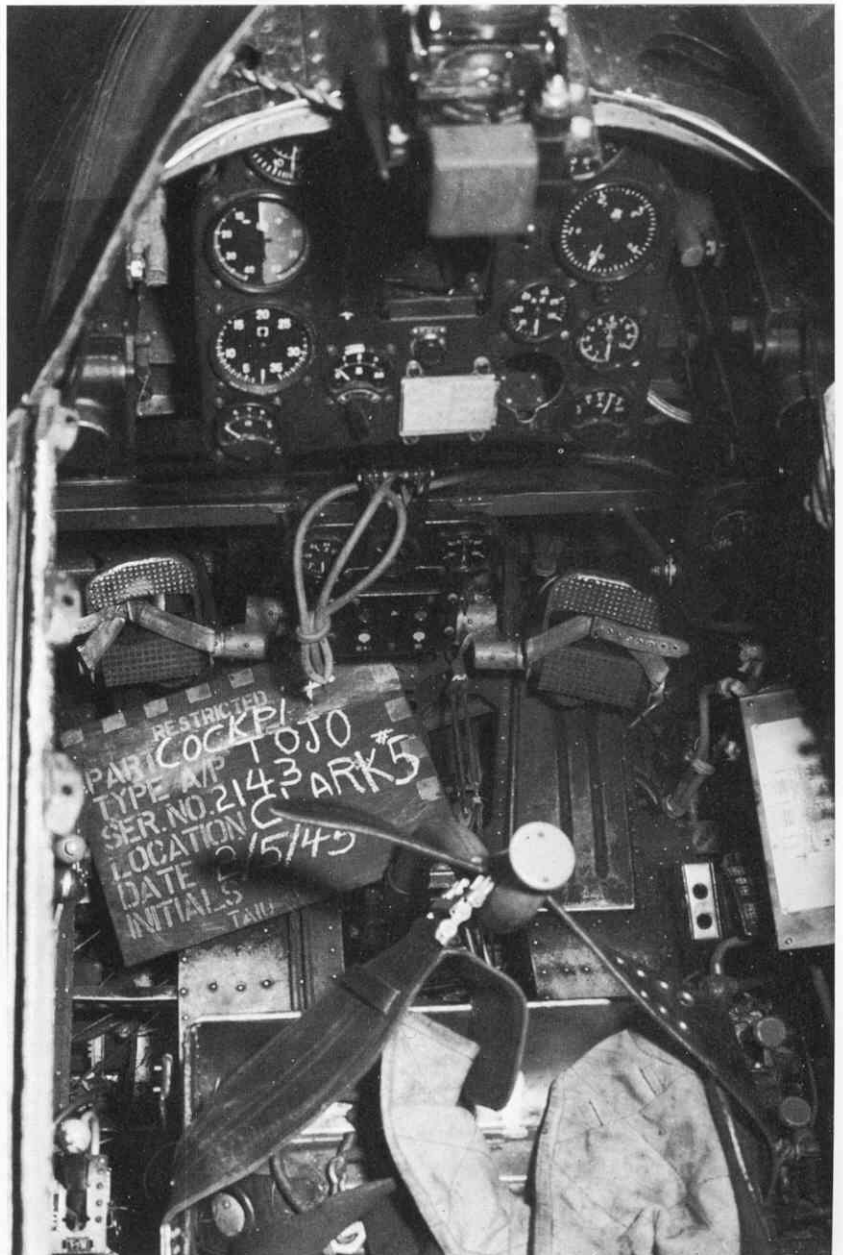


Nakajima's Ki.44 "Shoki," code named TOJO, was designed as an air defense interceptor, to have high speed and high rate of climb at the sacrifice of maneuverability. This was achieved, and with the Nakajima designed "butterfly" combat flaps, it had respectable maneuverability air-to-air combat.

TOJO was built around Japan's then most powerful engine, the 1,450 hp Ha. 109, intended originally for use in bombers. Many seasoned pilots who were proficient with the easily handled Ki.21 NATE and Ki.43 OSCAR, disliked TOJO for its "hot landings." The younger generation of pilots overlooked this, however, as they favored TOJO's better flying performance.

Designed and built almost simultaneously with Nakajima's OSCAR, both displayed similar internal structure features, but had distinctly different exterior design lines. Comparing TOJO's cockpit with that of OSCAR on page 25, one would expect standardization in cockpit arrangement and instrumentation, but there were major differences.

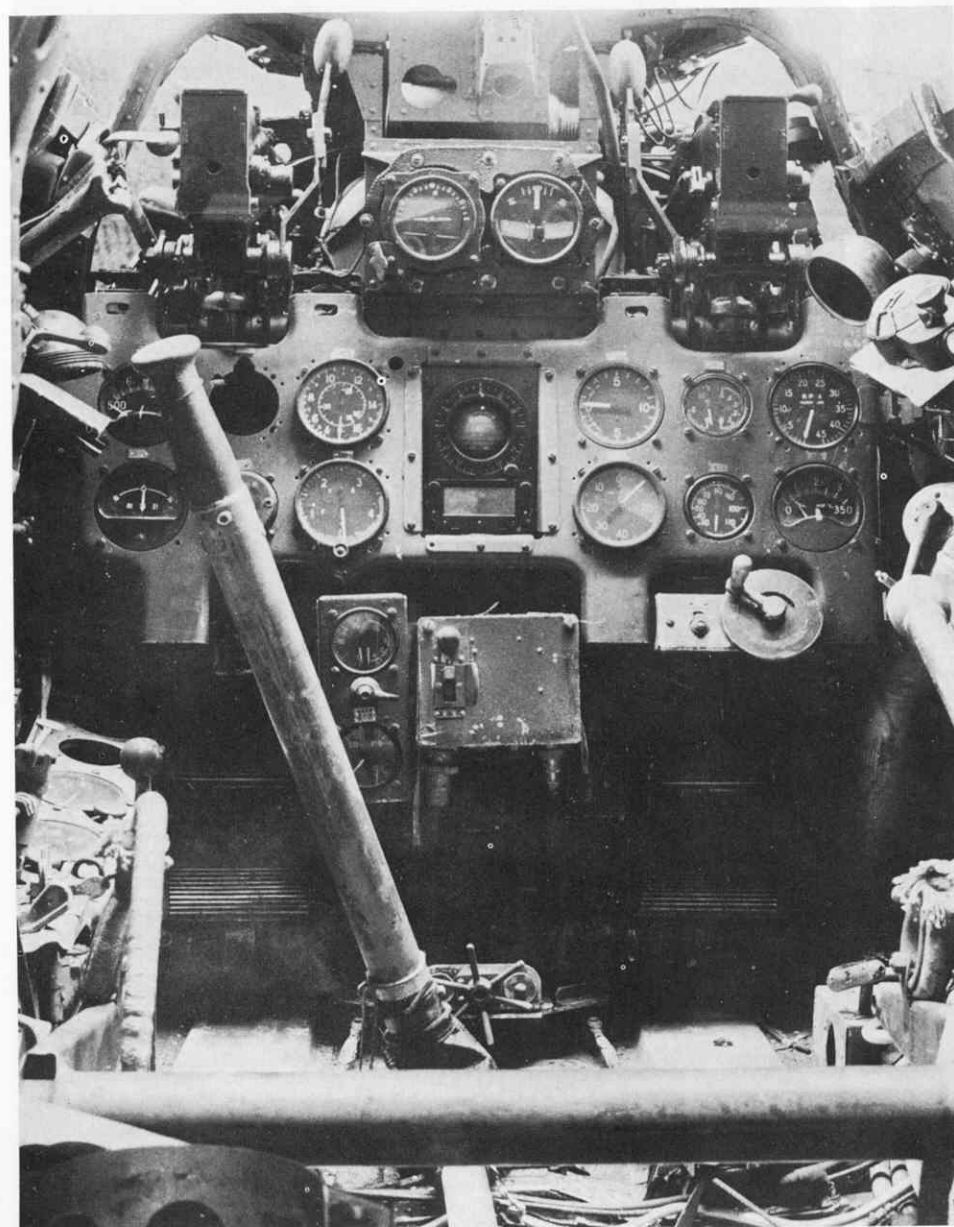
Above, two Nakajima Ki.44-IIb TOJOs ready for takeoff at Narimasu Air Base, (Camp Drake) outside Tokyo, January 1945. The cockpit photo at right is that of a Ki.44-IIb TOJO assigned to the 22d Sentai, and left behind at Clark Field, Philippines, early 1945. Below: TOJO is skeletonized for use as a training aid.



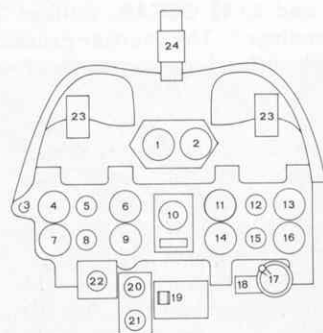
# ZERO, Mitsubishi A6M5 Rei-sen



A Mitsubishi A6M5 ZERO (above) captured on Saipan in June 1944, and later taken to the United States for evaluation. Below is the cockpit of a ZERO with seat removed to show instrument panel details.



In June 1944 twelve ZERO fighters, code named ZEKE, were captured on Saipan and shipped to the United States. Being the first flyable ZEROs of the newer Model 52 to be acquired by the Allies, most of the initial flight evaluations were accomplished in these aircraft. The earliest record pertaining to the Model 52 ZERO at the National Air and Space Museum, was of its evaluation by the Air Force prior to its transfer to the museum. Therefore, it is assumed that NASM's aircraft was acquired at Saipan. During restoration in 1974 markings were applied as on the aircraft above left, which was photographed after its capture. Tail marking is that of the 261st Naval Air Corps. Lower left photo shows the cockpit of the museum's ZERO prior to restoration. All Japanese instruments had been retained during its flight evaluation except for a change to an American made tachometer and removal of the clock. Note gun charging handles of the two 7.7 mm Type 97 machine guns in the upper fuselage.

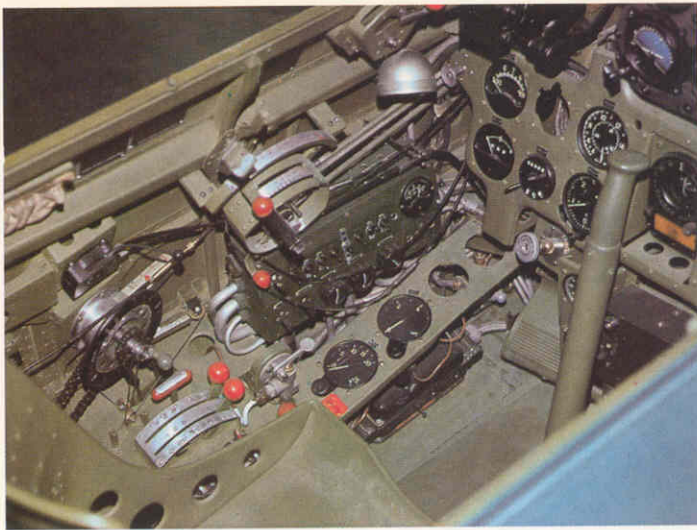


1. Artificial Horizon
2. Turn and Bank Indicator
3. Emergency Power Boost
4. Exhaust Temperature Gauge
5. Clock
6. Airspeed Indicator
7. Radio Direction Indicator
8. Magneto Switch
9. Altimeter
10. Magnetic Compass
11. Rate of Climb Indicator
12. Fuel & Oil Pressure Gauge
13. Engine Tachometer
14. Manifold Pressure Gauge
15. Oil Temperature
16. Cylinder Head Temperature
17. Oil Cooler Control
18. Ignition Booster Switch
19. Cannon Master Switch
20. Oxygen Supply Gauge
21. Hydraulic Pressure Gauge
22. Engine Primer
23. 7.7 mm Machine Guns
24. Gun Sight



All color pictures of the ZERO are of the restored aircraft of the National Air and Space Museum. Colors were matched carefully with originals and are represented reasonably here with the exception of the exterior. This is actually a very dark green, contrary to the blue which is the result of film exposure unbalance.

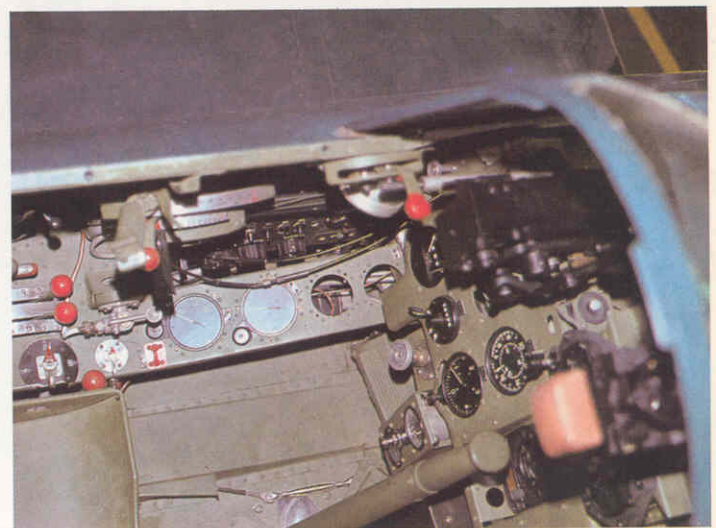
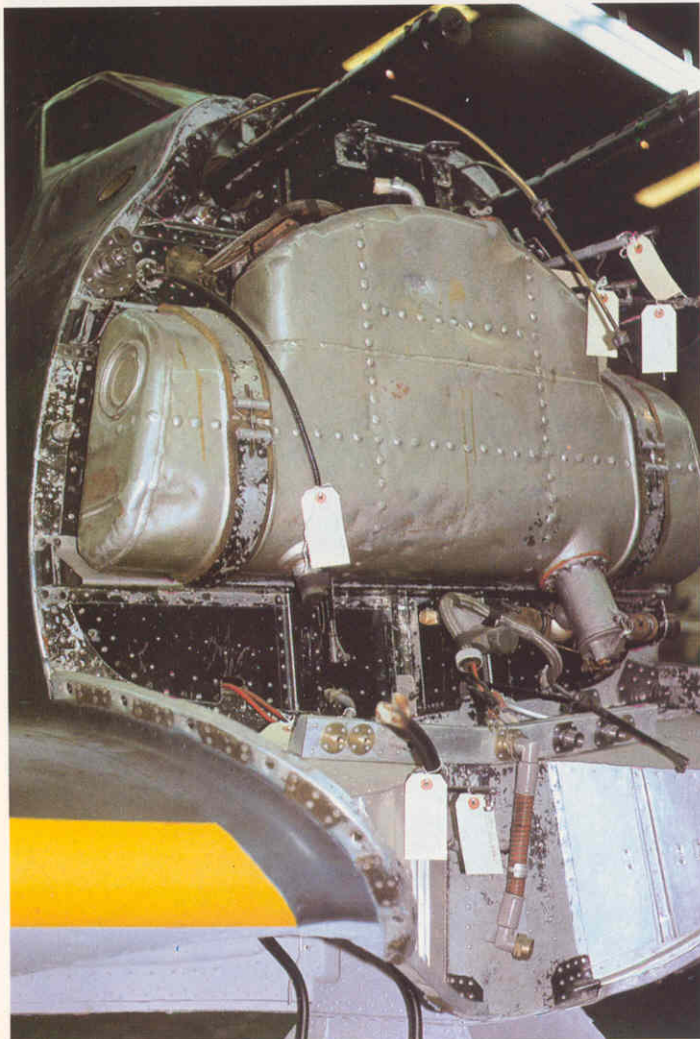




Above is left side of cockpit. Lighting control box is darker green from rest of interior. Rearmost red knobs are bomb release handles, while red "T" handle releases drop tank.



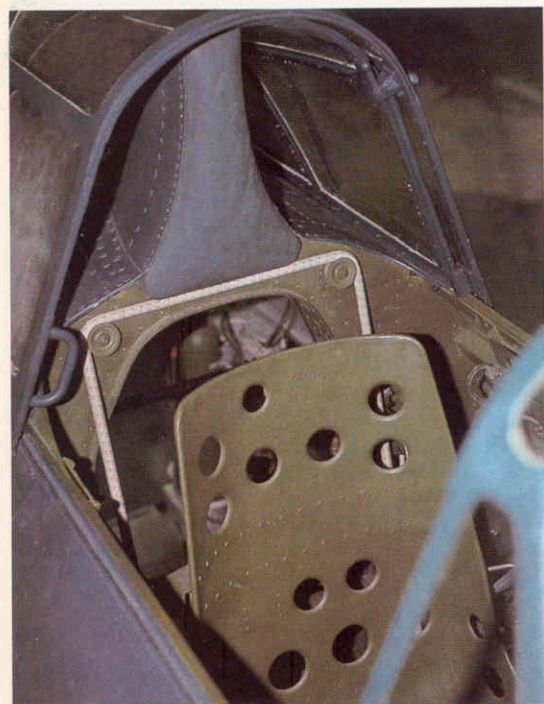
Above: Missing instrument should be a tachometer. Silver dome object is an adjustable cockpit light. Below: left side of cockpit showing engine controls. Mixture is forward red knob. Gun firing button is on the throttle handle.



Left: With engine removed, oil tank is shown attached to the forward bulkhead having machine guns above. Note the use of the translucent green, much of which has flaked off.



General view of cockpit (above). Below is a rear facing view of pilot's seat and head rest. Bungee cord balances seat to ease in adjusting.



Below: Vertical view looking into right side of cockpit. Empty racks at right side held Japanese radio equipment.

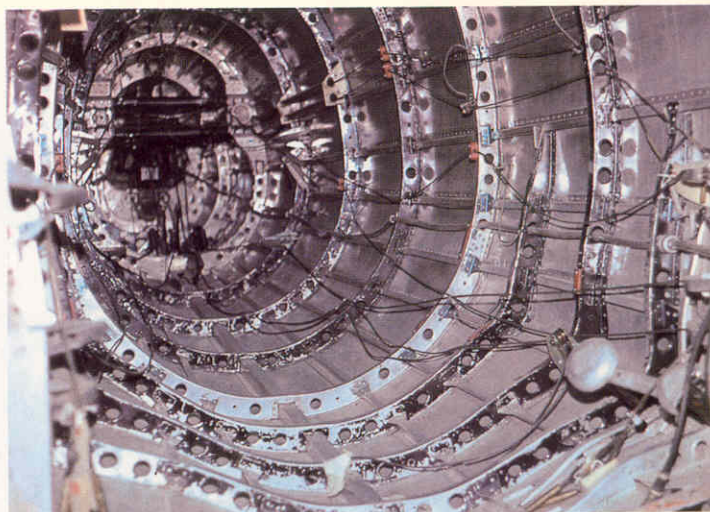
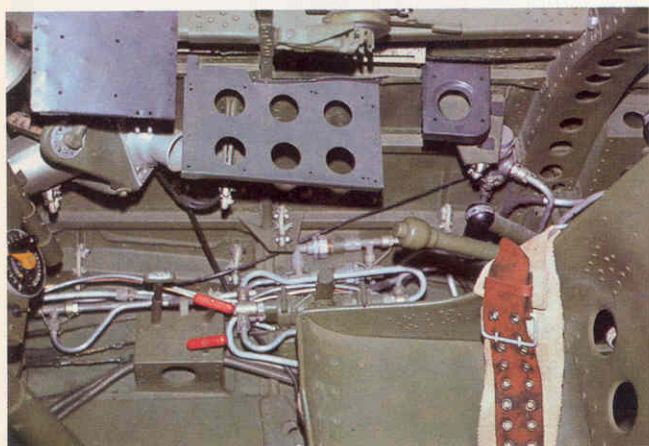
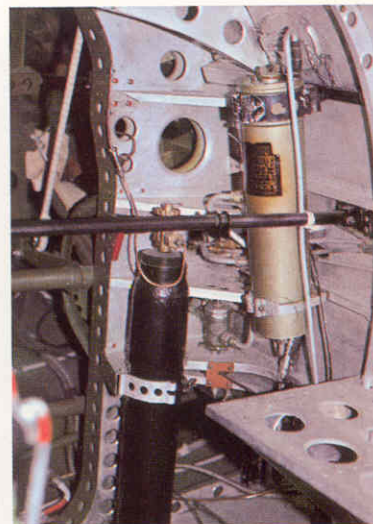
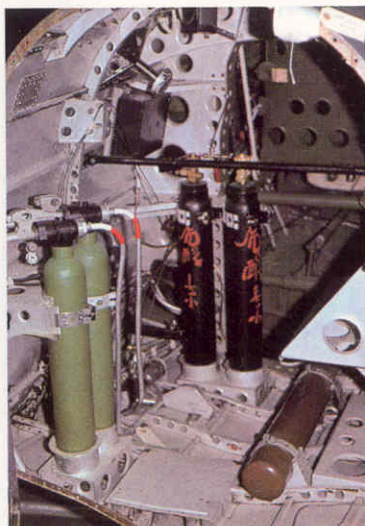
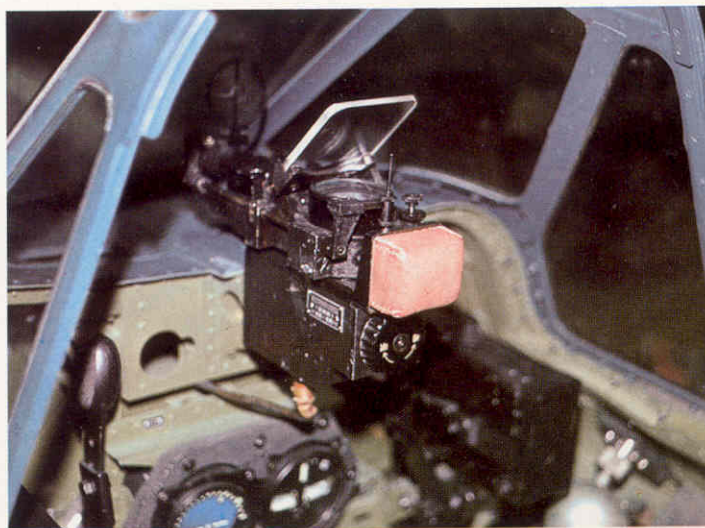


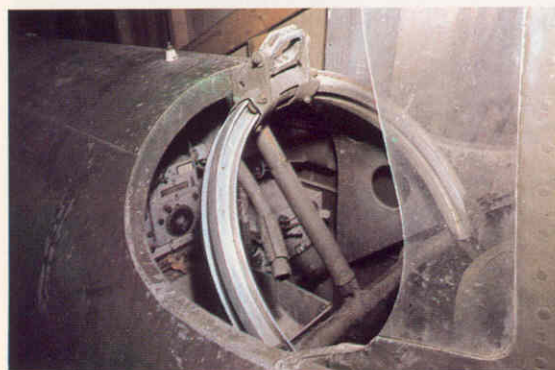
Photo above shows inside of aft fuselage. Note the random use of the translucent green protective coating.



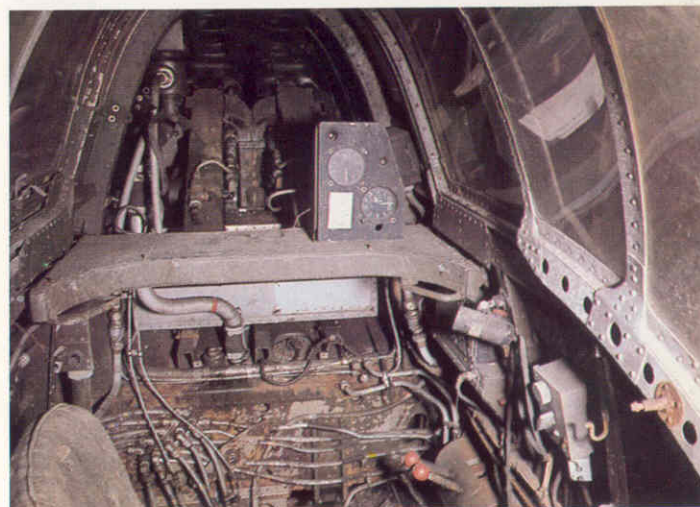
Behind pilot's seat, green bottles contained CO<sub>2</sub> for engine fire extinguisher system, while two black bottles on left, and one at right contained breathing oxygen. Container on wall at right was hydraulic reservoir. The brown bottle contained compressed air for charging the wing-mounted cannon.



# NICK, Kawasaki Ki.45 Toryu



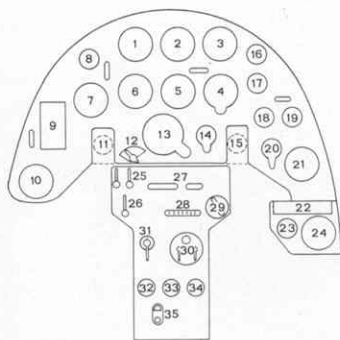
These color views are of the Kawasaki Ki.45 Kai-C NICK in storage at the National Air and Space Museum. All colors and markings, though weathered, are original and show a variety of greens used within the cockpit. Top left: left side of front cockpit. Second from bottom: pilot's seat looking to left rear. The two bottom views are of the rear seat compartment. Looking forward (below) the two brown objects are the twin 20 mm cannon mounted obliquely. To facilitate this installation, fuselage center-section fuel tanks had to be deleted. Note the American made radio gear mounted under the decking behind the gunner's position (lower left) for use during U.S. flight testing.



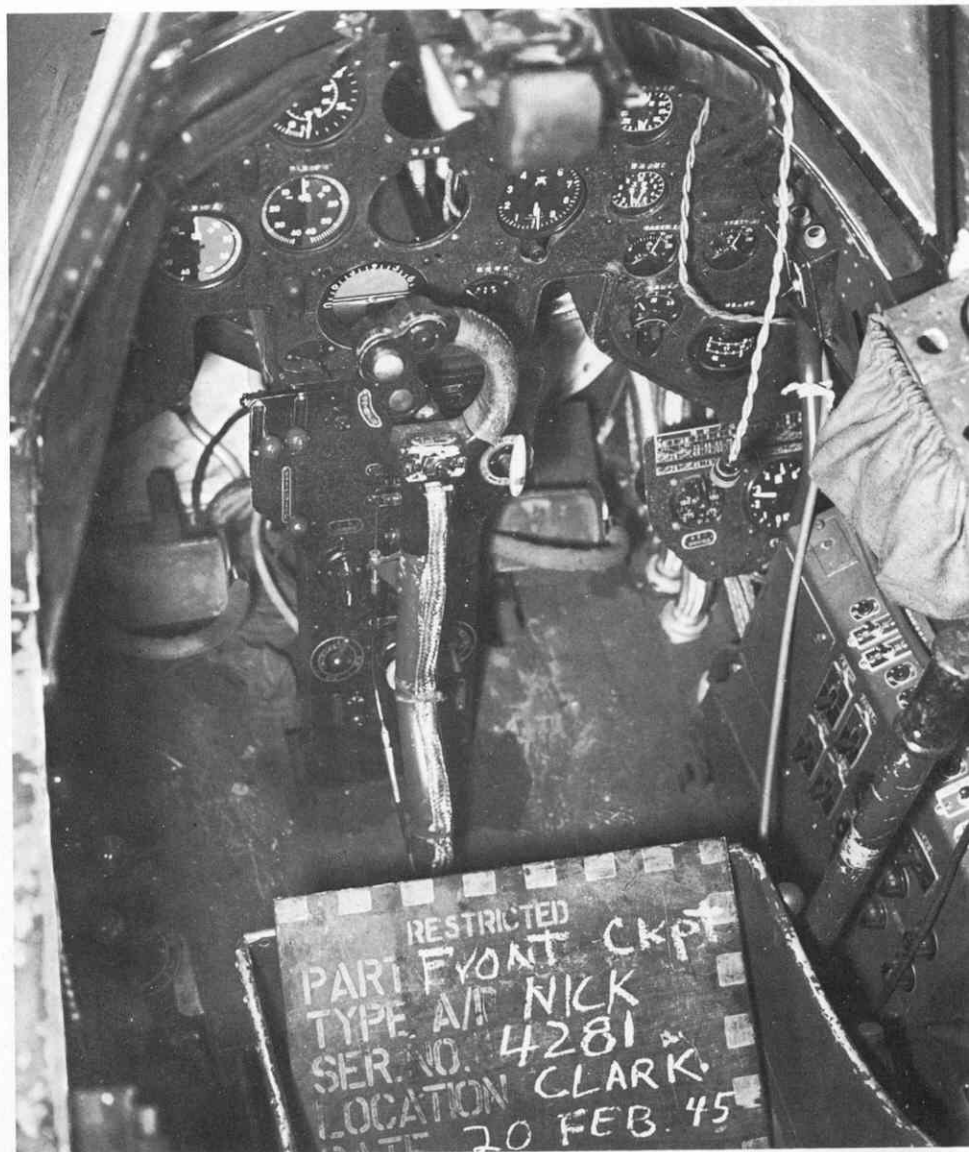
The Kawasaki Ki.45 Kai "Toryu," NICK, originally designed as a two-seat escort and attack fighter, proved one of Japan's best night fighters. Its kill power was credited to the twin fixed 20 mm Ho.5 cannon mounted obliquely to fire upward. The uppermost button on the control column fired these guns while the left button fired the 37 mm Ho.203 cannon in the ventral tunnel. The lower button released the bombs or drop tanks if carried. The instrument panel layout of NICK was made at a time when instrument flying was dependent upon the "needle-ball-airspeed system" of control. Basic instruments are placed in the center top of the panel while the artificial horizon, which later became the primary reference instrument, was nearly hidden from the pilot's view behind the control column.



Kawasaki Ki.45 Kai-C Toryu NICK, assigned to the 53rd fighter Group. Home station was Kashiwa Air Base, near Tokyo's new Narita International Airport.



1. Airspeed Indicator
2. Turn and Bank Indicator
3. Rate of Climb Indicator
4. Altimeter
5. Magnetic Compass
6. Manifold Pressure, R. Eng.
7. Manifold Pressure, L. Eng.
8. R.P.M. Synchronizer
9. Engine Tachometer (Dual)
10. Blank
11. Oxygen Press. (U.S. Install.)
12. Gyro Erection Knob
13. Artificial Horizon
14. Flight Clock
15. OxygenBlinker (U.S. Install.)
16. Fuel Pressure Gauge (Dual)
17. Oil Pressure Gauge (Dual)
18. Oil Temperature Gauge, Left
19. Oil Temperature Gauge, Right
20. Cylinder Head Temp. L. & R.
21. Fuel-Air Ratio Gauge (Dual)
22. Ki.45 Fuel Quantity Chart
23. Fuel Tank Reading Selector
24. Fuel Quantity Gauge
25. Cowl Flap Control, L. & R.
26. Gun Charger
27. Landing Gear Warning Lights
28. Wing Flap Position Indicator
29. Gun Safety Handle
30. Engine Ignition Switches L. & R.
31. Left-Right Selector (Unk.)
32. Instrument Vacuum Source Selector
33. Engine Primer Fuel Pump
34. Instrument Vacuum Source Selector
35. Vacuum Instrument Press. Control





These exceptional quality pictures of Kawasaki Ki.45 Kai-C NICK pilots and armors were taken by Mr Shigeo Hayashi at Kashiwa Air Base in the last year of the war. As a civilian photographer for the Imperial Japanese Army at the time, Hayashi reports that none of these pilots pictured here survived their repeated attacks against the B-29s. These views show excellent detail in the area of the gunsight as well as typical pilot clothing. Note pilot's initials on right glove. The electrical cord threaded through hand grips for stowage was for electrically heated flying suits. The windshield of NICK was unique in that a segment was cut out and replaced with a flat panel without the aid of metal reinforcement. Reflector gunsight required flat glass see-through areas to eliminate distortion.

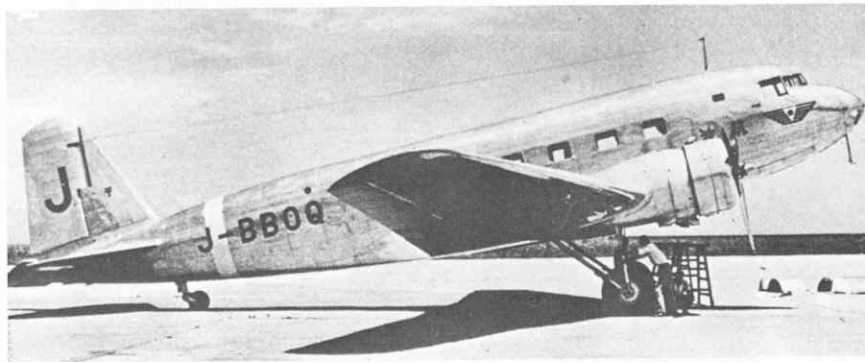


Aircrews reportedly liked the many good qualities of NICK as a reliable aircraft. Top among these were the heavy armament and fuel tank protection giving them improved survivability. Their heavy weaponry brought them a profound reputation in the ground attack roll. They were equally as effective in the night interceptor roll against the B-29 in the last stages of the war.

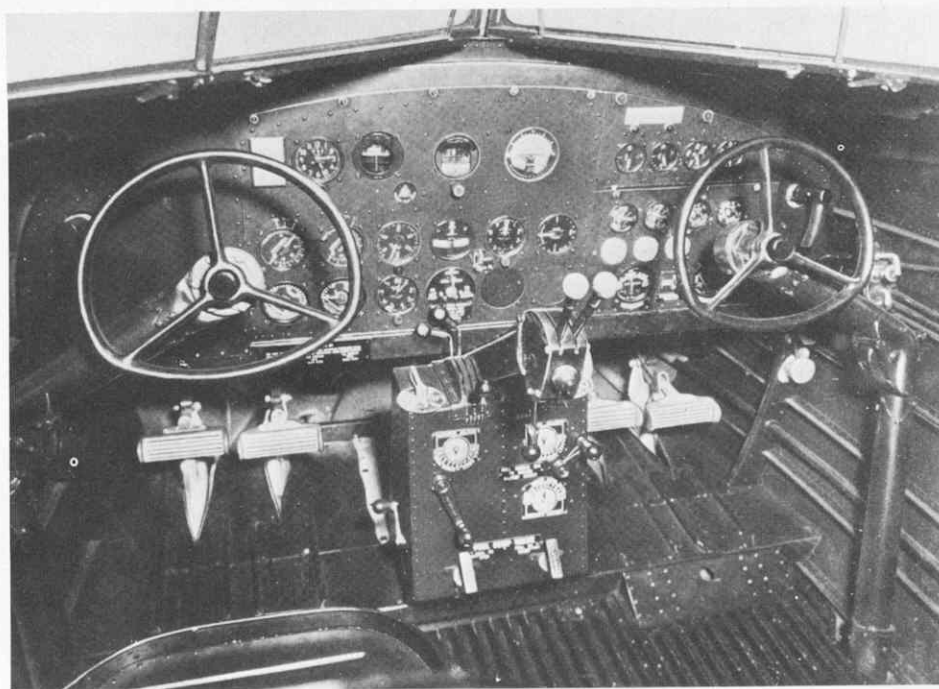


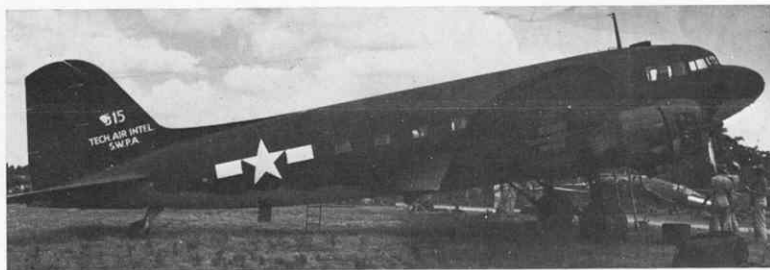
## Nakajima/Douglas DC-2, TESS

At the outset of World War II, U.S. intelligence sources anticipated encountering Japanese built DC-2s since Nakajima had obtained a manufacturing license from Douglas. Code name given to this transport was TESS. In reality, only six DC-2s were possessed by the Japanese: one purchased in October 1934 by Dai Nippon Airways, and major components of five others which were obtained later from Douglas. These were assembled by Nakajima using Japanese instruments and other standard components. Only one DC-2 was impressed into military service and that was with the Japanese Army.



The instrument panel above was obtained from a Nakajima assembled DC-2. This has more advanced instrument grouping than the earlier Douglas-built arrangement shown at the right. Main differences are the Jack & Heintz type automatic pilot system in the center of the Japanese version, and primary flight instruments placed in front of the pilot. Note that the power control quadrant of the DC-2 contains only the two throttles, whereas later modifications and DC-3s included propeller pitch and fuel mixture controls. A majority of Japanese twin-engine aircraft tachometers were of the dual, vertical reading type. This instrument is just below the left flight instrument grouping on the TESS panel. The DC-3 was a development of the DC-2 and the instrument panel of TESS more closely resembles that of the later DC-3 than does the Douglas-built DC-2. (See page 68 showing the DC-3 instrument panel layout.)

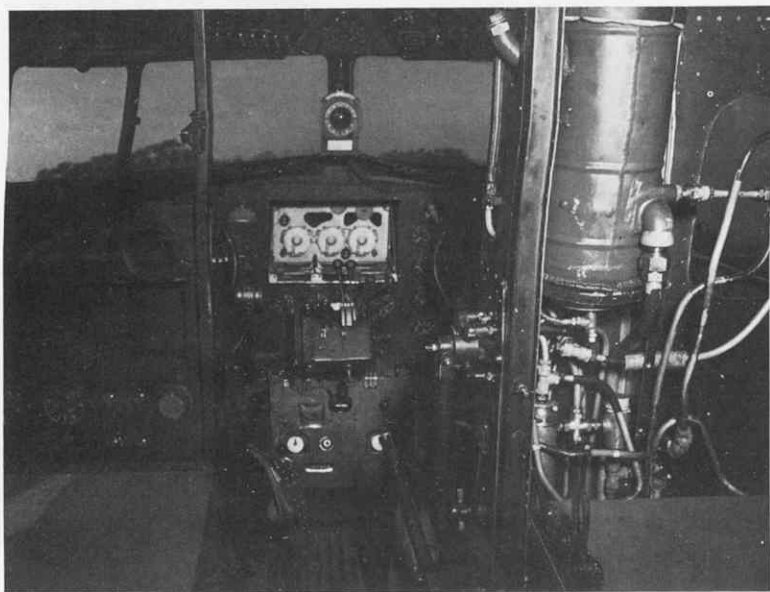




## TABBY, Nakajima L2D3 Compared with the Douglas DC-3

TABBY was virtually a Japanese version of the Douglas DC-3. Nakajima obtained a license from Douglas in 1937 for the manufacture of DC-3s for airline use. Later models became the L2D Type Zero Navy Transport of which 487 were built.

These cockpit pictures of TABBY are of the aircraft pictured above being evaluated by U.S. Forces at Zamboanga on the Philippine island of Mindanao, May 3, 1945. Slender cowling and the addition of propeller spinners are the main feature difference from the U.S.A.A.F. C-47 at right.

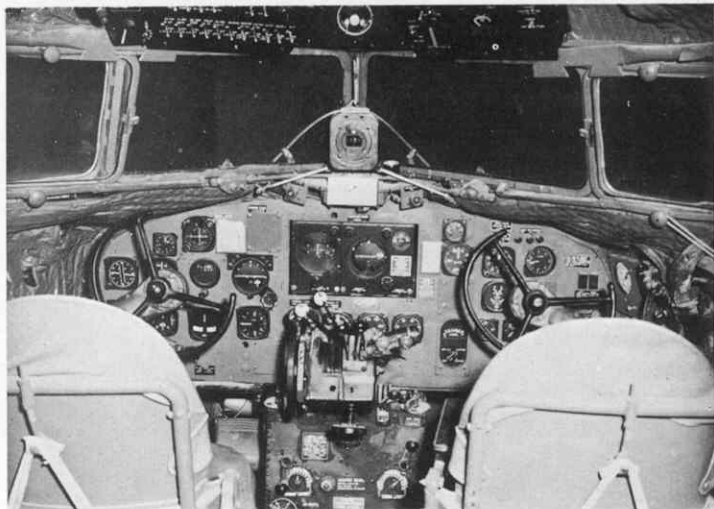


The central units for the automatic pilot have been removed from the instrument panel of this TABBY. These are similar in design to the Jack & Heintz model used in the DC-3. Japan had manufacturing rights to a large number of American aircraft components.

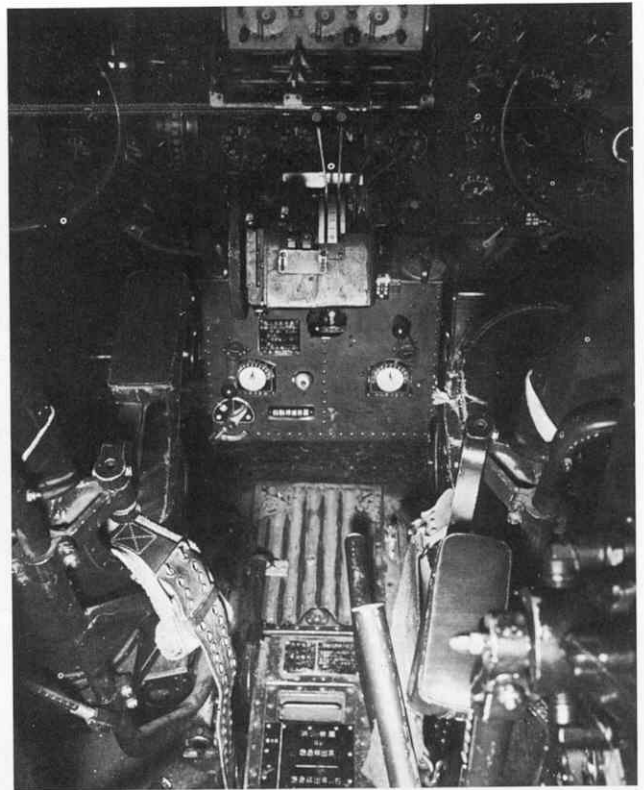
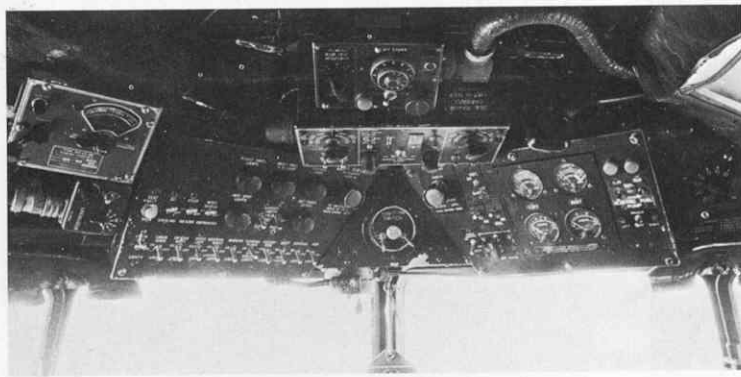
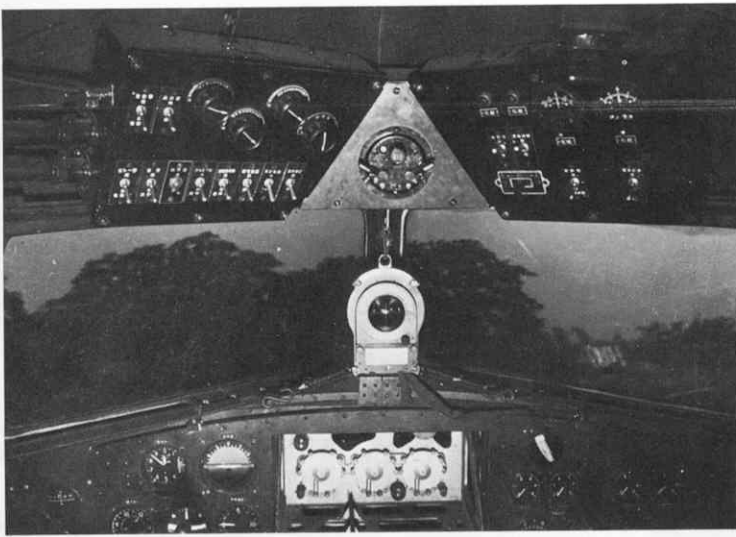
Overhead panel of TABBY (top of page 23) closely resembles that of the DC-3 (page 23, center). The master ignition push-pull switch is in the center, flanked by left and right engine magneto switches. There is no evidence of propeller feathering buttons on the Japanese version, while these are seen on the left and right side of the ignition switch in the guarded housing of the DC-3. Most of the overhead controls are electrical, radio, and lighting. With the replacement of the altimeter by an American type, it is evident that the aircraft was being flown by U.S. pilots.

Cockpit arrangement of the L2D3 TABBY (above) and the DC-3 (right) are virtually identical. DC-3s had a bulkhead with a center doorway directly behind the seats (removed in this picture) while the Japanese military version had wall opening cutouts. Navigator's station is in the left foreground, having an airspeed and altimeter on this bulkhead. At the right foreground is the hydraulic system. Hydraulic pump selector is in the center of the side panel, flap handle below, and a similar type landing gear handle below, out of picture.

The Japanese model was not equipped with windshield wipers as was the DC-3. Small square windows in windshield could be opened in flights should windshield vision be obstructed with ice. Long legged Americans found the cockpit of the DC-3 to be rather cramped for ease in full rudder and control column movement. Japanese pilots may have found this layout more suited to their stature.

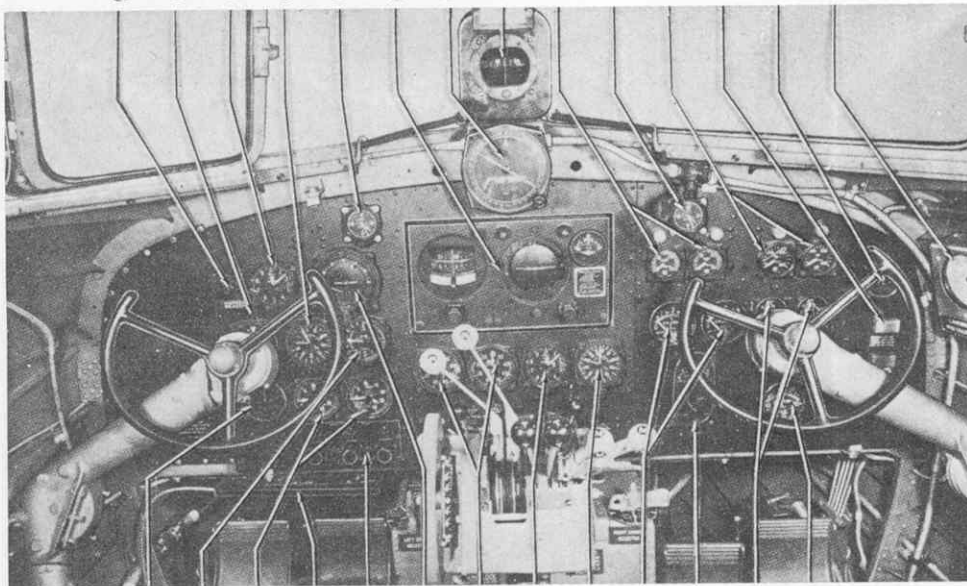






Close-up view of Nakajima L2D3 TABBY throttle quadrant above. The handle on the floor to the right of the pilot's seat is the landing gear positive down lock. Hand operated hydraulic pump is opposite at right, and engine fire extinguisher system is under cover on floor. Top left: Overhead electrical panel for L2D. Left: Same for DC-3. Below: C-47 instrument panel and pedestal.

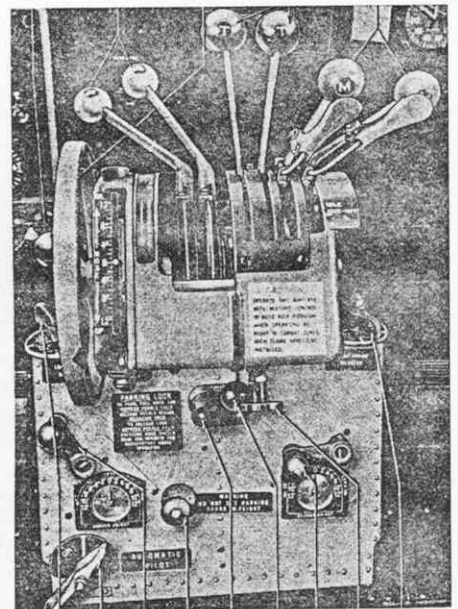
1 2 3 4 5 6 7 8 9 10 11 12 13 14



15 16 17 18 19 20 21 22 23 24 25 26 27

- |                                 |                                |   |
|---------------------------------|--------------------------------|---|
| 1. Marker Beacon Indicator      | 10. Clock                      | 19. Automatic Pilot Speed Controls          |
| 2. Bank and Turn Indicator      | 11. Engine Oil Pressure Gages  | 20. Artificial Horizon                      |
| 3. Altimeter                    | 12. Landing Gear Warning Light | 21. Manifold Pressure Gages (L.H. and R.H.) |
| 4. Airspeed Indicator (Pilot's) | 13. De-Icer Pressure Gage      | 22. Altimeter                               |
| 5. Clock                        | 14. Landing Gear Pressure Gage | 23. Airspeed Indicator Co-Pilot's           |
| 6. Automatic Pilot              | 15. Remote Compass             | 24. Cylinder Head Temperature Indicators    |
| 7. Azimuth Indicator            | 16. Rate of Climb Indicator    | 25. Gasoline Gage (All Tanks)               |
| 8. Magnetic Compass             | 17. Engine Tachometers         | 26. Oil Temperature Gages                   |
| 9. Engine Fuel Pressure Gages   | 18. Wing Flap Indicator        | 27. Outside Air Temperature Gages           |

1 2 3 4 5



6 7 8 9 10 11 12 13 14

- |                                    |                                      |
|------------------------------------|--------------------------------------|
| 1. Oil Cooler Control Levers       | 9. Parking Brake Control Knob        |
| 2. Propeller Controls              | 10. Shielded Lamp                    |
| 3. Elevator Trim Tab Control       | 11. Tail-Wheel Lock Lever            |
| 4. Throttle Controls               | 12. Aileron Trim Tab Control         |
| 5. Mixture Levers                  | 13. Throttle Controls Friction Lock  |
| 6. Left Engine Fuel Selector Valve | 14. Right Engine Fuel Selector Valve |
| 7. Automatic Pilot Control Valve   |                                      |
| 8. Rudder Trim Tab Control         |                                      |



Top picture is looking forward in a half-cargo, half-passenger version of TABBY. Below is a full passenger configured Douglas C-47D, circa 1949.



The Nakajima L2D TABBY was an adaptable Imperial Japanese Navy transport able to serve a wide variety of purposes. Like the American derivative, its military mission was primarily a cargo hauler, however both were easily converted into passenger carriers. Pictured here for comparison purposes are American and Japanese military versions of the Douglas DC-3s that have been passenger configured, yet are easily converted back to full cargo carrying duties. Normal passenger capacity was 21 when utilizing this type of seat.

As the war progressed and aircraft materials became in short supply, some TABBYs were produced with wood and steel being substituted in major parts of the airframe. TABBYs remained in service through the end of the war, and into the postwar period for several months as passenger carriers until all Japanese air operations were grounded by the Allies and the aircraft were scrapped.

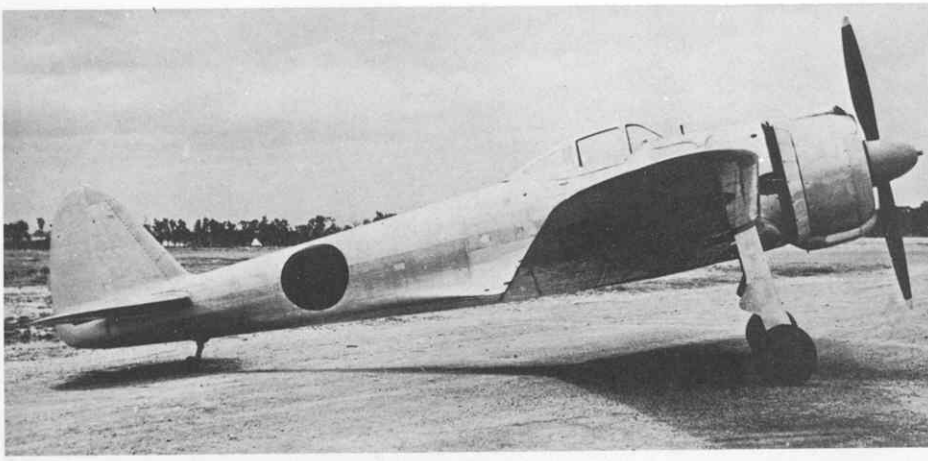


Photographed on Leyte, November 1944, and erroneously identified as the smaller TESS, the TABBY above is also part cargo and passenger configured. 'McArthur seats' in VC-47A below have a less comfortable appearance, but this aircraft was equipped with an electric galley in the rear.



Nakajima produced seventy-one of the TABBY type transports, while the major share of production was carried by Showa Aircraft Company by producing an additional 416 machines. The Showa built L2D3 TABBY (below) was easily recognizable by the addition of three windows on either side of the cabin and the access door window, a deviation from the Douglas design.

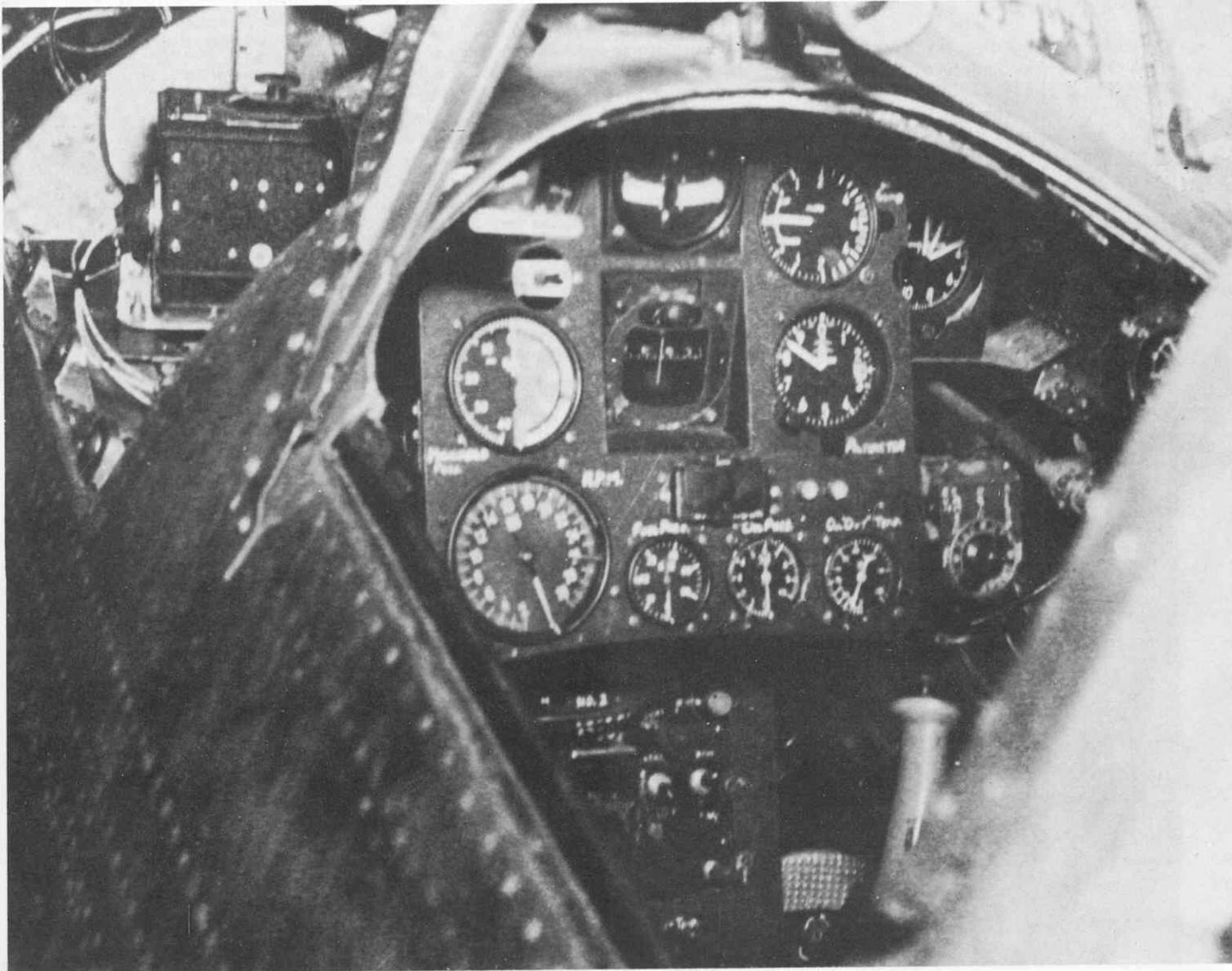


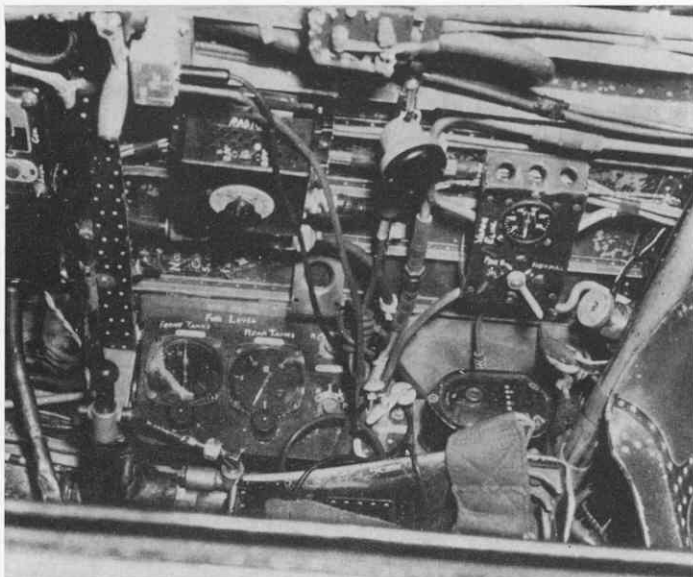


## Nakajima Ki.43-1, OSCAR

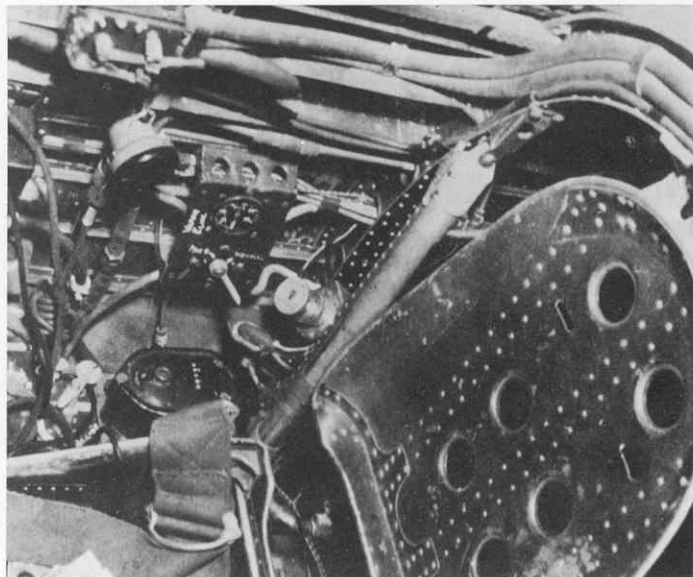
A product of Nakajima, the Ki.43 OSCAR was the Japanese Army's first line fighter, and served on every front to which the Imperial Japanese Army was committed. Known as the "Hayabusa" to the Japanese, OSCAR arrived on the combat scene several months after the opening blow of the Pacific and was often confused with the ZERO. Both were powered by nearly identical engines. While the ZERO had an edge in overall performance, it had the additional advantage of being first to catch the public's eye. If the OSCAR had been first, it might well have become the symbol of Japan's air power in place of the ZERO.

Above is the Nakajima Ki.43-1c, distinguished from later models by a two-bladed prop. Photographic interiors of OSCAR are of this type and presumably of this aircraft which fell into Allied hands. Picture below shows OSCAR ready for flight evaluation. Guns are removed and test equipment in its place. English reading dials replaced some instruments.





Right side of cockpit. Auxiliary hydraulic hand pump is in lower left corner with retracted telescoping handle.



Right rear of cockpit showing seat details. Note telegraph key at top of picture below which is possibly an American made and installed hand held microphone.

The cockpit arrangement of the Nakajima Ki.43 OSCAR was a mixture of good and bad qualities. For standards of its day it was average in control accessibility compared with other fighters. The instrument panel was simple and well organized with basic flight instruments nicely grouped. As was the case with most day fighters, gyro instruments were omitted. As would please any pilot, the command radio unit was placed conveniently in the center of the cockpit below the instrument panel. This kept the pilot's attention from being diverted away from flying the airplane while making the many necessary fine tuning adjustments.

The disadvantages within this cockpit are

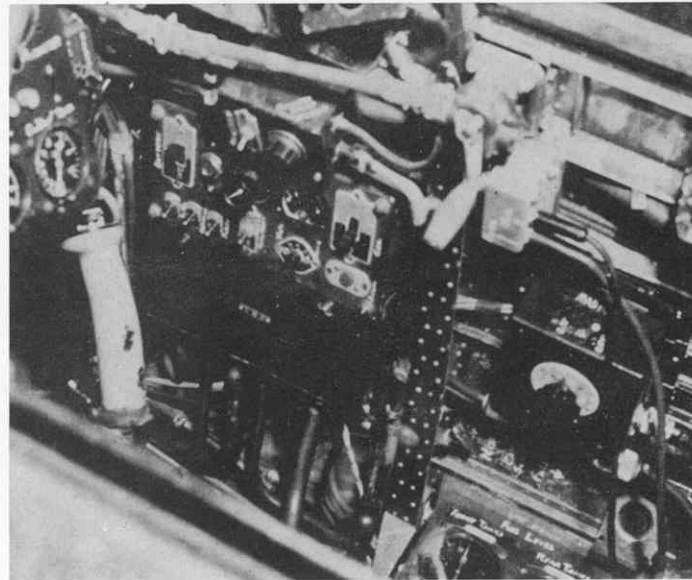
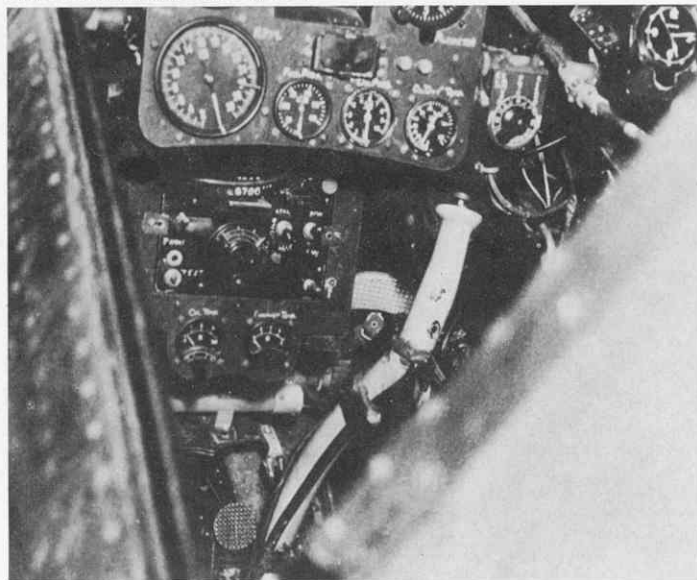
obvious in pictures on this page. Many controls and gauges were scattered throughout the cockpit, some in very difficult locations to see. Though unusual by today's standards, the "install where space permits" technique was common with most aircraft of that time period. The vital oxygen system controls and gauges were by the pilot's elbow, out of visual sight scan. Fuel quantity gauges, also on the right, offered a handy place to lay gloves or maps and therefore fuel monitoring easily could be overlooked during the press of combat. This was corrected in later models. The side-mounted navigation radio would have been difficult to read for tuning.

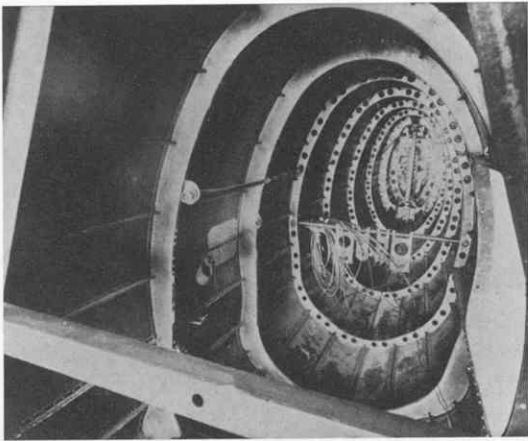
From a pilot's position in the cockpit, OSCAR's most distinct advantage was its all-round vision canopy. This was an unusual feature at the time of its initial design in 1938, for only its predecessor, late model Ki.27 NATEs, had a fully enclosed teardrop type canopy. The cockpit interior was snug for Japanese pilots, especially when dressed in restrictive winter clothing, and decidedly so for the Occidental pilots who later evaluated OSCAR's flying capability.

The light wing loading of OSCAR made it a docile airplane to fly, and quick to respond. Its wide tread landing gear and long fuselage kept it sure-footed on the ground.

Conveniently located below the instrument panel is the radio control box, below which are the oil temperature and exhaust gas temperature gauges. Gun selector switch is right of panel.

Front right corner of cockpit showing electrical control panel is in center of picture. The single hand crank (above center) adjusts engine cowl flap settings.

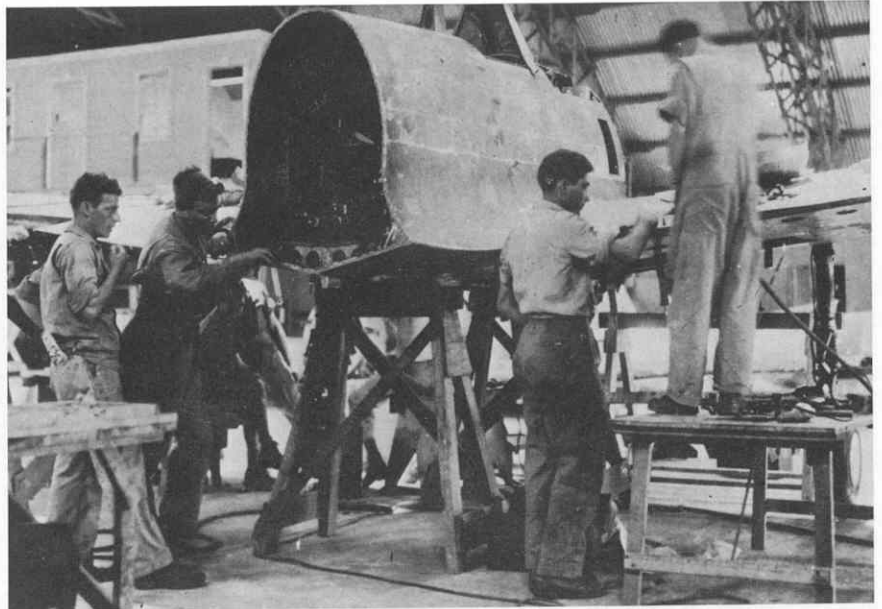




View of aft fuselage section interior.

Photographs of this Nakajima Ki.43-1 OSCAR were taken at Brisbane, Australia, as the first airplane of this type to be evaluated fully by Allied Intelligence personnel. Several damaged OSCARs were taken from Lae Airdrome, New Guinea, which was captured on September 16, 1943. These OSCARs, together with numerous other types, were disassembled and shipped to Brisbane by Air Technical Intelligence Unit personnel. Arriving there on November 4, 1943, they were sent to the A.T.I.U. hangar at Eagle Farm where reconstruction was begun. Servicable parts of several OSCARs were repaired, inspected and assembled to make one flyable aircraft. After one engine failure before flight, requiring an engine change, the first flight was made March 17, 1944, with Captain W.O. Ferrier as pilot. Subsequent performance flights were flown by S/Ldr. J. Cumming, R.A.A.F., against Allied fighters for tactical evaluation.

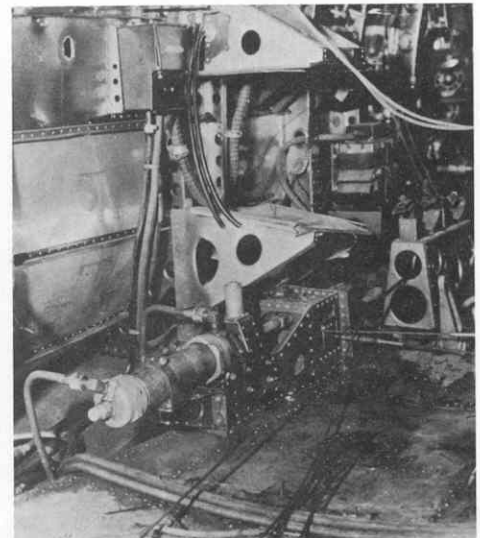
Construction techniques were surprisingly similar to those of the Zero. Fuselage separations and cross sections were nearly identical and the monocoque structure



The best components of several damaged OSCARs were disassembled, inspected and repaired in order to make one flyable craft.

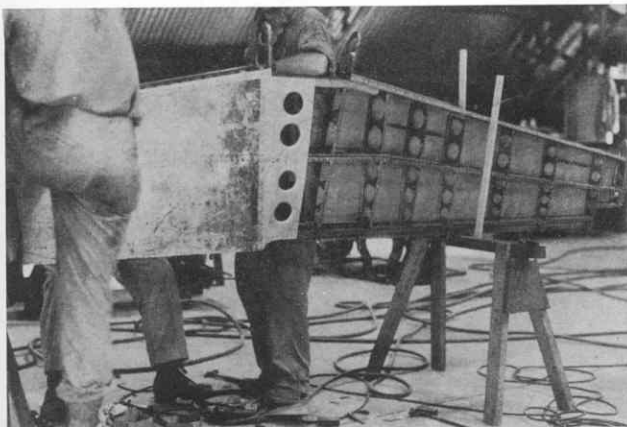
used the same rib and lap skin seam mating method. (See page 17.) Interior portions of the aircraft basically were unpainted. There are some exceptions, however, such as the stabilizer ribs, below. They were coated with the translucent protective coating before being assembled.

Cockpit surfaces of OSCAR appear to have been painted with a thin coating of interior olive green paint, or as on some structural members, the translucent green or blue protective coating. Most of the accessories such as radio boxes, oxygen control panel, etc., were painted flat black. The main instrument panel was of interior olive green.

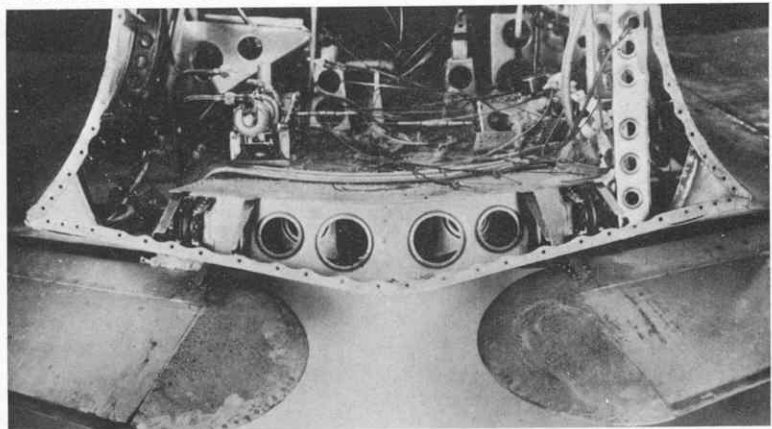


Looking forward from aft fuselage separation point. Hydraulic actuator in foreground is for wing flap operation.

Portion of skin is removed for stabilizer that is being inspected closely.



Combat maneuverability was credited to the butterfly wing flaps with gracefully curved corners that are in evidence here.

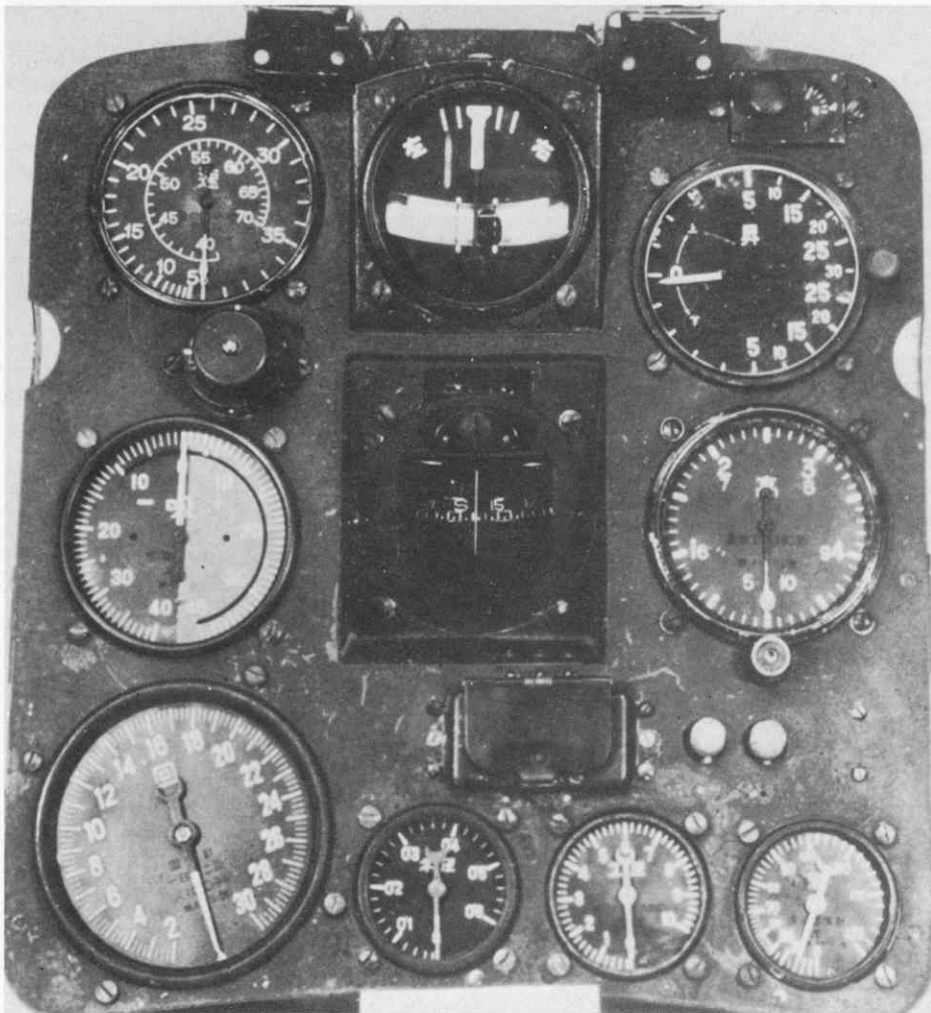




The telescope gun sight and flat canopy top identifies this as the early model of OSCAR. Japanese flying gear included a cotton hood that extended across the chin, worn under the leather helmet.

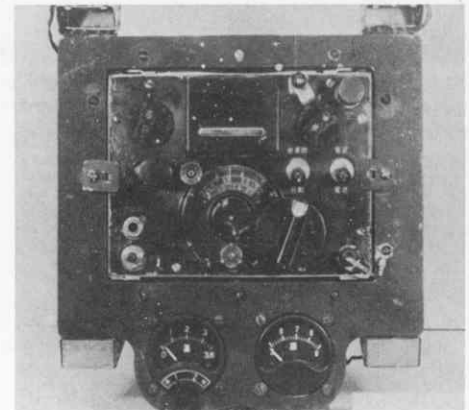
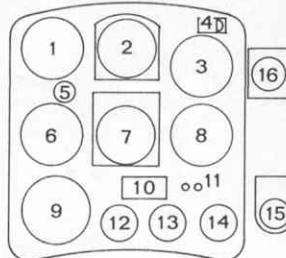


Final engine adjustments are made to the OSCAR before being buttoned-up for evaluation flying by the Americans. Components of several captured OSCARs were sent to Brisbane, Australia where this one flyable example was assembled and flown for the first time on March 17, 1944.

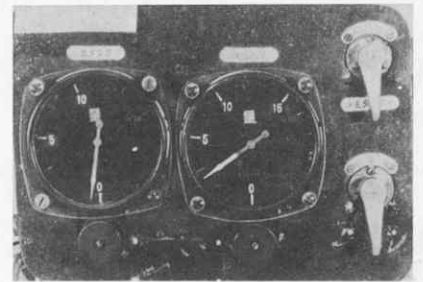


Instrument panel of the Ki-43-1c OSCAR.

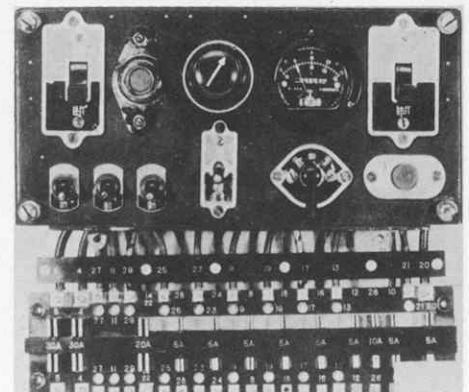
- |                            |                                 |
|----------------------------|---------------------------------|
| 1. Airspeed Indicator      | 9. Engine Tachometer            |
| 2. Turn and Bank Indicator | 10. Guarded Switch Cover        |
| 3. Rate of Climb Indicator | 11. Landing Gear Warning Lights |
| 4. Vacuum Pressure Gauge   | 12. Fuel Pressure Gauge         |
| 5. Engine Primer           | 13. Oil Pressure Gauge          |
| 6. Manifold Pressure Gauge | 14. Oil Temperature Gauge       |
| 7. Magnetic Compass        | 15. Armament Selector           |
| 8. Altimeter               | 16. Accelometer (U.S. Install.) |

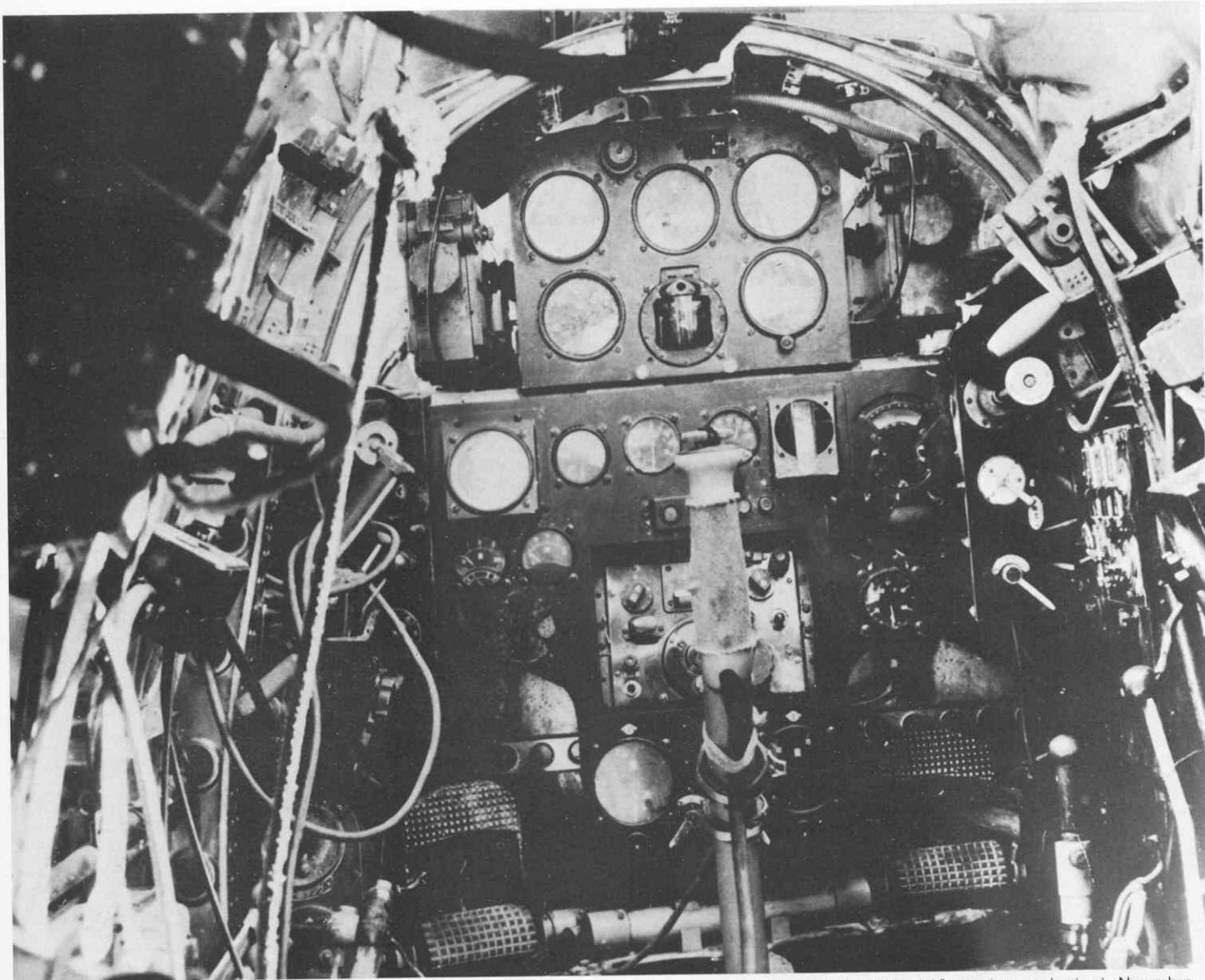


Command radio control panel with oil temperature (left) and exhaust gas temperature gauge (right).



Fuel quantity gauge (above) located on pilot's right. Below is electrical panel and fuse box. Battery switch is at the left with red and black background, while generator switch is at right. Below voltmeter is the engine ignition switch.





The more advanced Ki.43-II OSCAR Model 2 went into production in November 1942 with many advanced features over the Model 1. Cockpit was fully redesigned.

Appearing in 1942 was the refined Nakajima Ki.43-II OSCAR. Improved performance resulted from a new three-bladed prop and rounded canopy, an increase in engine power and a decrease in wing span.

A new instrument panel incorporated the compact grouping of flight instruments and collected all other gauges together. Fuel quantity indicators are mounted centrally just below the radio control box. Armament of two 12.7 mm machine guns located on either side of the upper instrument panel was light in comparison to Allied aircraft.



# KATE, Nakajima B5N2



The first KATE to be evaluated by the Americans fell into Allied hands during the capture of Saipan in June 1944. The picture below shows this KATE at Aslito Air Field (later named Isley Field) being readied for placement aboard an

aircraft carrier with ZERO fighters, to be carried to the United States. All interior photos are of this plane.



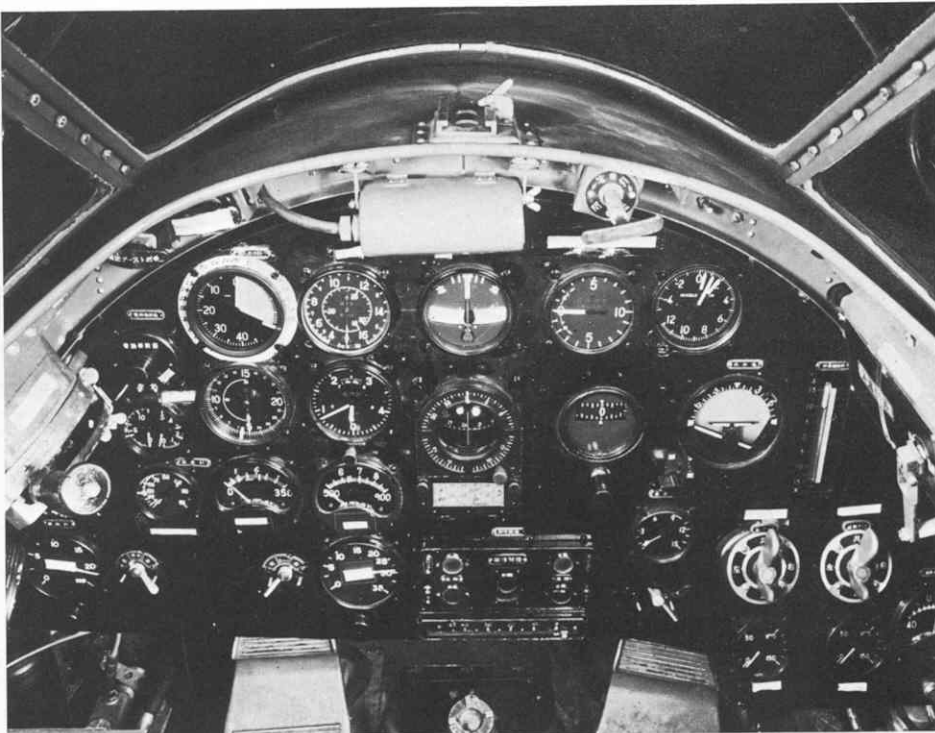
The Nakajima B5N2 KATE was the torpedo plane that played an important role in the attack on Pearl Harbor at the outset of the Pacific War. At that time it was the most advanced type of carrier-born torpedo bomber serving in any navy throughout the world. By 1944 technical advances in newer aircraft designed for this harrowing mission caused KATE to be assigned to second line units, giving way to the Nakajima B6N2 JILL.

Conceived in 1936, KATE was the first single-engine airplane in Japan to use a hydraulically operated retractable landing gear. To conserve carrier space it had manually folding wings which overlapped in order to reduce overall height. Its three-man crew consisted of a pilot, navigator/bombardier and radioman/gunner.

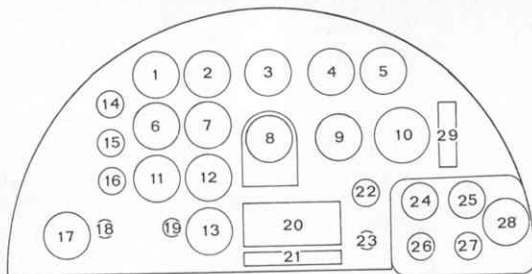


The cockpit of the Nakajima B5N2 KATE was found to be very cramped for American pilots, particularly since adjustments of the rudder pedals to their fullest extension was not sufficient for comfort. Trim tabs were easy to operate for the ailerons and rudder which were on the left console, however the more often used elevator trim was higher and further back in an awkward location. The wing flap and landing gear handles were on the right side of the cockpit, an unusual arrangement. Since the wheels had to be retracted before reaching 100 knots airspeed on climbout this necessitated a quick change of hands across the control column in order to get the gear up.

Three stick handles on the forward left console for bomb and torpedo release were in easy reach. Tail hook release and unlock levers were on the left cockpit wall, while engine controls for priming, fuel wobble pump, carburetor heat, and engine cowl flaps were directly below the throttle quadrant on the left side.



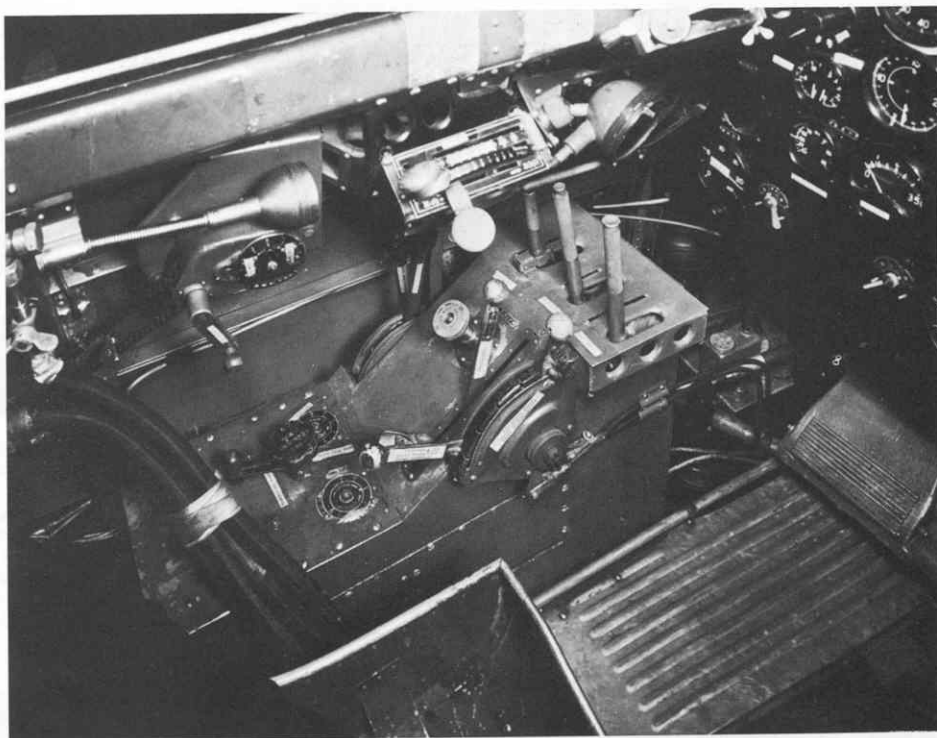
1. Manifold Pressure Indicator
2. Airspeed Indicator
3. Turn and Bank Indicator
4. Rate of Climb Indicator
5. Accelerometer (U.S. Install.)
6. Engine Tachometer
7. Altimeter
8. Magnetic Compass
9. Directional Gyro
10. Artificial Horizon
11. Cylinder Head Temperature
12. Fuel-Air Ratio Gauge
13. Fuel Quantity, Outboard Tanks
14. Engine Ignition Switch
15. Fuel and Oil Pressure Gauge



16. Oil Temperature Gauge
17. Fuel Quantity, Inboard Tanks
18. Fuel Tank Reading Selector
19. Fuel Tank Reading Selector
20. Landing Gear Warning Lights
21. Wing Flap Position Indicator
22. (Unknown)
23. (Unknown)
24. Left Wing Fuel Valve
25. Right Wing Fuel Valve
26. Hydraulic Pressure Gauge
27. Hydraulic Pressure Gauge
28. Voltmeter
29. Inclinometer

Visibility from the front cockpit of KATE was regarded by U.S. Navy pilots as good compared to the Helldiver, but inferior to the Avenger. Pilot seating was far enough forward not to be affected by the wing. The KATE sacrificed armor protection for crew and fuel tanks to enhance speed and maneuverability.

All pilots that flew KATE during the American evaluation considered it an excellent carrier airplane due to its quick takeoff and its slow, stable approach speed of approximately 75 knots. Its wide landing gear eliminated ground looping tendencies.

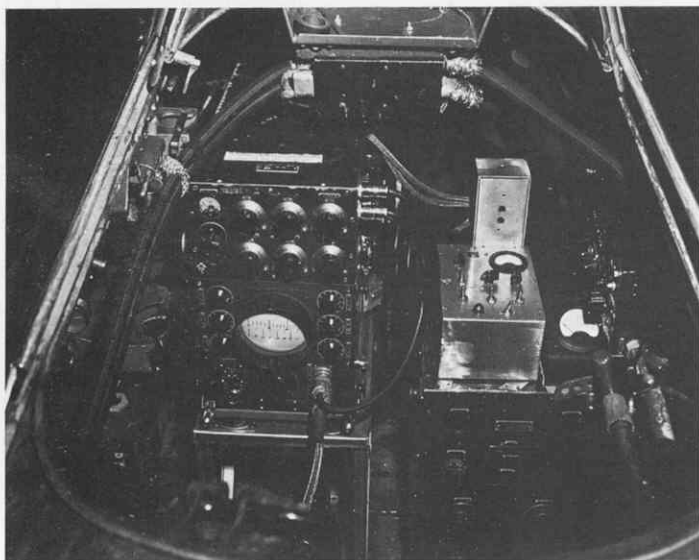




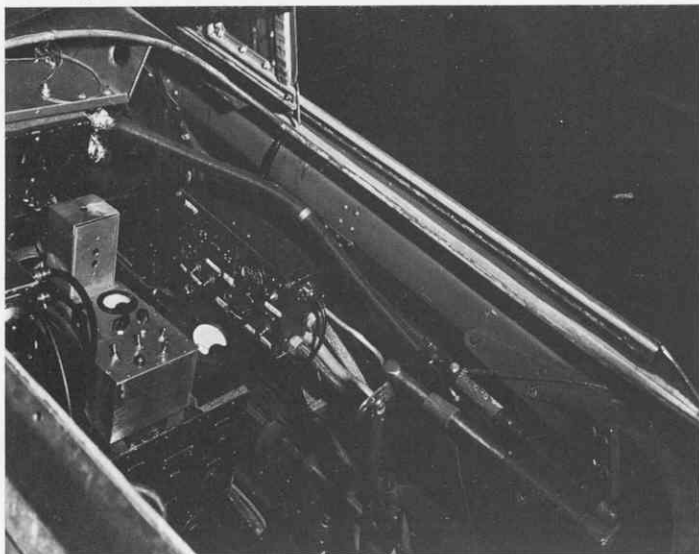
Left rear view of pilot's cockpit shows clearly that the entire area was painted interior olive green which is contrasted with black details.



Pilot's left console with engine controls in center just below throttle knob at top of picture. Bomb and torpedo manual release handles are at the right in picture.



Looking forward in rear cockpit of KATE equipped with early radar equipment. This installation was restrictive to gunner's movement in firing the flex-mounted machine gun.

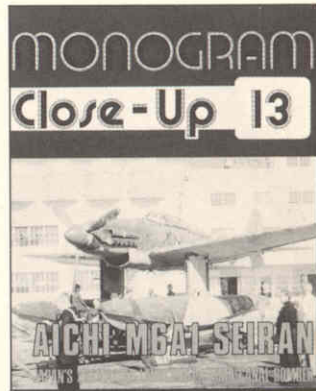
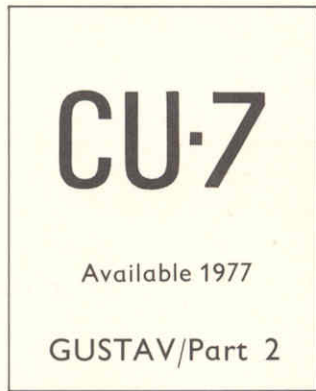
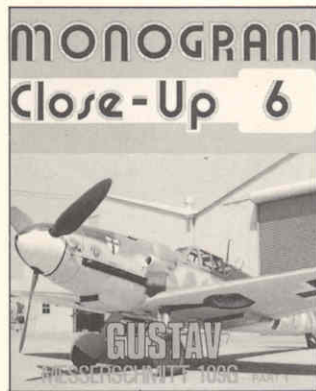
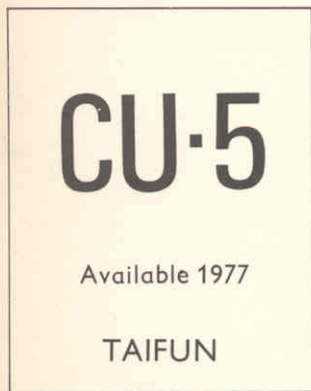
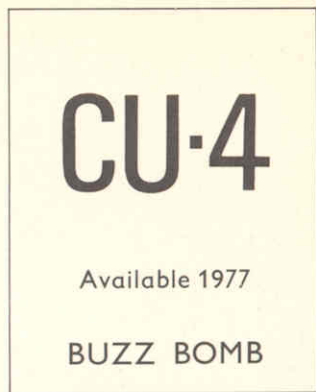
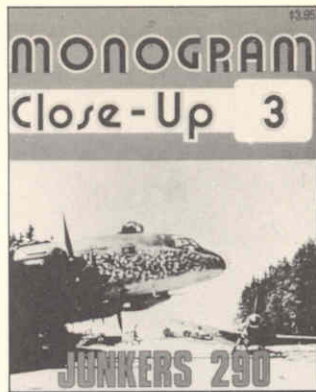
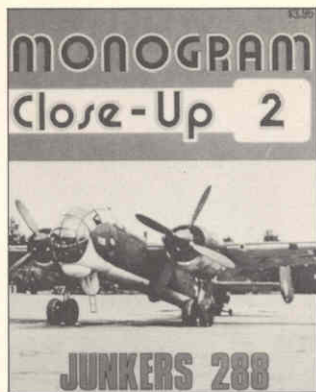
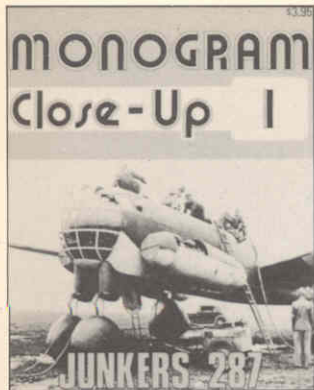


The center cockpit of the Nakajima B5N2 KATE carried the navigator/bombardier. Instruments included a large compass, free air temperature gauge and airspeed indicator. The bomb-sight was mounted on the left side of this cockpit. This second seat crew member assisted the pilot by working the interconnected wobble pump handle to extend and retract the arresting hook and to operate the emergency landing gear release mechanism.

The radioman/gunner occupied the rear seat. When radar was included, controls were installed in this position. The fuselage began to narrow at that point and with the canopy being quite low, movement for the gunner was greatly restricted.

During the American evaluation of the effectiveness of the rear gun position, runs were made on the KATE by an F6F-5 while the gun was manned by an aircrewman with combat experience in handling the twin .30 cal. installation in the TBD-1 and the turret of the TBF-1. He also had some experience with the aft guns in the SBD and SB2C. In his opinion the gun was very hard to move on the scarf ring, which extended only around the rear half of the cockpit. The gunner's seat did not move, and in fact hindered him. In all runs except those from above and behind, it was very difficult, because of the narrow cockpit, to get in a sighting position behind the gun. In most cases it was necessary to get out from behind the small canopy into the slipstream.

At left is the right front view of rear cockpit. Note scarf mount for one flexible 7.7 mm machine gun, the only armament carried by KATE.



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