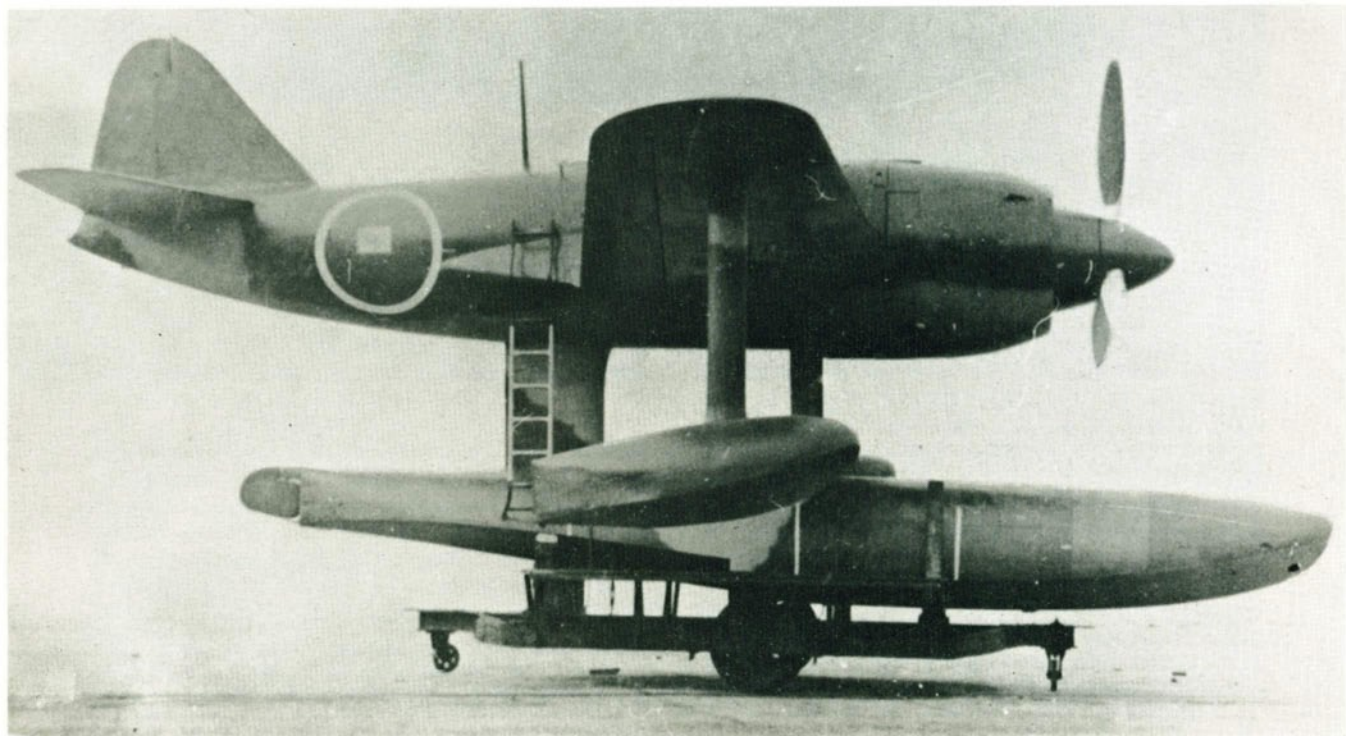
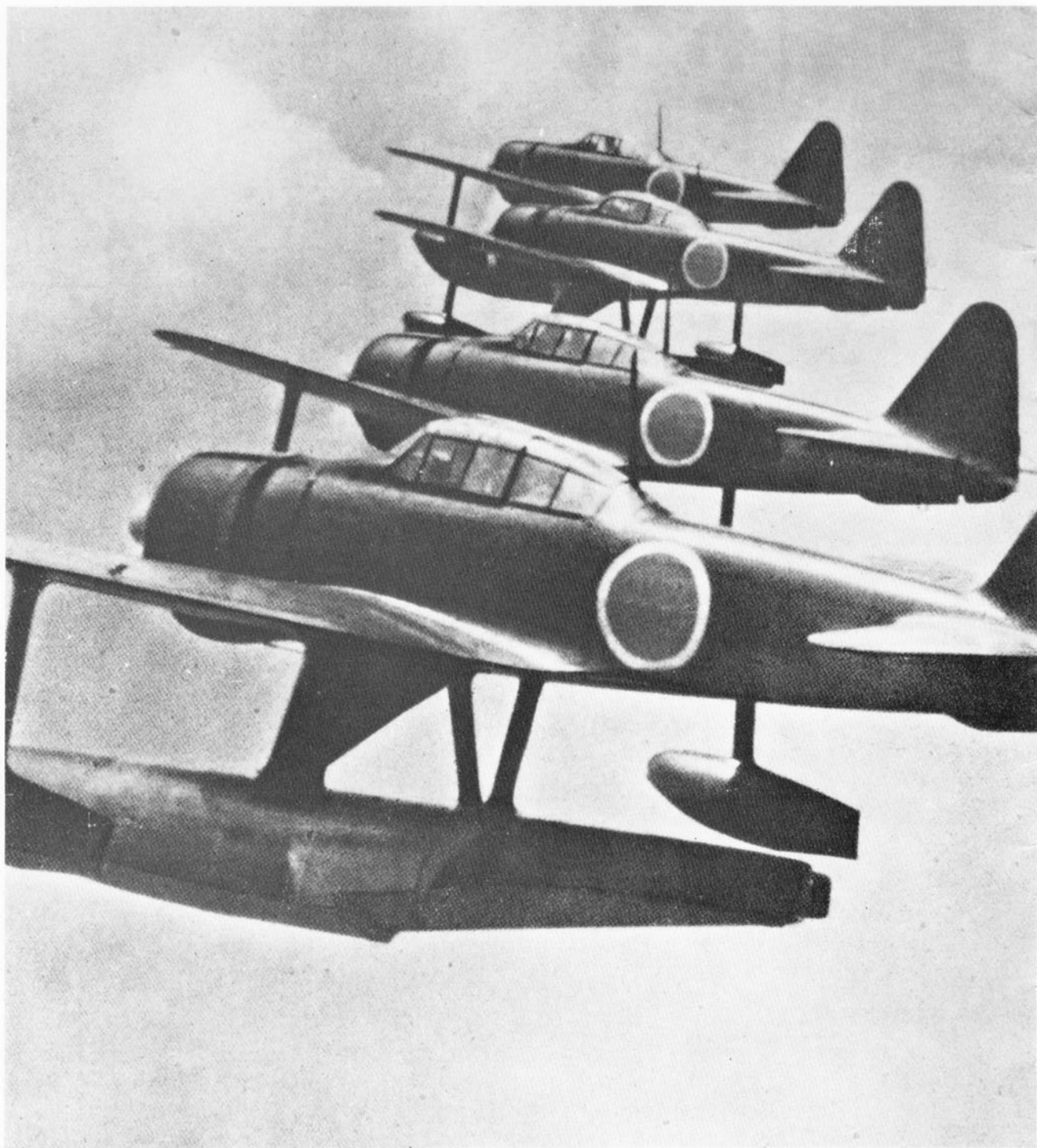


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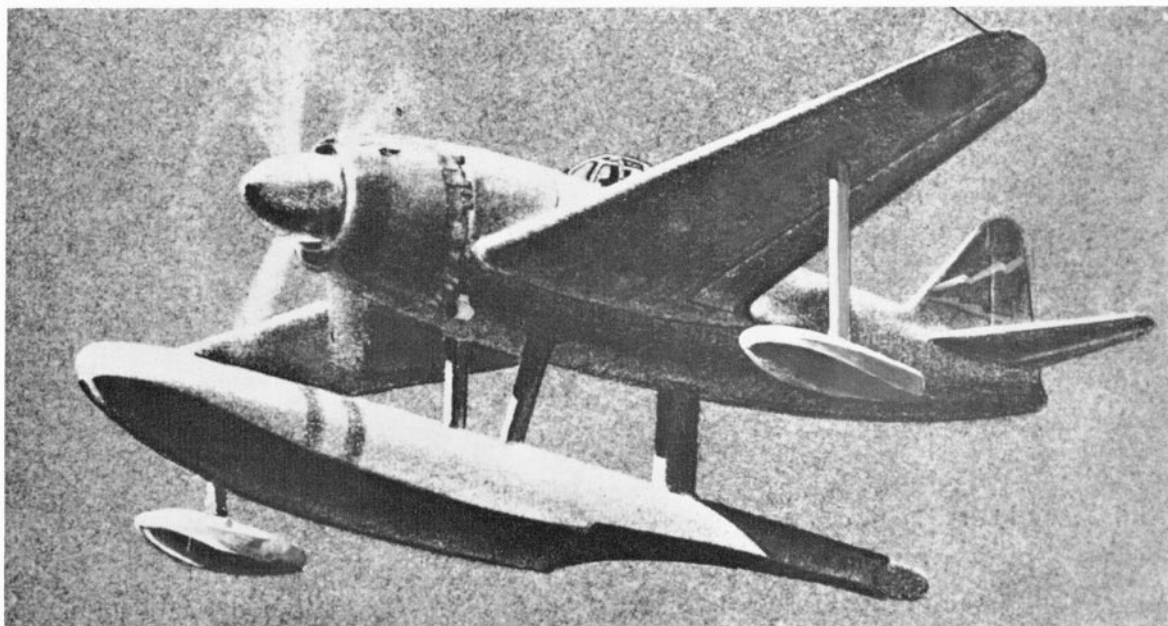
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KAWANISHI N1K KYOFU/‘REX’ & SHIDEN/‘GEORGE’





Navy Type 2 Floatplane Fighter Model 11 (A6M2-N, "Rufe") developed by Nakajima from the famous Mitsubishi A6M2 Reisen to serve as an interim floatplane fighter pending availability of the Kawanishi N1K1. (Photo: National Archives)



Heavily retouched photograph of the first Kawanishi N1K1 prototype fitted with the original contra-rotating propellers.
(Photo: National Archives)

Kawanishi Kyofu, Shiden and Shiden Kai Variants

René J. Francillon, Ph.D.

WHILE examples of the successful modification of land-based aircraft into floatplanes are numerous (e.g. Nakajima A6M2-N “Rufe”, Supermarine Spitfire VB and IX floatplanes, Fiat I.C.R.42 and Grumman F4F-3S Wildcat), the Kawanishi N1K1-J Shiden (Violet Lightning) is unique in the annals of military aviation for being the only land-based fighter aircraft derived from a floatplane fighter.

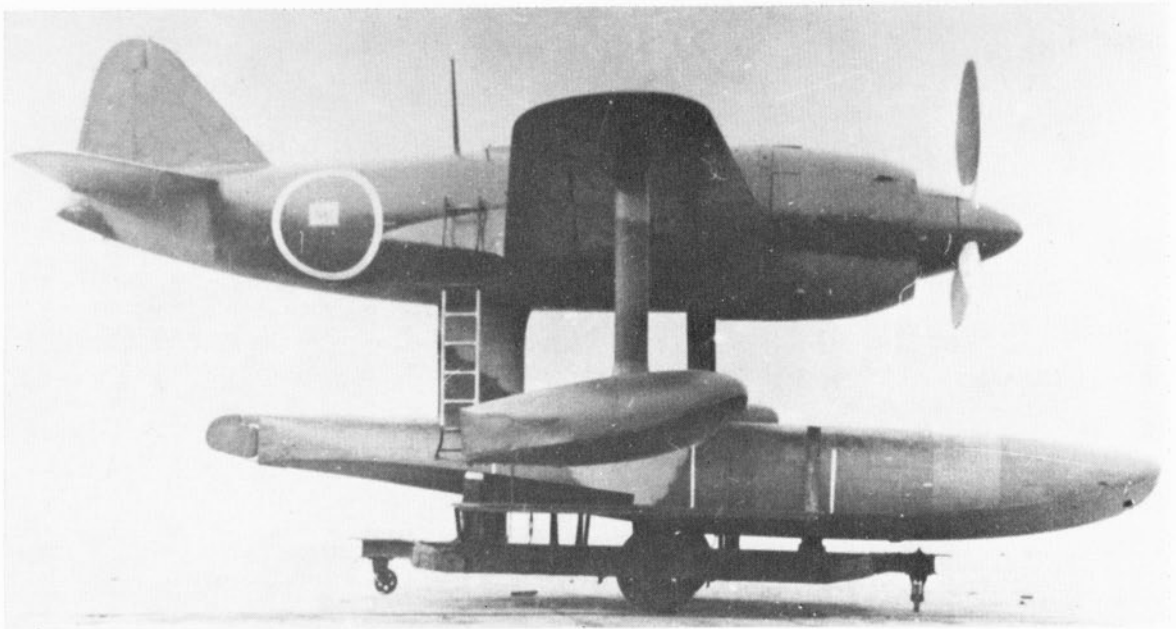
Despite its rather unusual origin and the initial lack of interest with which it was received by the Imperial Japanese Navy—it was developed as a private venture by the Kawanishi Kokuki Kabushiki Kaisha (Kawanishi Aircraft Co. Ltd.)—the Shiden, and more especially so its derivative the N1K2-J Shiden Kai (Violet Lightning, Modified), was without question the best fighter aircraft operated by that Service during the closing months of World War II.

The development of the Kawanishi series of floatplane and landplane fighters was initiated by the Imperial Japanese Navy in September 1940 to meet the special needs which the impending war against American forces in the Pacific created. At that time the Imperial Japanese Navy had just begun to take delivery of its first Mitsubishi A6M2 Reizens (Zero Fighters)*

* See Profile No. 129: Mitsubishi A6M2 Zero-Sen (and No. 190: A6M3). “Reisen” is nickname derived from “Rei-Sentoki” or Zero Fighter—thus, also, “Zero-Sen”.

which, for its time, had a remarkable maximum range of 1,930 miles when carrying a 72·6 Imperial gallon drop tank beneath the fuselage. This compared favourably with the contemporary Supermarine Spitfire II and Curtiss P-40E Warhawk which, respectively, had maximum ranges of 500 and 850 miles. Yet, despite a ferry range of almost 2,000 miles, the A6M2 Reisen possessed a practical combat radius of action of no more than 550 miles. Exceptional as this performance was, it was clear to the Air Staff of the Imperial Japanese Navy that even the Mitsubishi A6M2 would have insufficient radius of action to provide air support for amphibious operations in the islands scattered throughout the vast expanses of the Pacific where available airfields were few and far between. The reader should remember, for example, that no airfield existed in the southern Solomon Islands until the completion by Japanese construction battalions and Korean labourers of an airfield on the island of Guadalcanal. Even so, the Japanese did not have an opportunity to use this airfield as it was captured by the Marine Corps in early August 1942, a week prior to becoming operational.

To supplement the inadequate range of land-based A6M2 fighters, the Imperial Japanese Navy planned on using carrier-based aircraft to provide the necessary air support for their amphibious forces. Attractive as this solution appeared it had its limitations, namely the



Production N1K1 *Kyofu* powered by a 1,460 h.p. Mitsubishi *Kasei 13 (MK4C)*.
(Courtesy of the National Air and Space Museum, Smithsonian Institution)

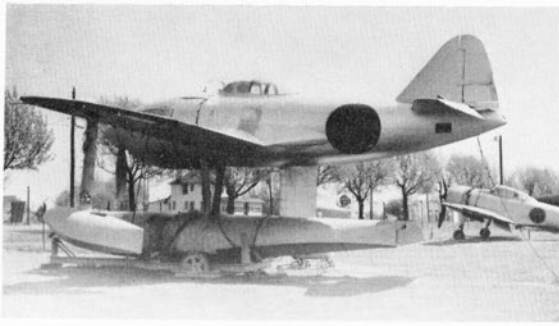
insufficient number of aircraft carriers in the Japanese fleet. At this time—1940—there were only four fleet carriers and three light carriers in service and the Navy planned on introducing into service during 1941 two additional fleet carriers and one light carrier. Taking into consideration the need to refit and overhaul or use for training one or two carriers at a time and the requirement to assign to the *Rengo Kantai* (Combined Fleet) for strategic operations at least six aircraft carriers, the Imperial Japanese Navy could plan on having at its disposal in 1941 for support of landing forces no more than two aircraft carriers. This was clearly insufficient to cover effectively all operations throughout the Pacific. Thus the Japanese planners began to develop considerable interest in the floatplane fighter concept.

While maximum speed and climb rate of a floatplane fighter were performance inferior to those of land- or carrier-based fighters because of the extra aerodynamic drag of the floats, the penalty paid was judged to be more than outweighed by the greater operational flexibility of the floatplane fighter which could be operated either from seaplane tenders—of which the Imperial Japanese Navy had fourteen in service in 1941—or from the many lagoons in the islands of the Pacific. Furthermore, high performance was not a major consideration in evaluating an aircraft which was intended to operate primarily in areas where no airfields existed; hence little likelihood of any sustained enemy air opposition with the exception of attacks by long-range land-based bombers or flying-boats. In combat, the floatplane fighter rôles were to be the interception of enemy water-based aircraft and the provision of air support to the ground forces.

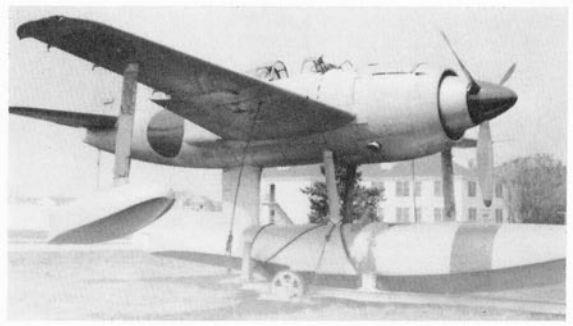
Having accepted the floatplane fighter concept as the one promising the optimum means to provide air support to amphibious forces in far-flung operations, the Imperial Japanese Navy proceeded with due speed

to initiate a two-phased development programme for this type of combat aircraft. As an interim measure, Nakajima Hikoki K.K. (Nakajima Aeroplane Co. Ltd.) was instructed to design a floatplane version of the Mitsubishi A6M2 *Reisen*—the A6M2-N—which they were already manufacturing. To follow this interim aircraft, Kawanishi Kokuki K.K. (Kawanishi Aircraft Co. Ltd.) was instructed to design an entirely new aircraft with higher performance than that which could be expected from the Nakajima A6M2-N. The choice of Kawanishi to design this new fighter might have seemed to be surprising. This company, while having considerable experience in the manufacturing of seaplanes—large flying-boats and reconnaissance floatplanes—had no previous experience in the design and manufacture of fighter aircraft. Yet, the choice of Kawanishi was logical as this company was, on one hand, the only major supplier of Japanese naval aircraft of which the engineering team was not overloaded with work in the Fall of 1940 and, on the other hand, it was already well ahead in the design of a new high-speed reconnaissance floatplane, the E15K1 *Shiun* (Violet Cloud) “Norm”. In the opinion of the Japanese naval staff, Kawanishi’s experience with the *Shiun* gave this company the necessary expertise to design a high-performance floatplane fighter.

While Nakajima was able to proceed at a fairly rapid pace with the design and construction of the A6M2-N, the prototype of which made its first flight on December 8, 1941, Kawanishi had a much more ambitious task to tackle. At the time of its conception, the aircraft received the designation K-20 under the newly-introduced Service Aeroplane Development Programme designation system. This indicated that it was the second project entrusted to Kawanishi and was designed to a Navy Experimental 15-Shi Floatplane Fighter specification. Eventually K-20 received the naval short designation N1K1 which indicated that



Captured N1K1 Kyofu photographed at NAS Willow Grove, Pennsylvania. In the background can be seen a Mitsubishi A6M5c Reisen.



Appearing too late to participate in the type of operations for which it had been intended, the N1K1 Kyofu had a rather indifferent and brief combat career.

it was the first version of the first type of floatplane fighter built for the Imperial Japanese Navy and that this was a Kawanishi design.

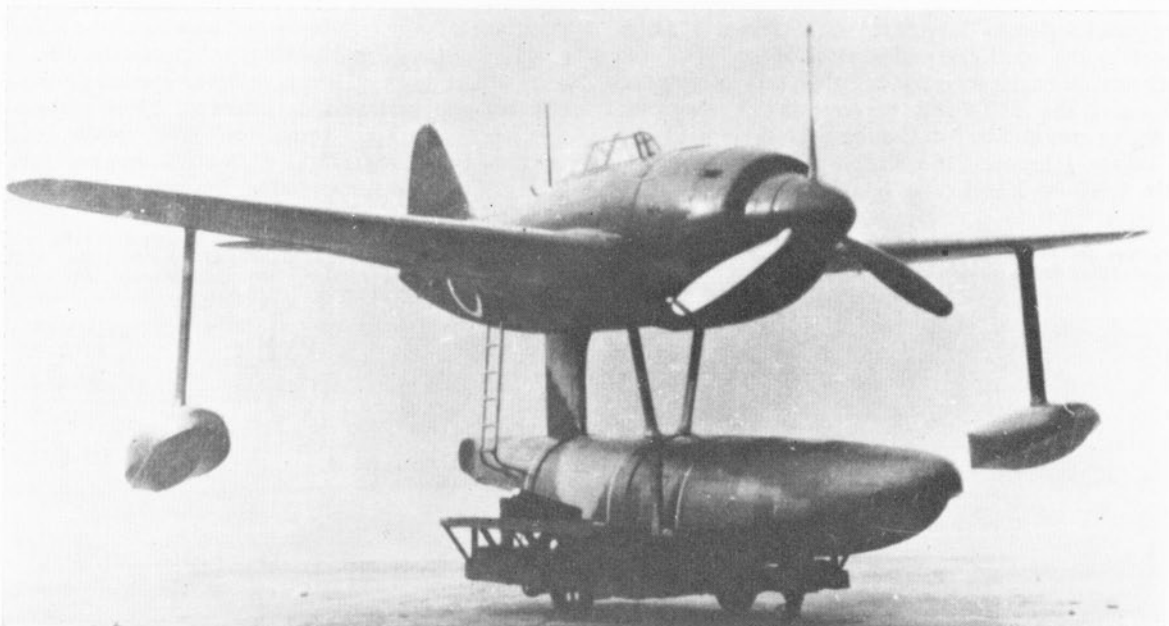
Under the leadership of a team of engineers led by Messrs. Elizaburo Adachi, Toshihara Baba, Hiroyuki Inoue and Shizuo Kikuhara, Kawanishi undertook to design an aircraft embodying a number of novel features. Among the first decisions made by the design team, one of the most notable was the selection of a mid-mounted wing with a laminar-flow aerofoil section similar to that designed for the Kawanishi E15K1 Shiun "Norm" by Professor Ichiro Tani of the Tokyo Imperial University. Initially, Kawanishi also intended to use stabilizing floats fitted with metal planing bottom and rubberized-fabric top. Similar in design to those fitted to the E15K1 prototype, these floats were pneumatically-inflated when extended but, after deflation, could be retracted into the outer wing panels with only their planing bottom protruding beneath the lower surface of the wings. However, difficulties experienced with this type of floats during the E15K1's flight trials programme prior to completion of the first N1K1 floatplane fighter, led to their replace-

ment by fixed cantilever stabilizing floats of all-metal construction. Whereas the E15K1 was characterized by a main central float attached to the bottom of its fuselage by explosive bolts which were intended to enable the crew to jettison this drag-producing float when attacked by enemy aircraft, the N1K1 was fitted with a more conventional main central float attached to the fuselage by a V-strut forward and an I-strut to the rear.

Having adopted the basic aerodynamic configuration for their new aircraft, the Kawanishi engineers began to search for a powerplant which would provide both the high horsepower rating needed to meet the performance requirements and the low frontal area desired to permit minimum drag. With the exception of the Aichi Atsuta, which was being developed for the Yokosuka D4Y Suisei (Comet), coded "Judy", series of dive-bombers, no liquid-cooled in-line engine was available to the designers of Japanese naval aircraft and Kawanishi felt that this in-line engine would be too difficult to maintain under the extremely primitive conditions in which the N1K1 would operate. After ruling out the use of the only

Three-quarter front view of a Navy Floatplane Fighter Kyofu Model 11 on its beaching trolley.

(Photo: Courtesy of the National Air and Space Museum, Smithsonian Institution)



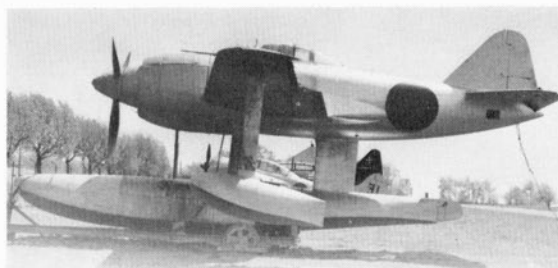
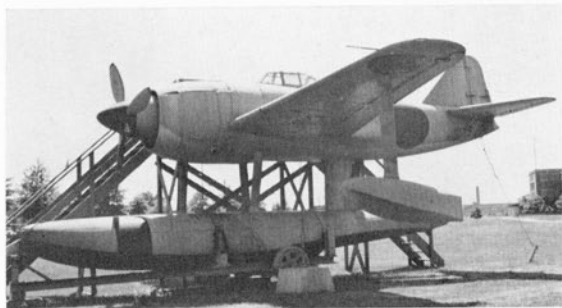


The Willow Grove Kyofu with a Mitsubishi A6M5c Reisen, and a Messerschmitt Me 262 B-1a in the background.
(Photo: via Herbert Heckert)

liquid-cooled engine available, the NIK1 design team had at its disposal two types of 14-cylinder air-cooled radials, the Nakajima Sakae (Prosperity) series and the Mitsubishi Kasei (Mars) series. Both types were reliable, well-proven powerplants. The Sakae 21 had a take-off rating of 1,130 hp whereas the Kasei 13 or 14 offered some 30 per cent. more power on take-off. However, the Kasei had been designed primarily for use on bomber aircraft and thus had a diameter 16 per cent. larger than that of Sakae. In spite of its larger diameter and resultant greater drag, the more powerful Kasei engine was chosen by Kawanishi to power the NIK1. In order to offset the drag of this engine and also to counteract propeller torque on take-off, Kawanishi elected to adopt a powerplant installation similar to the one used in early production E15K1s. Thus, the Kasei 14 (MK4D) radial engine had two contra-rotating 2-blade propellers with large spinner. In this form the NIK1 prototype was completed at Kawanishi's Naruo plant in April 1942 and made its first flight on May 6.

While construction of the NIK1 prototype was proceeding in the experimental shop of the Naruo plant, the engineering team initiated a series of preliminary design studies for a landplane version of the aircraft. The maximum speed planned for the floatplane fighter was 270 kt (311 mph) which compared favourably with the top speed of 331.5 mph reached by the then standard land- and carrier-based aircraft of the Imperial Japanese Navy, the A6M2 Reisen. Encouraged by the calculated performance of the NIK1, the Kawanishi engineers estimated that by replacing the floats of the NIK1 with a conventional retractable landing gear and by substituting a 1,800 hp Nakajima Homare (Honour) 18-cylinder radial in place of the 1,460 hp Kasei, they could build a land-based

Bearing the Allied code name "Rex", the Kyofu was flown in combat over Balikpapan and central Japan.
(Photo: via Herbert Heckert)



Navy Floatplane Fighter Kyofu Model 11. Note that the constant-speed VDM propeller was driven via an extension shaft.

interceptor fighter possessing a top speed of 350 kt (403 mph).

In December 1941, these engineers presented the results of their studies on the feasibility of producing a landplane version of the NIK1 to Kawanishi's management and, shortly thereafter, even though the Imperial Japanese Navy evidenced no interest in this proposal, the company decided to go ahead, as a private venture, with detailed design and construction of prototypes. The project became known internally as the Kawanishi Model X-1 Experimental Land-based Fighter. To minimize cost and expedite work, it was decided to keep modifications to a minimum and most changes affected the power plant installation and the replacement of floats by a fully-retractable land undercarriage. In the event, the design and construction of the main landing gear units was to present Kawanishi engineers with their major challenge. This was because of the location of the wings at mid-fuselage and the increase in diameter of the big 4-blade propeller for the Homare engine. It was necessary to design extra-long main undercarriage legs which, at the same time, had to contract considerably in order to fit into the wing wells.

As the design of the Model X-1 land-based fighter was under way so the prototype of the NIK1 floatplane fighter was first flown on May 6, 1942. Reports from the company's test pilot praised the general handling characteristics but pointed out that forward visibility on the water and during the final phase of the approach left much to be desired because of the bulky engine. Nothing could be done to correct this deficiency which, anyway, was considered a small price to pay for the performance achieved. More serious, however, were the complaints from pilots and mechanics alike regarding the unsatisfactory performance of the contra-rotating propeller. Teething

Three-quarter rear view of the only NIK1 Kyofu still in existence. The aircraft is presently stored in crates at Silver Hill, Maryland, by the National Air and Space Museum, Smithsonian Institution.
(Photo: via Herbert Heckert)



troubles with the propeller gearbox were considered to be of major magnitude in the light of the lack of experience of Japanese aero-engine manufacturers with contra-rotating propellers. Consequently, Kawanishi decided that on the second and subsequent NIK1s the troublesome Kasei 14 and its contra-rotating propeller installation should be replaced with the more conventional Kasei 13 (MK4C) which had similar ratings but drove a normal constant-speed 3-blade propeller via an extension shaft.

Eventually the Kasei 14-powered first prototype was handed over to the Imperial Japanese Navy for service trials on August 17, 1942, some 23 months after the programme had been initiated. This was followed, respectively in October and December of the same year, by the Kasei 13-powered second and third NIK1 prototypes. Armed with two synchronized 7.7 mm Type 97 machine-guns mounted in the upper side of the engine cowling and with two wing-mounted 20 mm Type 99 Model 1 cannons, these aircraft achieved a top speed of 300 mph at 19,685 ft and thus were 30 mph faster than the interim Nakajima A6M2-N floatplane fighter which had entered service in the summer of 1942. Deliveries of additional NIK1 prototypes and service trial models increased steadily and in July 1943 the first production aircraft was handed over to the Imperial Japanese Navy. However, the service trial programme for the NIK1 was still being conducted by the staff of the Koku Gijutsu Sho (Air Technical Unit) at Yokosuka and the type was not declared ready for service use until December 1943.

Meanwhile Kawanishi had gone ahead with the design and construction of the Model X-1 Experimental Land-based Fighter and the first was completed at Naruo in December 1943. Powered by a 1,820 hp Nakajima Homare 11 (NK9A) 18-cylinder air-cooled radial driving a 3.3 m (10 ft 9.29/32 in) VDM (German) four-blade constant-speed propeller, the first Model X-1 was armed with two synchronized 7.7 mm Type 97 machine-guns and two 20 mm Type 99 Model 1 cannons in underwing gondolas. Its first flight was

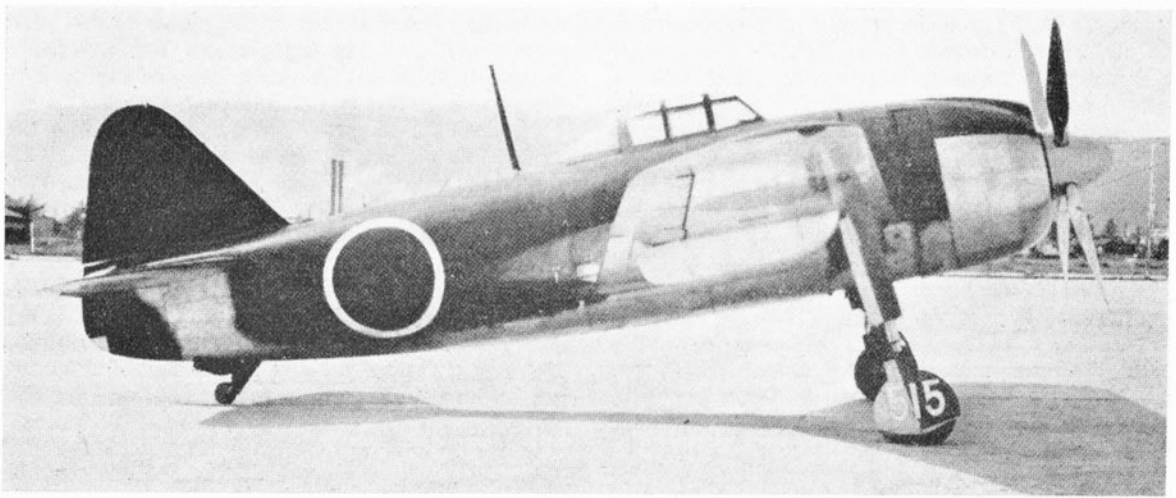
made from Itami Airport on December 27, 1942 and represented quite an achievement for Kawanishi Kokuki K.K. as this first flight followed initiation of this private venture by only one year, thus vindicating the logic of the design team who had realized early the value of developing a landplane version of the NIK1 rather than starting with a brand-new design. This opinion, nevertheless, was not shared by the technical staff of the Kaigun Koku Hombu (Navy Air Headquarters) because in October 1942 they had accepted for large-scale production the Mitsubishi J2M2 Raiden (Thunderbolt) as the first land-based interceptor fighter of the Imperial Japanese Navy. The situation was aggravated further because, rather than considering the Kawanishi private venture for production they had instructed this company to undertake the design of a totally new aircraft to a Navy Experimental 17-Shi Otsu (B) Type Interceptor Fighter specification (the Kawanishi K-90 or J3K1) in competition with the Mitsubishi J4M1 Senden (Flashing Lightning).

Undaunted by the Imperial Japanese Navy's lack of interest in the Model X-1, Kawanishi doggedly went on testing its private venture X-1 and by July 1943 had four prototypes in flying condition. Unfortunately, all was not well with the Model X-1 which, during manufacturer's trials, was beset with major teething troubles affecting the powerplant installation. For example, the VDM propeller ran rough, oil leaks in the engine recurred with disturbing frequency, cylinder temperature had a tendency to rise alarmingly and the engine vibrated dangerously while failing to develop its rated power. Bad as these problems were, responsibility could not be attributed to the Kawanishi design team as they were shared to a greater or lesser extent with all other aircraft powered by the unreliable early versions of the Nakajima Homare engine. On the other hand, however, the engineers of Kawanishi could be blamed for another set of teething troubles which stemmed from the cumbersome and elongated main undercarriage legs. These complex units proved quite unreliable and Kawanishi, lacking experience in the

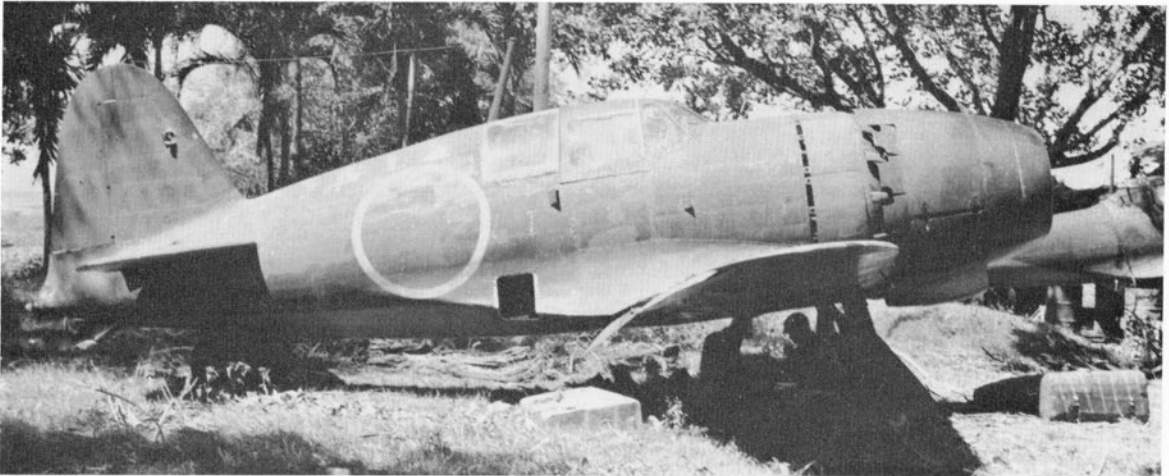
A Kawanishi Model X-1 Experimental Land-based Fighter tested by the Imperial Japanese Navy. Note absence of air scoop on the lower engine cowling lip, a feature which identified the early Model X-1 prototypes.

(Photo: Courtesy of the National Air and Space Museum, Smithsonian Institution)





Kawanishi Model X-1 armed with two fuselage-mounted 7.7 mm. machine-guns and two 20 mm. cannons in wing gondolas.



Initially favoured by the Imperial Japanese Navy over the private venture Kawanishi Model X-1, the Mitsubishi J2M3 Raiden was eventually superseded by the N1K1-J Shiden and N1K2-J Shiden Kai. (Photo: National Archives)

A Kawanishi N1K1-J Shiden Model 11 with underwing gondolas removed. Note external oil cooler protruding beneath the port side of the engine cowling.





Navy Interceptor Fighter Shiden Model 11 (NIK1-J) of the 201st Kokutai in the Philippines. This particular aircraft bore the tail number 201-53 on its vertical surfaces. Note details of the armament installation.

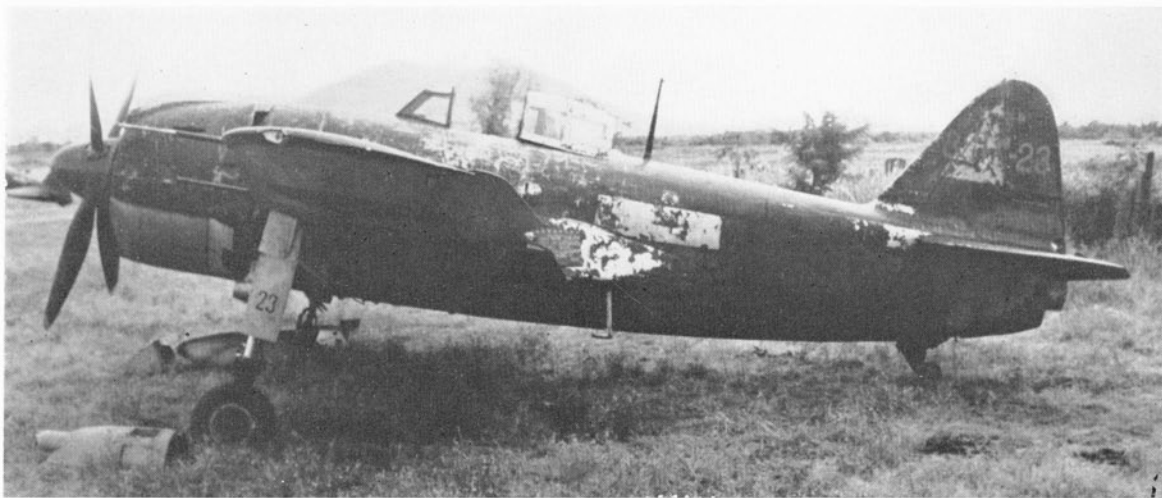
design of retractable undercarriages, was never able to correct this deficiency. As if fate had decided that the private venture Kawanishi land-based fighter would suffer all possible misfortunes, test pilots reported bitterly that visibility on the ground was sub-standard. They reported also that performance fell well below expectations due mainly to the fact that the Homare engine could not produce its rated power. Thus, the Model X-1 reached a top speed of only 310 kt (357 mph) whereas Kawanishi had anticipated that it would possess a maximum speed of 350 kt (403 mph).

Shortly after starting the flight trials programme of the Model X-1 and before knowing the extent to which this aircraft was going to be beset by teething troubles, Kawanishi undertook a major redesign of the aircraft to correct some of its major shortcomings. To this effect, it was decided to move the wings to a low position—thus enabling the use of a simpler and shorter main undercarriage—and to simplify the aircraft's structure to ease production and maintenance. As this redesign appeared to promise good results, the Imperial Japanese Navy elected in the Spring of 1943 to sponsor this programme, and to free the Kawanishi design team to work on this programme they cancelled the development of another Kawanishi project. This was the Navy Experimental 18-Shi Otsu (B) Type Interceptor Fighter specification Jimpu (J6K1), a derivative of the projected J3K1 mentioned earlier.

Despite its lack of interest in the Model X-1 Experimental Land-based Fighter, the Imperial Japanese Navy took delivery of one of the four prototypes for test purposes. Beginning in July 1943, this aircraft was evaluated by pilots of the Koku Gijutsu Sho at Yokosuka but, still resenting the fact that the project had not been sponsored by the Navy, the Service pilots criticized severely the results of Kawanishi's endeavours. Not only did they confirm the findings of the manufacturer's trials but also they

complained about the overall poor workmanship. Nevertheless, the Imperial Japanese Navy began to show active interest in the aircraft. This was because, on one hand the development of the interceptor fighter which had been so far sponsored by that Service—the Mitsubishi J2M2 Raiden—was running into serious trouble, while on the other hand the rapidly changing war situation resulted in a pressing need for that Service to obtain a substantial number of interceptor fighters. Consequently, the Imperial Japanese Navy decided to sponsor further development of the Kawanishi land-based fighter, the aircraft being then officially designated NIK1-J Shiden (Violet Lightning) Interceptor Fighter. At that time it was decided that the NIK1-J would be developed as an interim type pending availability of the projected modified version of the aircraft with simplified structure and low-wing configuration which was designated NIK2-J Shiden Kai (Violet Lightning, Modified) Interceptor Fighter. To assist Kawanishi with the development of the Model X-1 prototype into the combat-worthy NIK1-J, the Navy assigned to this company a number of Service engineers and technicians and took over the responsibility for the programme.

While all this activity on the land-based versions of the Kawanishi fighter was taking place, the Navy continued its development flight trials programme with the floatplane fighter progenitor, the NIK1 Kyofu (Mighty Wind). Eventually, in December 1943, by which time the Imperial Japanese Navy had already taken delivery of some 53 Kyofus, the floatplane fighter was declared by that Service as being ready for operational duty. Due to the changing war situation, floatplane fighters primarily designed for support of offensive operations were less vital and it was decided to curtail Kyofu production in favour of stepping-up production of the Shiden and Shiden Kai land-based fighters. Thus, the ninety-seventh and last Kyofu was



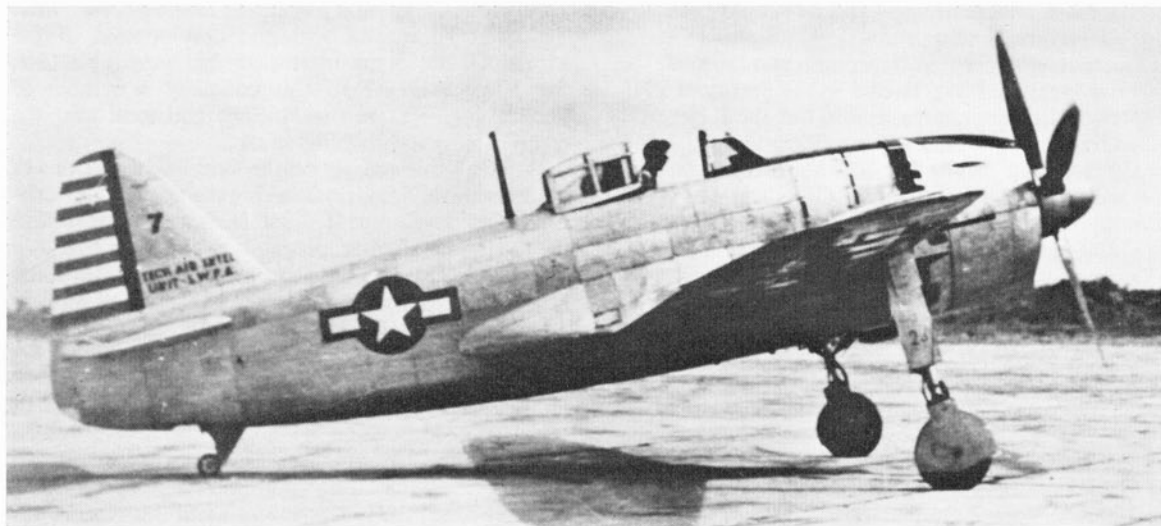
A Shiden Model 11 abandoned at Clark Field by the 341st Kokutai, the first operational unit to be equipped with Shidens.

delivered to the Imperial Japanese Navy in March 1944 and development of a version with improved performance, the N1K2 with a 1,900 hp Mitsubishi Kasei 23 (MK4R) engine, was suspended prior to completion of a prototype. With the exception of the fitting under each wing of a rack for a 30 kg (66 lb) bomb, early production N1K1s differed little from the prototypes. Late production Kyofus were, however, characterized by the use of a 1,530 hp Kasei 15 (MK4E) with individual exhaust stubs instead of a 1,460 hp Kasei 13 with a single exhaust collector pipe.

With only 97 Kyofus built, it is hardly surprising that the type saw limited operations. N1K1s were, however, encountered by Allied aircrews in two widely-separated areas, Borneo and the Japanese home islands. In Borneo, Kyofus were operated as interceptors to protect the vital oil refineries at Balikpapan and were met in combat by Consolidated B-24 Libera-

tors of the U.S. Fifth Air Force, the Royal Australian Air Force, and by carrier-based aircraft of the British Pacific Fleet. Other Kyofus were flown as interceptors by the Otsu Kokutai (Otsu Naval Air Corps) which was based on Lake Biwa in the Japanese main island of Honshu. In spite of its commendable manoeuvrability, the Kyofu was no match for such Allied fighters as the Grumman F6F Hellcat and the Vought F4U Corsair and the aircraft lacked the necessary performance to intercept high-flying Boeing B-29 Superfortresses. This in no way reflected a failure on the part of Kawanishi to meet the design's performance requirements but stemmed rather from the fact that the Kyofu, which had been designed as an air-superiority fighter operating in support of offensive amphibious operations in areas where little or no opposition from land- or carrier-based aircraft was anticipated, had to be operated as a defensive fighter against large numbers of

A Kawanishi N1K1-J Shiden Model 11 being tested by an American pilot of the Technical Air Intelligence Unit, Southwest Pacific Area. The aircraft is believed to be the same one as the machine illustrated in the markings of the 341st Kokutai which had been found abandoned at Clark Field. (Photo: via Herbert Heckert)



high-performance Allied land- or carrier-based aircraft at a time when the Allies were dictating the war's progress on their terms.

With the assistance of Navy personnel Kawanishi worked hard during 1943 to correct as many deficiencies in the landplane version of its fighter as possible and the number of aircraft built in the Naruo plant mounted steadily while an additional N1K1-J production line was set up in the newly-completed Kawanishi plant at Himeji. Compared with the Model X-1 prototypes, the pre-production N1K1-J aircraft differed mainly in their powerplant and armament installations. The unreliable 1,820 hp Homare 11 (NK9A) of the prototypes gave place to the improved 1,990 hp Homare 21 (NK9H) which was fitted with individual exhaust stubs and was enclosed in a modified cowling incorporating an additional air scoop in its lower lip and to which was attached externally on the port side an oil cooler. Firepower was increased by replacing the two 20 mm Type 99 Model 1 cannons in wing gondolas by two 20 mm Type 99 Model 2 cannons—which were faster firing and had a higher muzzle velocity—and by adding two wing-mounted weapons of the same calibre, thus bringing total fixed armament to two 7.7 mm machine-guns and four 20 mm cannons. At the same time numerous minor internal modifications were introduced and a ventral rack for a 400-litre (88 Imp. gallons) belly drop tank was added. In this form the N1K1-J was accepted for production in December 1943 as the Navy Interceptor Fighter Shiden Model 11 but the type was not declared ready for combat operations until ten months later.

While the Imperial Japanese Navy was testing the N1K1-J, Kawanishi was producing at a fast pace so that by the time the aircraft had been found ready for combat, 461 Naruo-built and 201 Himeji-built Shiden Model 11s had been accepted by the Navy. The peak monthly combined production rate in the two plants (106 aircraft) was reached in October 1944. Production



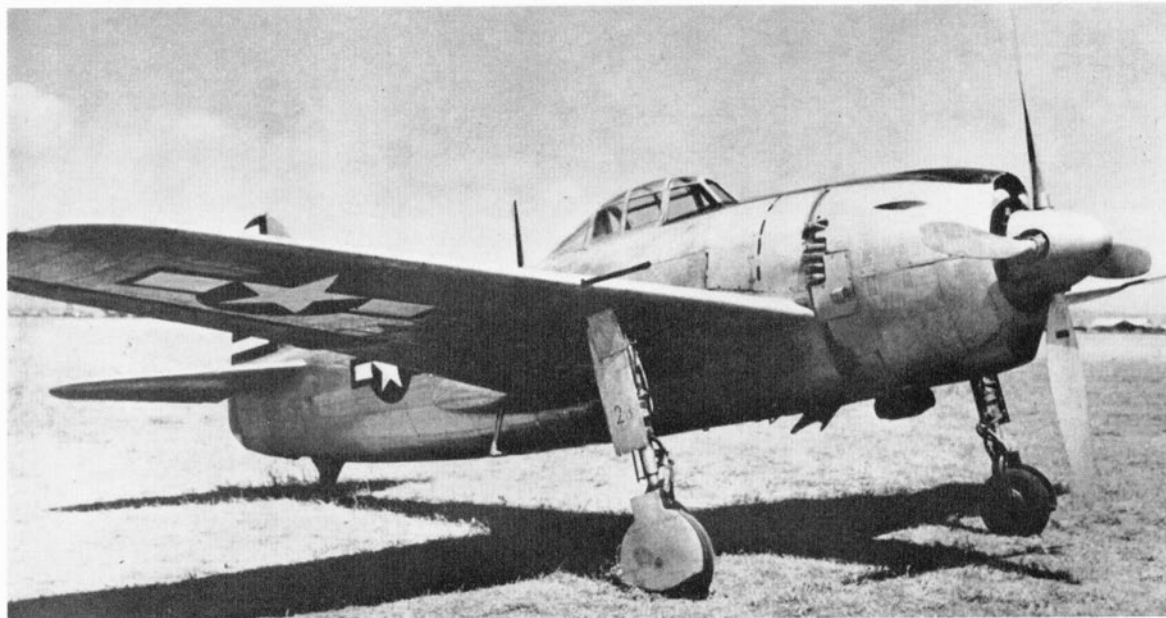
Wreckage of a Kawanishi N1K1-J destroyed on the ground in the Philippines. (Photo: via Herbert Heckert)

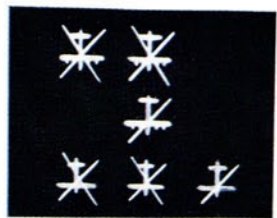
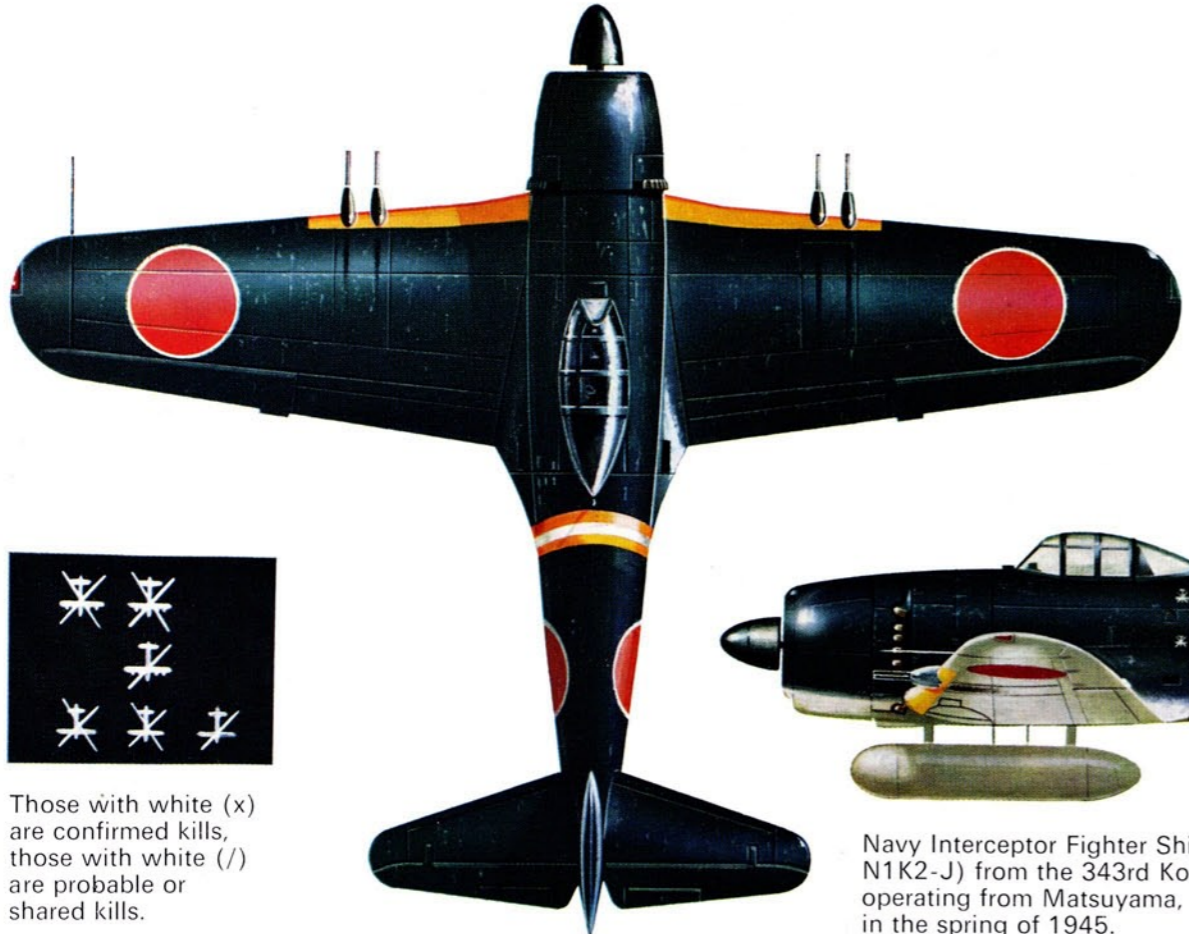
of the N1K1-J, which in the plans of the Navy was only an interim aircraft pending availability of the N1K2-J, was terminated at the Naruo plant in November 1944 with the delivery of the 541st Shiden but continued at the Himeji plant so that between December 1943 and June 1945, a further 466 Shidens were delivered. Most of the 1,007 aircraft built in these two plants were Shiden Model 11s which were similar to the pre-production aircraft powered by the 1,990 hp Homare 21 and were armed with two fuselage-mounted 7.7 mm machine-guns and four 20 mm cannons (two within and two beneath the wings) but five variants of the Shiden were realized:

N1K1-Ja Shiden Model 11A: Same powerplant as Model 11 but armament was modified to include four 20 mm Type 99 Model 2 cannons mounted internally within the wings. Both the fuselage-mounted 7.7 mm machine-guns and the 20 mm cannons in underwing gondolas were dispensed with.

N1K1-Jb Shiden Model 11B: Similar to the Model 11A with the exception of the use of modified square-tipped, horizontal tail surfaces and the installation of two strengthened underwing racks which enabled the carriage of 250 kg (551 lb) bombs instead of 60 kg (132 lb) bombs.

Captured "George 11" in U.S. markings. Note the gap between the upper and lower cover plates on the main landing gear; this gap resulted from the need to contract the oleo leg prior to retracting the gear into its well. (Photo: R.A.A.F. Official)



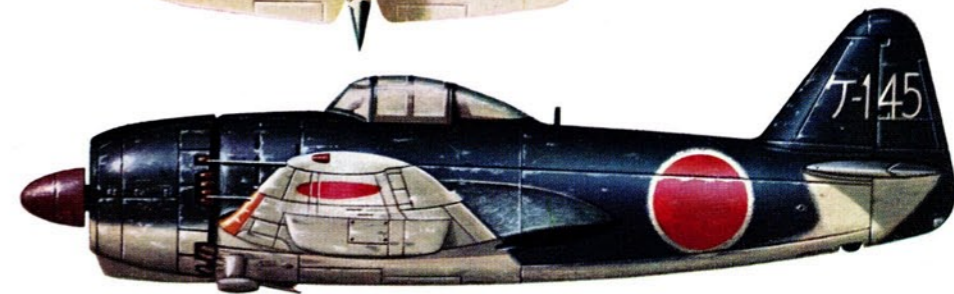
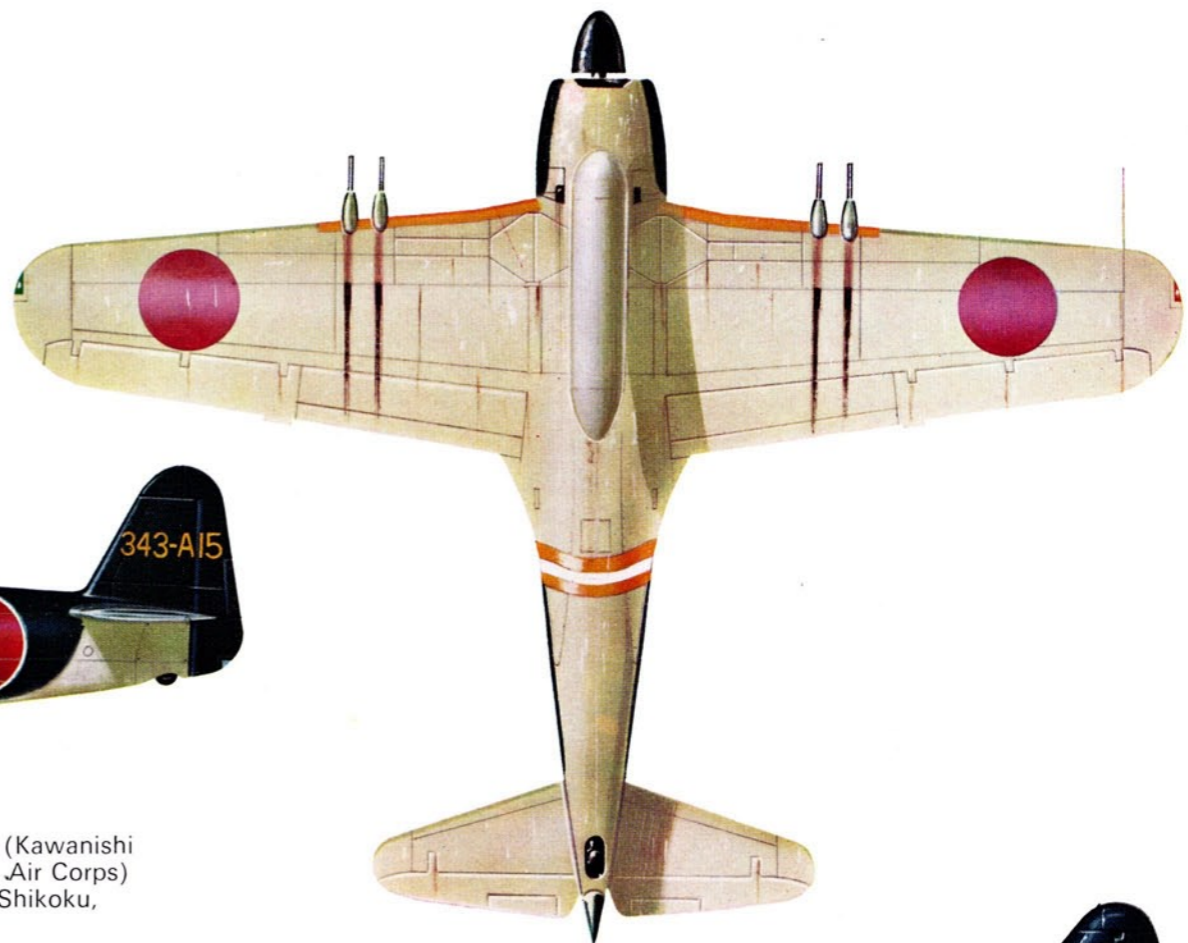


Those with white (x) are confirmed kills, those with white (/) are probable or shared kills.

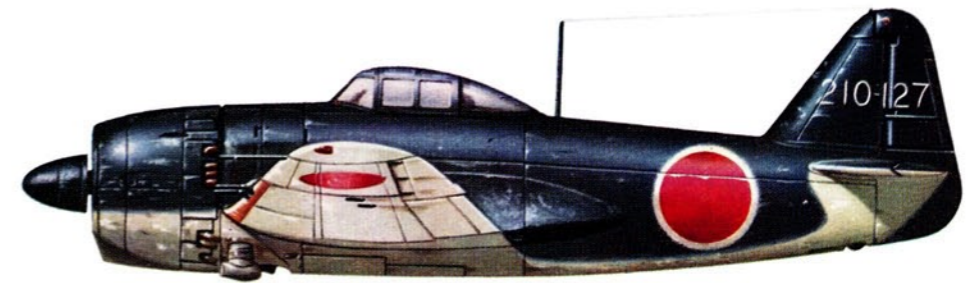
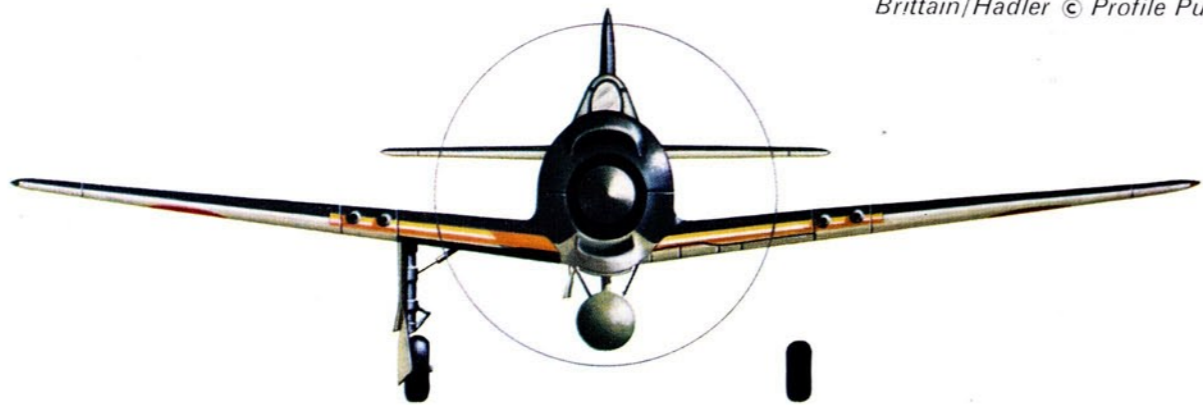


Navy Interceptor Fighter Shiden Kai Model 21 (Kawanishi N1K2-J) from the 343rd Kokutai (343rd Naval Air Corps) operating from Matsuyama, Ehime Prefecture, Shikoku, in the spring of 1945.

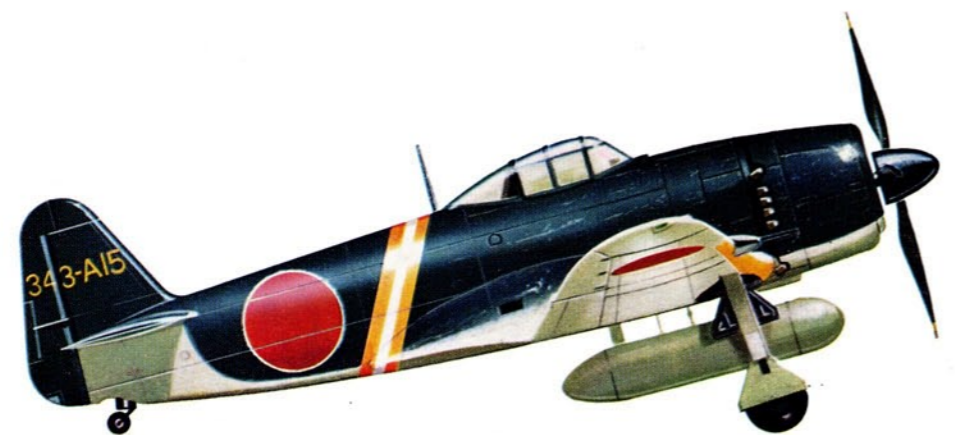
Brittain/Hadler © Profile Publications Ltd.



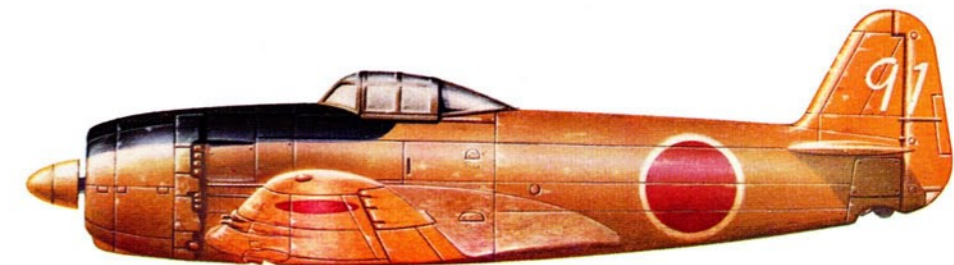
N1K1-J Shiden Model 11 from the Genzan Kokutai



N1K1-Ja Shiden Model 11A from the 210th Kokutai, Meiji, 1945

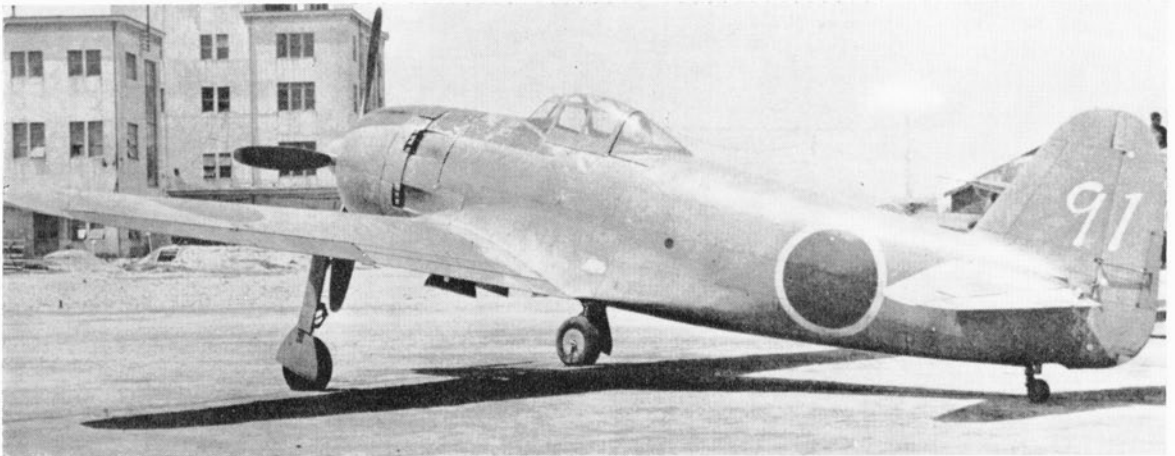


N1K2-J Shiden Kai prototype





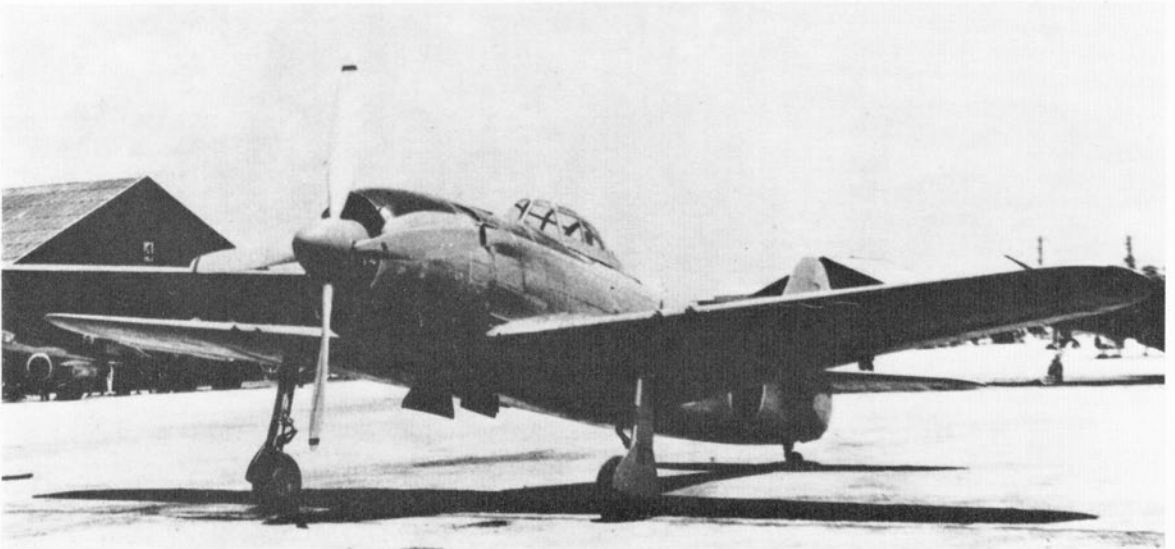
Navy Interceptor Fighter Shiden Model 11A (N1K1-Ja) characterized by the location into the wings of all four 20 mm. cannons. The aircraft is seen fitted with a 400-litre (88 Imp. gal.) drop tank.



The N1K2-J prototype which was painted orange and had a black anti-glare panel above the engine cowling. The number 91 was painted in white on the vertical tail surfaces.

Prototype N1K2-J with the cleaner engine cowling characterizing this particular aircraft.

(Photo: Courtesy of the National Air and Space Museum, Smithsonian Institution)



NIK1-Jc Shiden Model 11C: Variant similar to the Model 11B but specially intended as a fighter-bomber. Four bomb racks, two beneath each wing, enabled this variant to carry a maximum bomb-load of 1,000 kg (2,204 lb).

NIK1-J Kai: Experimental modification of one Shiden Model 11 which was fitted with a solid-propellant rocket engine beneath the rear fuselage. Not proceeded with.

NIK1-J Kai Shiden Model 11 Kai: Towards the end of the war, as the number of available NIK2-J Shiden Kais increased, several NIK1-J Model 11 aircraft were modified as dive-bombers for use against the Allied fleet during the anticipated invasion of the Japanese homeland. To this effect, these aircraft were fitted with a large ventral pannier containing six launching tubes for rocket projectiles and in which a 250 kg (551 lb) could be partially housed. This variant did not reach operational status.

The first operational unit of the Imperial Japanese Navy to take delivery of Shidens was the 341st Kokutai (Naval Air Corps) which received its aircraft while in training at Kasanohara. After being successively transferred within Japan from the First Koku Kantai, (Air Fleet) to the 61st Koku Sentai (Air Flotilla) and then to the 62nd Koku Sentai, the 341st Kokutai became part of the Second Koku Kantai on June 15, 1944. Conducting the service trials of the Shiden at operational unit level, the 341st Kokutai experienced quite a bit of trouble due to the shortcomings of the main undercarriage and also because of the uncertain reliability of the Shiden's Homare 21 engine. Nevertheless pilot training was conducted at a fair pace and, by the time of the Allied landing on Leyte, the 341st Kokutai had more trained Shiden pilots than necessary to operate its normal complement of aircraft. As a result of this situation, which stemmed from the Navy's decision to use this Naval Air Corps both as a Shiden operational testing unit and as a Shiden conversion unit, the 341st Kokutai was able to transfer a number of pilots to the 201st Kokutai of the First Koku Kantai which immediately converted from the Reisen to the Shiden at their Cebu base in the Philippines.

With the Allied landing on Suluan Island in Leyte Gulf during the early morning hours of October 17, 1944, the struggle for the reconquest by the Allies of the Philippine Islands had been launched and the Japanese initiated their long-planned Sho Operation No. 1 to contain the Allied move. During strikes by carrier-based aircraft of the U.S. Navy, the 201st Kokutai lost several Shidens and thus became the first unit to take this aircraft into combat. However, by October 23, the 201st Kokutai was reinforced by the 341st Kokutai which arrived at Clark Field with 23 Shidens. In spite of the inherent qualities of their mounts, the Shiden pilots had a most difficult task in front of them because the American forces had an overwhelming numerical air superiority. In the air the Shiden fared comparatively well and, for example, the first combat mission by the 341st Kokutai, 18 Shidens met a markedly larger number of Hellcats and during the ensuing combat they destroyed seven F6Fs for the loss of ten Shidens. Performance-wise the Shiden was only 13 mph slower than the Grumman F6F-3 and 23 mph slower than the F6F-5 and its armament and protection were substantially better than those of the



Production NIK2-J Shiden Kai Model 21 photographed at the Naruo Works of Kawasaki Kokuki K.K.

Mitsubishi A6M5 Reisen which equipped the bulk of the fighter units of the Imperial Japanese Navy. However, the Shiden was still suffering from serious technical troubles including undercarriage failures, engine oil leaks and buckling of the metal skin during violent evasive manoeuvres while maintenance problems reduced availability of the aircraft for combat sorties. Furthermore, in common with other contemporary Japanese aircraft, the Shiden was often poorly built as, with notable lack of foresight, the Japanese drafted the civilian labour without regard to skill or to industry requirements, thus forcing the aircraft manufacturers to rely increasingly on unskilled teenage and woman labour. In the Philippines, ground losses suffered by Japanese air units, including the Shiden-equipped 201st and 341st Kokutais, were very heavy due to the almost constant pressure kept on Japanese airfields by American fighter aircraft and, in spite of constant arrivals from Japan of replacement aircraft, the Shidens had all but disappeared from the Philippines within three months of the landing on Suluan Island.

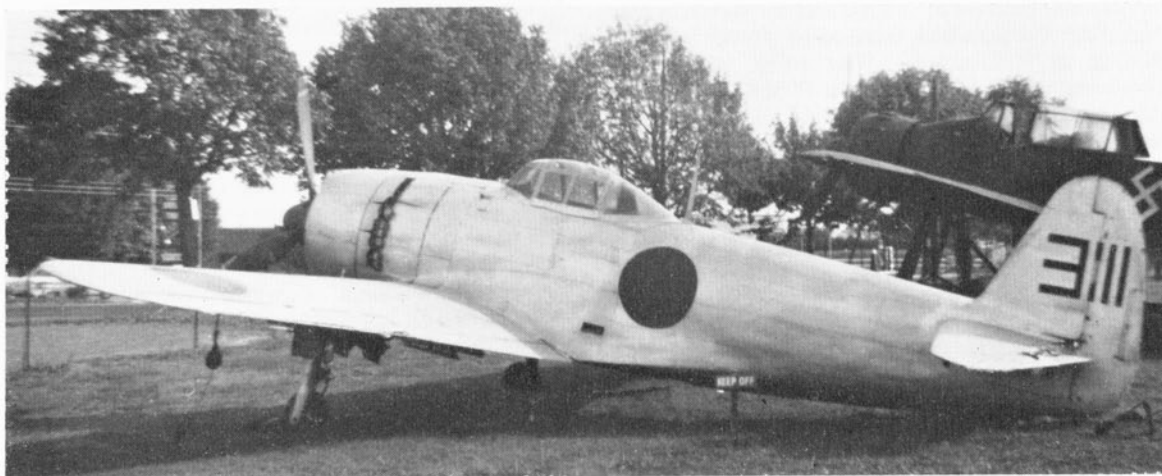
On March 26, 1945, the 77th Infantry Division of the U.S. Marine Corps landed on the small islands of Kerama Retto, 15 miles west of Okinawa, thus starting the battle for Okinawa which lasted until June 21. While air combats over and around Okinawa are better remembered for the massive use by the Japanese forces of kamikaze aircraft, Okinawa was also a major sector of operations for Shidens. An idea of the magnitude of efforts put up by Shiden-equipped Kokutais can be judged from the fact that on April 6 some 110 sorties were flown by Shiden pilots. The results achieved, however, were poor because Allied air superiority had now reached a level which the Japanese could no longer effectively contest. Other Shidens were also operated in the defence of Japan but the aircraft was virtually impotent against the high-flying Boeing Superfortresses in daylight operations as they had neither the necessary climb performance to obtain a favourable combat position nor had they sufficient speed advantage to catch up with the mighty B-29s (the maximum speed of the Shiden, which was reached

On this three-quarter rear view the Shiden Kai look aerodynamically much cleaner than the fat-bellied Shiden.



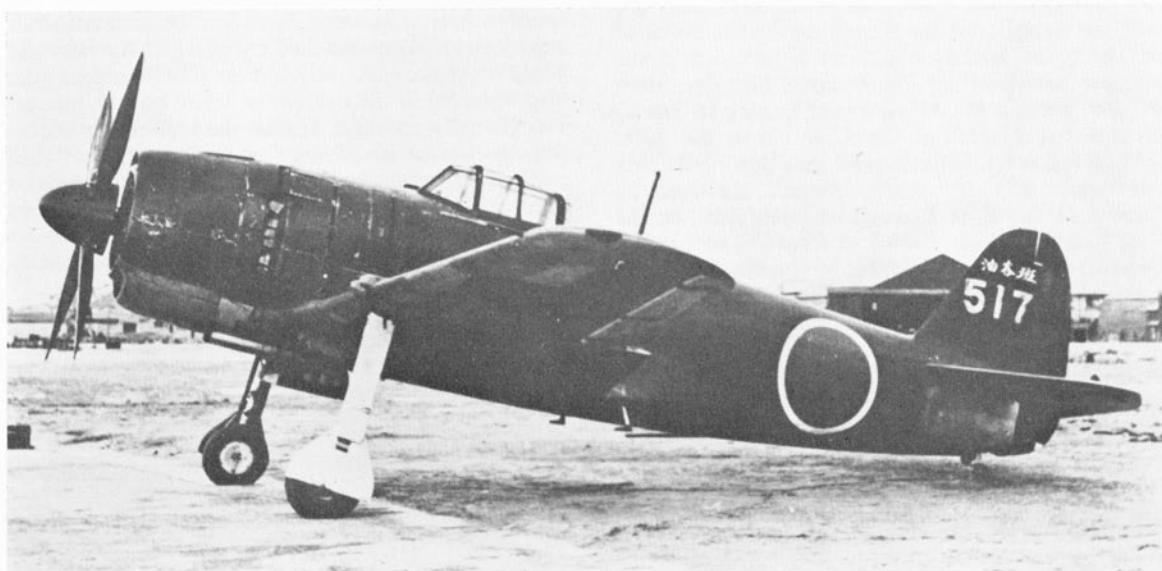
at 19,355 ft, was 363 mph while the B-29 had a maximum continuous cruising speed of 342 mph at 30,000 ft). While the results achieved in combat operations by the Shiden were not very impressive in themselves, this lack of success can be attributed more to the overall unfavourable conditions under which the aircraft was called to operate (e.g., Allied numerical superiority, insufficient number of experienced Japanese pilots, lack of petrol, etc.) than to inherent defects in the design of the aircraft. Japanese and Allied pilots alike considered the Shiden as being, next to its derivative the Shiden Kai, the best fighter aircraft available to the Imperial Japanese Navy during the final ten months of the war in the Pacific. For the Allies, the aircraft presented an additional problem as from a distance the fat-bellied Shiden could be easily confused in the air with the fat-bellied F6F Hellcat and thus the Shiden possessed a definite tactical advantage.

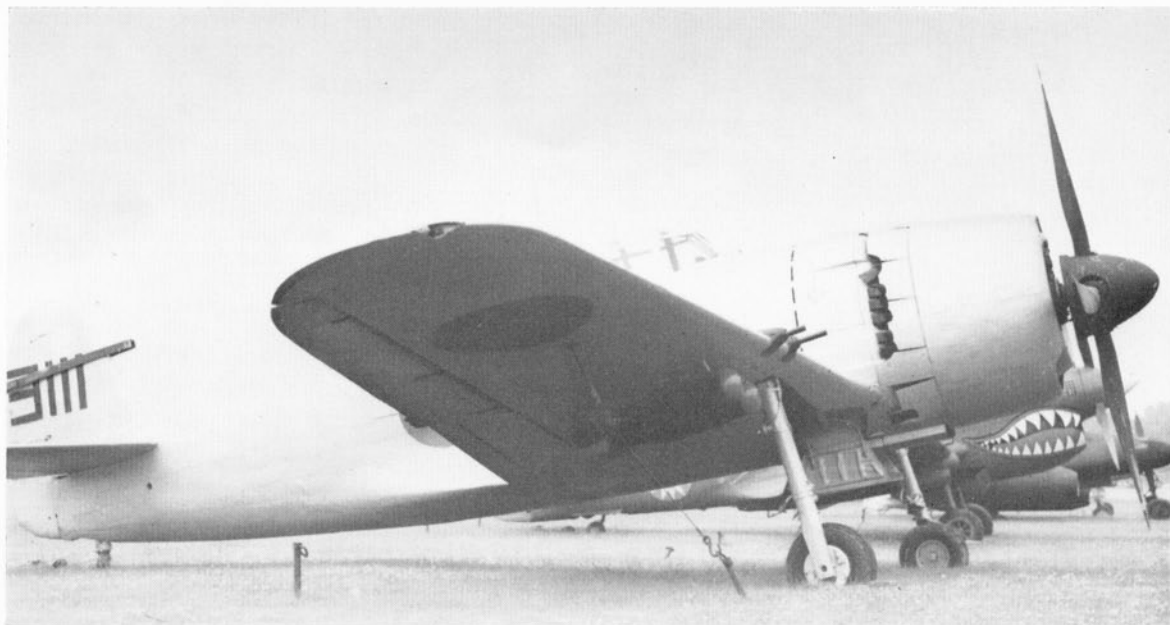
Development of the definitive of the Kawanishi series of landplane fighters, the Shiden Kai, which had been initiated in the spring of 1943 led to the first flight of a prototype on December 31, 1943. Still powered by a 1,990 hp Homare 21, the first NIK2-J had a much cleaner appearance than the NIK1-J as its wings had been removed to the lower fuselage and its engine was enclosed in a much cleaner cowling. The aircraft was also fitted with a modified undercarriage which was simpler, shorter, stronger and more reliable while construction was simplified by reducing the number of parts—excluding nuts, bolts and rivets—from 66,000 to 43,000. The armament of the NIK2-J was similar to that carried by the NIK1-Ja but the length of the aircraft was increased by 46 cm (1 ft 6½ in) by extending the rear fuselage and fitting completely revised vertical tail surfaces. Flight test results immediately vindicated the sanguine hopes of Kawanishi and the Imperial



A Shiden Kai and an Arado Ar 196 on display at NAS Willow Grove.

Navy Interceptor Fighter Shiden Kai Model 21. The Chinese characters on the fin above the number 517 read Yutani-han (Yutani Unit). (Photo: Courtesy of the National Air and Space Museum, Smithsonian Institution)



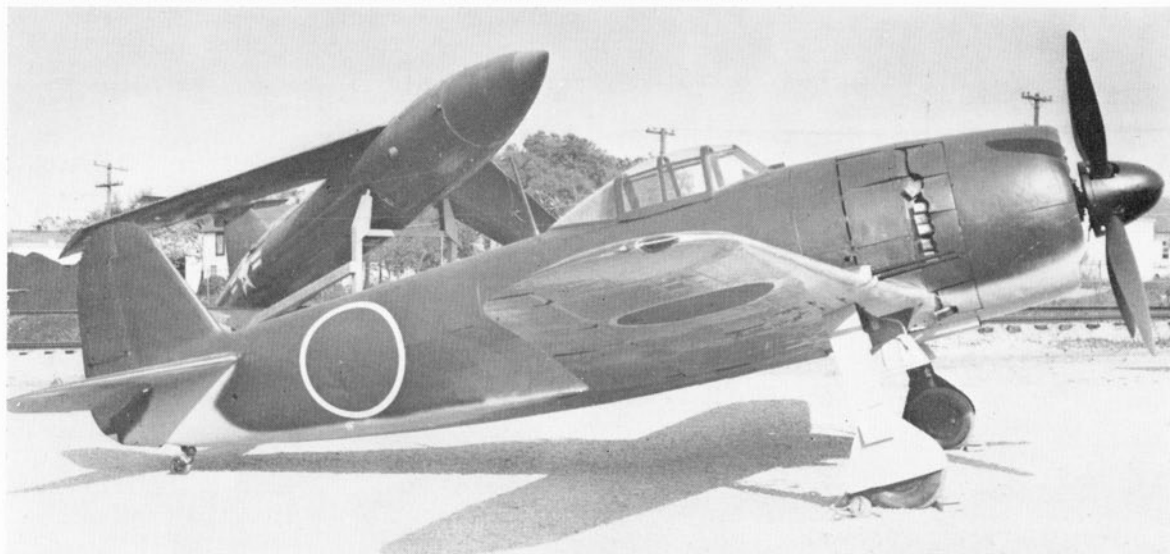


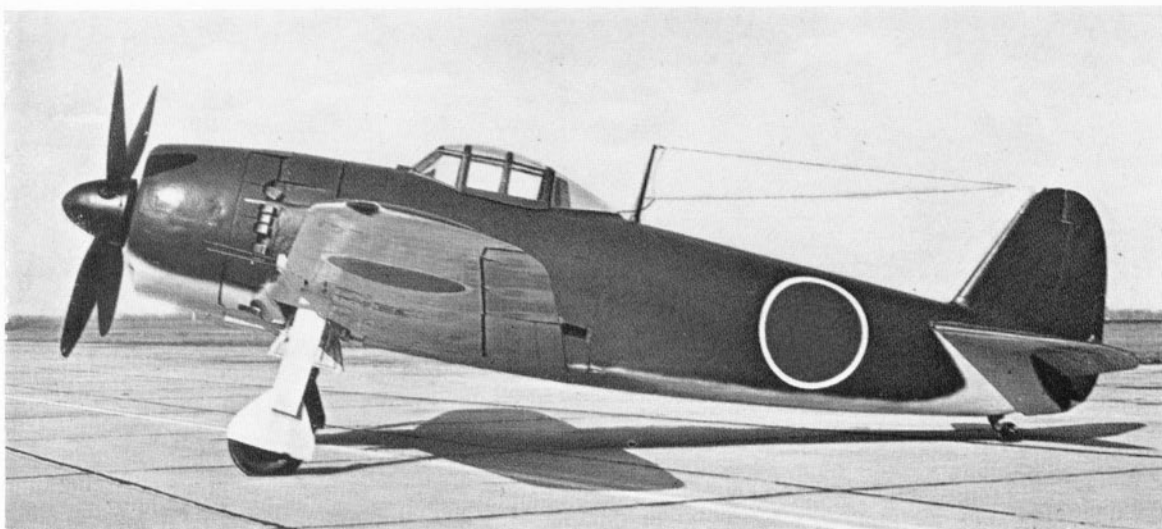
The N1K2-Ja now displayed at the Air Force Museum is seen here at NAS Willow Grove before being restored.

Japanese Navy in the Shiden Kai and pilots commented particularly favourably on the following improvements over the N1K1-J: better forward visibility on the ground, more sensitive control surfaces and more reliable undercarriage. However, in spite of improvements in the powerplant installation, the engine itself remained a source of troubles but nothing could be done by Kawanishi to correct this situation as the Nakajima Homare 21 had been adopted by both the Imperial Japanese Navy and the Imperial Japanese Army as their standard engine. From the performance standpoint, the Shiden Kai was only 6 mph faster than the Shiden and, with a top speed of 369 mph at 18,375 ft, it was slower than the similarly-powered Nakajima Ki.84-1a Hayate (Gale) of the Imperial Japanese Army which reached a maximum speed of 392 mph at 20,800 ft. Compared with the Mitsubishi

J2M3 Raiden, which was the only other interceptor fighter available to the Navy, the Shiden Kai had a nominal maximum speed advantage of 4 mph but it had a much longer range while being more manoeuvrable and having markedly superior visibility from the cockpit. Consequently, the Navy adopted the Shiden Kai as its main type of interceptor fighter and ordered the aircraft into production as the Navy Interceptor Fighter Shiden Kai Model 21 in the following factories: Kawanishi's Naruo and Himeji Works, Aichi's Ettoku plant, Mitsubishi's 7th Airframe Works at Tsurushima, Showa's Shinonoi plant and in its own arsenals at Hiro and Omura. Including the prototype and pre-production aircraft, 428 Shiden Kais were built between December 1943 and August 1945 (see accompanying table for details of deliveries by the various contractors) in the following versions:

The Air Force Museum's N1K2-Ja with a Martin TM-61 Matador in the background.



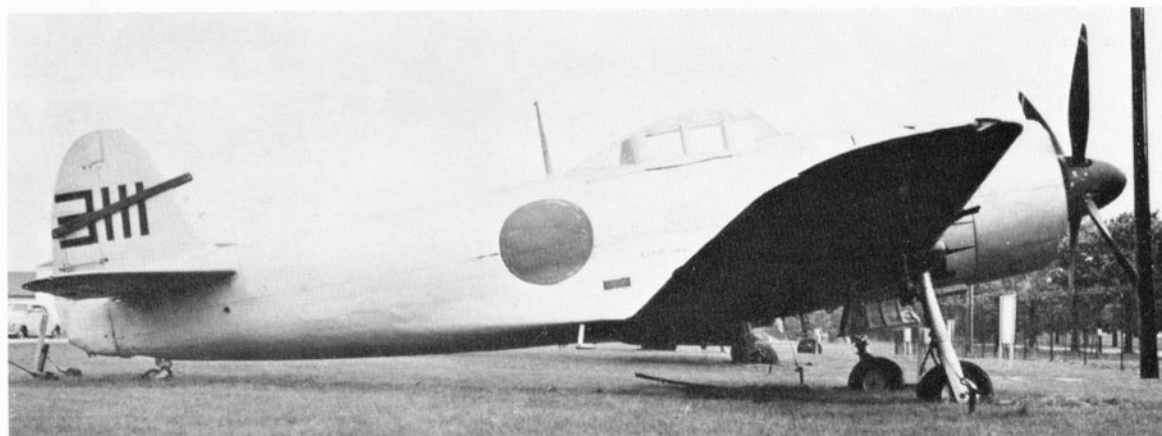


A beautifully restored Shiden Kai Model 21A which is now on display at the Air Force Museum, Wright-Patterson AFB, Ohio.



On this photograph can be seen the location of the two bomb racks beneath each wing. The ability to carry four bombs was a feature which characterized the Shiden Kai Model 21A (N1K2-Ja).

Bearing the Allied code name "George 21", the Shiden Kai was the best operational fighter aircraft of the Imperial Japanese Navy at the time of the surrender.





A Kawanishi NIK2-Ja Shiden Kai at NAS Willow Grove, Pennsylvania.

NIK2-J Shiden Model 21: Main production version differing from the prototype in minor details and in having an engine cowling similar to that used on the NIK1-J Model 11. This modification was adopted to retain the maximum degree of commonality between the Shiden and the Shiden Kai.

NIK2-Ja Shiden Kai Model 21A: Fighter-bomber variant fitted with four, instead of two, racks for 250 kg (551 lb) bombs.

NIK2-K Shiden Kai Rensen: Two-seat fighter trainer with instructor's seat behind the pilot's seat. Both cockpits were enclosed under a single elongated canopy. Engine and armament similar to those fitted on the Shiden Kai Model 21. Few built in the Naruo plant.

NIK3-J Shiden Kai 1 Model 31: Prototypes with Homare 21 engine moved forward six inches to correct a centre of gravity problem. Armament increased by the addition of two fuselage-mounted

13.2 mm Type 3 machine-guns. Two built in the Himeji plant.

NIK3-A Shiden Kai 2 Model 41: Projected carrier-based version of the NIK3-J. Not realized.

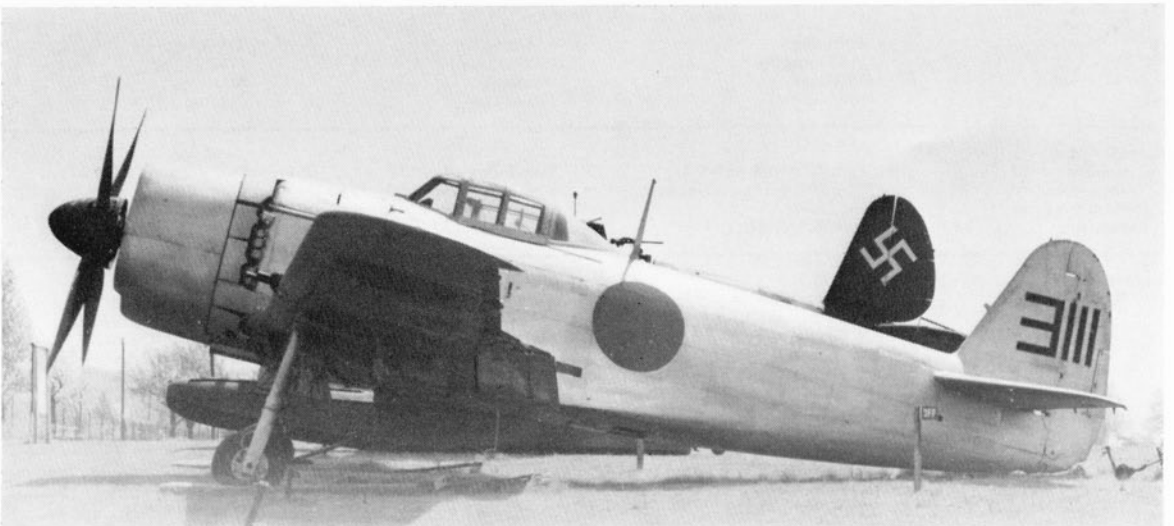
NIK4-J Shiden Kai Model 32: Similar to the NIK3-J but powered by a 2,000 hp Homare 23 (NK9H-S) with low pressure fuel-injection system. Two built in the Naruo plant.

NIK4-A Shiden Kai 4 Model 42: Carrier-based version of the NIK4-J. Retractable arrestor hook fitted beneath the rear fuselage. One prototype built at Naruo.

NIK5-J Shiden Kai 5 Model 25: Projected development of the NIK2-J powered by a 2,200 hp Mitsubishi [Ha-43] 11 (MK9A) and mounting an armament similar to that of the NIK3-J. One prototype destroyed prior to completion during an Allied bombing raid on the Naruo plant.

Finally, one more variant of the Shiden Kai was

Kawanishi Shiden Kai. Note spurious markings on the tail and wrong location of the fuselage Hinomaru which were painted in the United States.



projected to improve the aircraft's performance at high altitude and was to have been powered by a 2,000 hp Homare 44 fitted with a mechanically-driven three-speed supercharger. The end of the war came before realization of this project.

After completing the evaluation of the NIK2-J Shiden Kai, the Imperial Japanese Navy assigned this type to a new elite formation—the 343rd Kokutai—which was formed at Matsuyama on December 25, 1944 under the command of Commander Minoru Genda. This officer, who is well-known for planning the details of the attack of Pearl Harbour while serving on the staff of Adm. Isoroku Yamamoto, and who later became the first Chief of Staff of the Japanese Air Self Defense Force, was able to select experienced pilots and ground crewmen for his new command and thus became the leader of the best fighter unit of the Imperial Japanese Navy. In the process, the 343rd Kokutai became unofficially known as the "Genda Circus" and as the "Ken Butai" (Sword Unit). Assigned a major responsibility in the defence of Shikoku and Kyushu, the 343rd Kokutai operated

mainly from Matsuyama against Superfortresses, Iwo Jima-based North American P-51 Mustangs and Allied carrier-based aircraft. During these operations one of the pilots from this unit, Warrant Officer Kinsuke Muto, distinguished himself when in February 1945 he engaged single-handed twelve Hellcats. Despite the odds, Kinsuke Muto destroyed four American aircraft and forced the others to break off combat.

While the Shiden Kai gained fame in the hands of the pilots of the 343rd Kokutai, the war had taken its final turn to Japan's disadvantage. Allied advances throughout the Pacific had reduced to a trickle the flow of much needed petroleum products from the East Indies to Japan and the Daihonei (Imperial General Headquarters) had no other recourse but to impose strict limitations on flying to conserve petrol for the vital struggle which would have to be fought at the time of the anticipated Allied amphibious assault against the Japanese home islands. Thus, in the last few weeks preceding the dawn of the nuclear age, Shidens and Shiden Kais stayed mostly in their protected hangars.

SPECIFICATIONS

	KAWANISHI KYOFU	SHIDEN	SHIDEN KAI
Dimensions			
Span	12.0 m (39 ft 4 $\frac{7}{8}$ in)	12.0 m (39 ft 4 $\frac{7}{8}$ in)	12.0 m (39 ft 4 $\frac{7}{8}$ in)
Length	10.589 m (34 ft 8 $\frac{3}{4}$ in)	8.885 m (29 ft 1 $\frac{33}{64}$ in)	9.345 m (30 ft 7 $\frac{33}{64}$ in)
Height	4.75 m (15 ft 7 in)	4.06 m (13 ft 3 $\frac{33}{64}$ in)	3.96 m (12 ft 11 $\frac{33}{64}$ in)
Wing area	23.5 sq m (252.951 sq ft)	23.5 sq m (252.951 sq ft)	23.5 sq m (252.951 sq ft)
Weights			
Empty	2,752 kg (6,067 lb)	2,897 kg (6,387 lb)	2,657 kg (5,858 lb)
Loaded	3,500 kg (7,716 lb)	3,900 kg (8,598 lb)	4,000 kg (8,818 lb)
Maximum	3,712 kg (8,184 lb)	4,321 kg (9,526 lb)	4,860 kg (10,714 lb)
Wing loading	148.9 kg/sq m (30.5 lb/sq ft)	166.0 kg/sq m (34.0 lb/sq ft)	170.2 kg/sq m (34.9 lb/sq ft)
Power loading	2.3 kg/hp (5.0 lb/hp)	2.0 kg/hp (4.4 lb/hp)	2.0 kg/hp (4.4 lb/hp)
Power Plant			
Type	Mitsubishi Kasei 13	Nakajima Homare 21	Nakajima Homare 21
Take-off rating	1,460 hp	1,990 hp	1,990 hp
Fuel capacity			
Internal	660 litres (145 Imp gal)	716 litres (158 Imp gal)	716 litres (158 Imp gal)
External	160 litres (35 Imp gal)	400 litres (88 Imp gal)	400 litres (88 Imp gal)
Armament			
Nose-mounted	Two 7.7 mm Type 97	Two 7.7 mm Type 97	Two 7.7 mm Type 97
Wing-mounted	Two 20 mm Type 99 Model 1	Two 20 mm Type 99 Model 2	Four 20 mm Type 99 Model 2
Wing gondolas	—	Two 20 mm Type 99 Model 2	—
Bombs	Two 30 kg (66 lb)	Two 60 kg (132 lb)	Two 250 kg (551 lb)
Performance			
Maximum speed	264 kt at 5,700 m (304 mph at 18,700 ft)	315 kt at 5,900 m (363 mph at 19,355 ft)	321 kt at 5,600 m (369 mph at 18,375 ft)
Cruising speed	200 kt at 2,000 m (230 mph at 6,560 ft)	200 kt at 2,000 m (230 mph at 6,560 ft)	200 kt at 3,000 m (230 mph at 9,845 ft)
Climb to	5,000 m (16,405 ft)	6,000 m (19,685 ft)	6,000 m (19,685 ft)
in	5 min 32 sec	7 min 50 sec	7 min 22 sec
Service ceiling	10,560 m (34,645 ft)	12,500 m (41,010 ft)	10,760 m (35,300 ft)
Range: normal	570 naut miles (656 st miles)	773 naut miles (890 st miles)	926 naut miles (1,066 st miles)
maximum	900 naut miles (1,036 st miles)	1,374 naut miles (1,581 st miles)	1,293 naut miles (1,488 st miles)

MONTHLY DELIVERIES OF KYOFUS, SHIDENS AND SHIDEN KAIS (August 1942-August 1945)

	Kawanishi Naruo	Kawanishi Himeji	Aichi Ettoku	Mitsubishi Tsurashima	Showa Shinonoi	Hiro Arsenal	Omura Arsenal	TOTAL
Kawanishi Kyofu								
1942								
August	1	—	—	—	—	—	—	1
September	—	—	—	—	—	—	—	—
October	1	—	—	—	—	—	—	1
November	—	—	—	—	—	—	—	—
December	1	—	—	—	—	—	—	1
1943								
January	2	—	—	—	—	—	—	2
February	1	—	—	—	—	—	—	1
March	—	—	—	—	—	—	—	—
April	1	—	—	—	—	—	—	1
May	—	—	—	—	—	—	—	—
June	—	—	—	—	—	—	—	—
July	5	—	—	—	—	—	—	5
August	8	—	—	—	—	—	—	8
September	9	—	—	—	—	—	—	9
October	11	—	—	—	—	—	—	11
November	13	—	—	—	—	—	—	13
December	15	—	—	—	—	—	—	15
1944								
January	9	—	—	—	—	—	—	9
February	10	—	—	—	—	—	—	10
March	10	—	—	—	—	—	—	10
TOTAL	97	—	—	—	—	—	—	97

Kawanishi Shiden

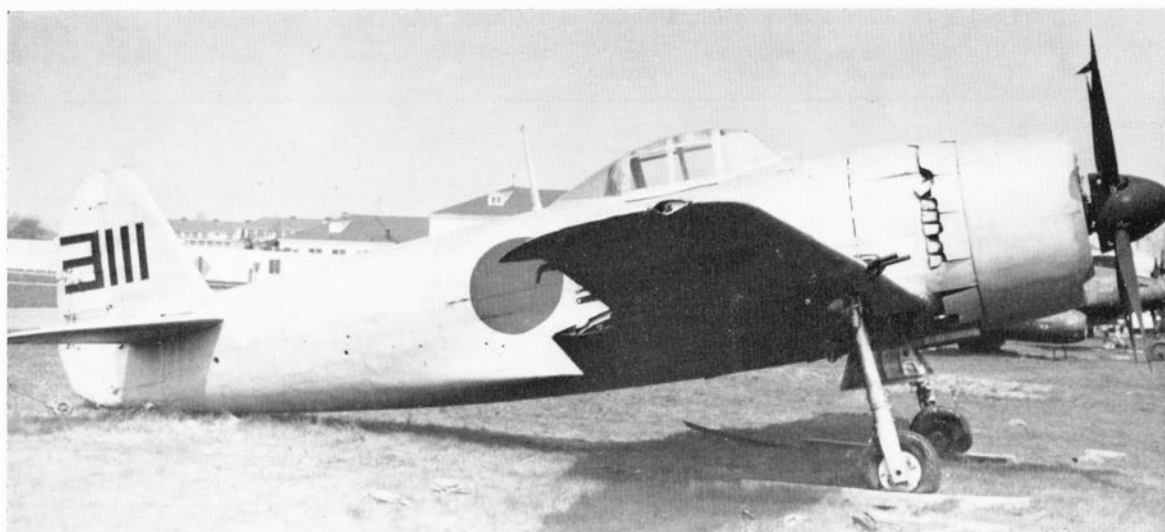
1943								
July	4	—	—	—	—	—	—	4
August	6	—	—	—	—	—	—	6
September	11	—	—	—	—	—	—	11
October	14	—	—	—	—	—	—	14
November	16	—	—	—	—	—	—	16
December	19	1	—	—	—	—	—	20
1944								
January	16	1	—	—	—	—	—	17
February	36	4	—	—	—	—	—	40
March	50	15	—	—	—	—	—	65
April	70	23	—	—	—	—	—	93
May	9	8	—	—	—	—	—	17
June	43	28	—	—	—	—	—	71
July	63	27	—	—	—	—	—	90
August	41	51	—	—	—	—	—	92
September	63	43	—	—	—	—	—	106
October	49	51	—	—	—	—	—	100
November	31	51	—	—	—	—	—	82
December	—	51	—	—	—	—	—	51

Continued overleaf

Navy Interceptor Fighter Shiden Kai Model 21A at NAS Willow Grove on April 14, 1958.

(Photo: R. Besecker)





Shiden Kai without ailerons and landing gear cover.

	Kawanishi Naruo	Kawanishi Himeji	Aichi Ettoku	Mitsubishi Tsurashima	Showa Shinonoi	Hiro Arsenal	Omura Arsenal	TOTAL
Kawanishi Shiden (continued)								
1945								
January	—	24	—	—	—	—	—	24
February	—	30	—	—	—	—	—	30
March	—	30	—	—	—	—	—	30
April	—	15	—	—	—	—	—	15
May	—	7	—	—	—	—	—	7
June	—	6	—	—	—	—	—	6
TOTAL	541	466	—	—	—	—	—	1007
Kawanishi Shiden Kai								
1943								
December	1	—	—	—	—	—	—	1
1944								
January	1	—	—	—	—	—	—	1
February	1	—	—	—	—	—	—	1
March	1	—	—	—	—	—	—	1
April	2	—	—	—	—	—	—	2
May	1	—	—	—	—	—	—	1
June	1	—	—	—	—	—	—	1
July	3	—	—	—	—	—	—	3
August	2	—	—	—	—	—	—	2
September	1	—	—	—	—	—	—	1
October	6	—	—	—	—	—	—	6
November	17	—	—	—	—	—	—	17
December	31	—	—	—	—	—	—	31
1945								
January	35	—	—	—	—	—	—	35
February	47	—	—	—	—	—	—	47
March	56	2	—	1	—	—	—	59
April	72	8	—	1	—	—	2	83
May	61	20	—	—	—	—	2	83
June	7	13	—	3	—	—	2	25
July	11	1	1	1	—	—	4	18
August	5	—	—	3	1	1	—	10
TOTAL	362	44	1	9	1	1	10	428
GRAND TOTAL	1000	510	1	9	1	1	10	1532

Series Editor: CHARLES W. CAIN