

Description of a Propeller Driven plane the Kyushu J7W Shinden

Intended Audience

The description of the Kyushu J7W Shinden, a propeller-driven plane, is intended for a general audience. It is a description of the function of the aircraft and the main parts of it, it is for informational purposes.

General Description

Definition and purpose

The Kyushu J7W Shinden is a propeller-driven prototype fighter plane for the Japanese Imperial Army in World War II. Kyushu JW7 Shinden translates to “Magnificent Lightning”. J7W stands for Land-based fighter(J), 7 for 7th design, and W for the manufacturer Watanabe. Created in 1943 with its first flight in 1945, the Kyushu JW7 Shinden was designed to intercept the B-29 four-engine propeller-driven bomber, an American fighter plane during World War II.

Overall description

The overall design of the Kyushu JW7 Shinden plane was unique to other planes produced in Japan until 1943. The design was called the “Canard configuration” design, canard is the French word for Duck, this design was first used by the Wright brothers. This design puts the engine and the wings of the aircraft in the rear of the plane. The elevator of the plane was placed on the front, nose of the aircraft. Aircraft designers use the term “canard configuration” for an aircraft with the main wings mounted to the rear of the plane while the smaller wings are mounted to the front of the plane.

The plane was 31 feet 8 inches (9.66 m) in length. The wingspan of the plane was 36 feet 5 inches (11.11 m). The Wing Area was 220 feet and 2 inches (20.5 m²). The height was 12 feet and 10 inches (3.92 m).

The ceiling of the plane is 36,360 feet (12,000 m). The total weight of the empty plane was 8,019 lb. (3,645 kg). The maximum weight of the plane at take-off was 11,663 lb. (5,288 kg). The crew capacity of the plane was one. The speed of the aircraft was 469 mph or 750 km/h. The range of the plane was 513 miles (850 km). This fighter plane was armed with four 30 mm type five cannons. It had provision for four 66 lb. bombs as well as two 132 lb. bombs.

Figure 1 shows an overview of the Kyushu J7W Shinden.



The Kyushu J7W Shinden system

Theory Process

The Kyushu J7W Shinden operates on the principle of maximum speed and armed interception of the B-29. The Canard design on the Kyushu J7W Shinden was implemented for improving two factors on the combat aircraft. Those were more aircraft control and reduced the drag when lifting off. A traditional aircraft has a 2250 lbs. lift, meaning 2250 lbs. in the front of the plane, and horizontal stabilizers that function as smaller wings to further stabilize the aircraft. These stabilizers are 250 lbs., this system is called "tail downforce". This creates a drag because most of the weight is on the lift of the aircraft and this creates a drag, in the Canard design the weight is reversed and the 250 lbs. stabilizers are placed in the front to create less drag during the lift. This successfully creates less drag, and the aircraft has a faster lift.

Operator

The Kyushu J7W Shinden is designed to be used by the Dai-Ichi Kaigun Koku Gijitsusho, translated to the First Naval Air Technical Arsenal. It is also designed to be operated by the members of the Japanese military aviation force.

List of parts

The four main parts of the aircraft, the Kyushu JW7 Shinden are the nose, the body, the main wings, and the tail. These can be divided by the exterior and the interior parts of the aircraft. Figure 2 shows the exterior of the Kyushu J7W Shinden. Figure 3 shows the interior of the Kyushu J7W Shinden.

First part

The external part of the first part of the aircraft consists of six parts on stabilizer wings at the nose of the plane. The stabilizer wings have the Leading-Edge Slat, the Mass Balance, the Slotted Flap, the Flap external Hinge, the Elevator, and the Nose Gear Door.

The interior of the horizontal stabilizer wings has six parts. They are four Machine Guns, the Fore Plane Incidence, the Machine Guns Access Panel, the Armour Glass, the Gun Camera, and the ammunition bay access.

Description and Purpose

The Horizontal stabilizer wings are 5.5', in length. Their function is to stop the up-down movement of the aircraft, known as pitch, and to reduce the drag, or the air resistance, during lift-off. This is achieved with their smaller length and reduced weight on the build of them. The Leading-Edge Slats on the stabilizer wings are used to add force during take-off and landing, it increases the lift. The Mass Balance is placed on the horizontal stabilizer wings to reduce the oscillation or the swaying of the wings. The slotted flap and the flap's external hinge function as deflectors of force during take-off and landing. The flaps and hinges also function to change the shape of the wing during take-off and landing depending on the forces required. The elevator also functions to deflect force but with up and down motions. The nose gear door is a retractable undercarriage for the wheels and gear to fold up into to resist drag during the lift.

The internal part of the nose of the Kyushu J7W Shinden was the combat part of the aircraft, it included all the weaponry for the plane. The function of the four 30mm Machine Guns is for defending against opposition, and to fully function with an unmanned aerial system. Fore Plane Incidence is 1' 00' degree, this angle is connected to the fuselage in this direction for minimal drag. The 70mm Armour Glass was designed to be shatter-proof, not bulletproof. This was done to maintain a lightweight to perform at top speed. The Gun Camera was used to keep track of the enemy, to record, and create tactical strategies. Lastly, the ammunition bay access was a compartment for holding ammunition, or bombs, this was also called the bomb bay.

Second part

Further down the plane, the external body consists of four parts. The fuel tank access panel, the engine cooling air intake duct, the fuel tank drain, and the fuselage fuel tank access panel.

The interior of the body of the aircraft has four parts. The parts are the cowl flap, the supercharger air intake, the oil tank filler cap, and the engine access door.

Description and Purpose

The body of the aircraft in the canard design holds the engine and the nose and the rear of the aircraft together, it is also called the fuselage. The body of the plane includes the engine and the fuel, there are access panels for inspections and repairs in the body of the plane. On the exterior of the body, the fuel tank access panel is a removable aircraft skin to give access to the interior of the plane, and the engine.

The engine cooling air intake duct primarily functions to provide stable air pressure to the engine and for overall flight conditions. The fuel tank drain is used to drain any water in the aircraft system and the fuel lines of the aircraft. The fuselage fuel tank access panel allows for access and inspection of the fuel lines and the fuel tank.

On the interior, the cowl flaps are small doors of the engine that function to increase the cool airflow through the cowling to the engine. The supercharger air intake serves to produce more power in the engine. The oil tank filler cap is a gravity-safe lock for the aircraft's fuel tank, it is opened to refuel the aircraft, then sealed. The engine access door is another panel that allows for inspection and access to the engine.

Third part

The third part of the aircraft is the main wings of the aircraft. The main wings have internal and external parts. The external parts of the main wings are the pitot tube, the fuel drain, the methanol drain, the bomb racks, the navigation light, the split flaps, the tail wheel, the trim tab, and the All-metal aileron.

The interior of the main wings is composed of the formation light, the methanol tank filler cap, the sweep back angle, the main spar, the rudder balance weight, and the rudder control rod.

Description and Purpose

On the exterior of the plane, the pitot tube is a small tube that measures the flow speed and air pressure. The fuel drain on the wings also functions to remove water and other contaminants in the fuel tank. The methanol drain serves to maintain the flow of methanol and ensure it doesn't flow into other systems. The 30kg to 60kg bomb racks are designed to carry and release weapons of 30kg or 60kg. The navigation light serves to provide information on the position, integration, and status of the aircraft. The all-metal aileron is under the control of the pilot, who can roll the aircraft longitudinally. The tail wheel controls the up-down, and the side-to-side movements of the plane, and stabilizes it. The split flaps produce more lift. The trim tabs are also controlled by the pilot, they serve to further stabilize, it controls the air pressure or hydro pressure to control the speed of the aircraft.

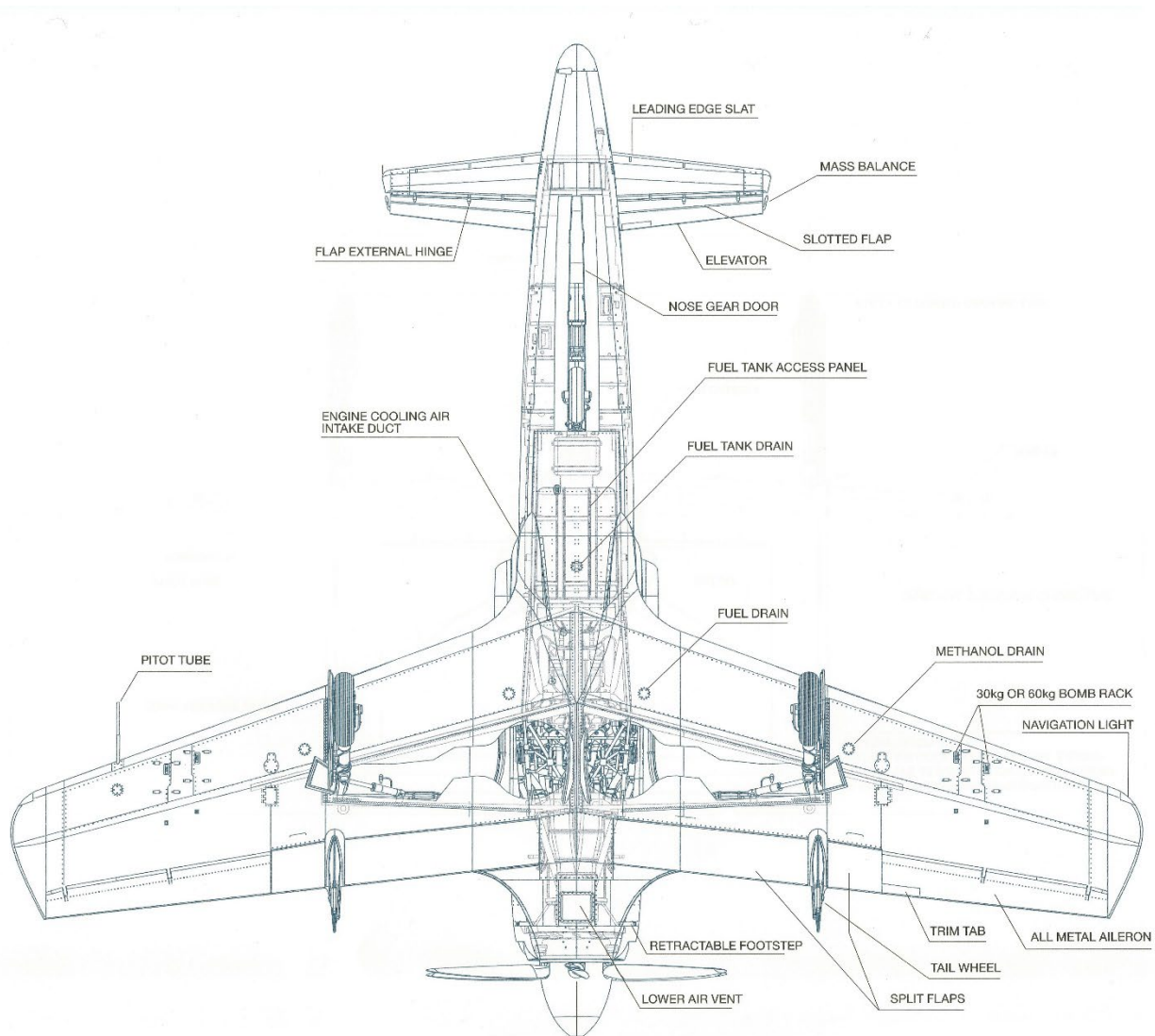
The formation light on the interior of the plane allows the planes to fly close to each other in the dark, this is called fingertip formation. The methanol tank filler cap is used to lock the tank, and it is opened to refuel it. The sweep-back angle allows for reduced drag and super speed. The main spar is 31', this is the span of the main wings. It carries a load of wings. The rudder weight balance is used as a counterweight to balance the positioning of the plane. Lastly, the rudder control rod controls the vertical movement of the aircraft, this is called yaw.

Fourth part

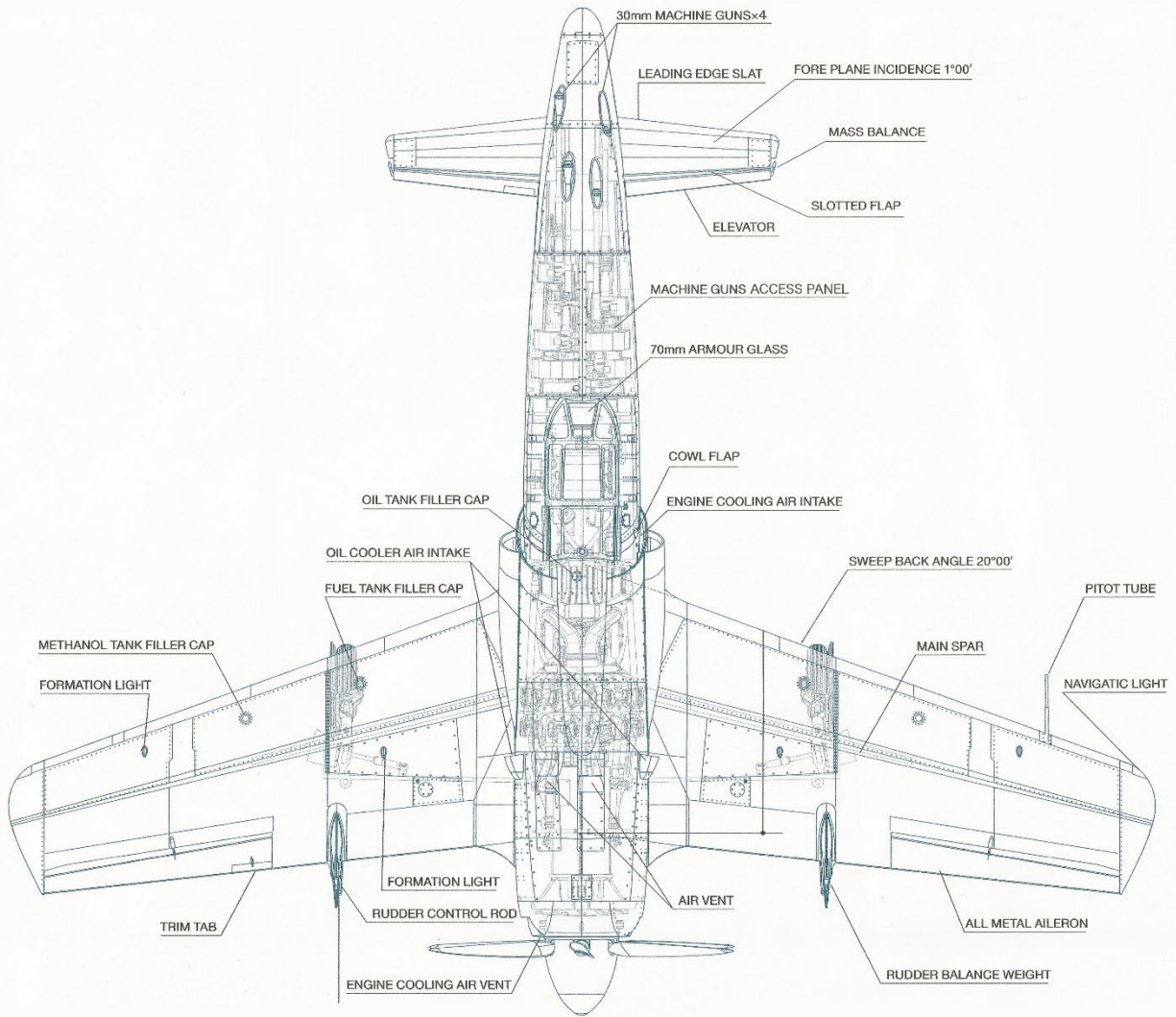
The fourth part of the Kyushu J7W Shinden is the tail. The tail has three parts on the exterior of it. They are the retractable footsteps and the lower air vent. The interior of the tail has one part, the engine cooling air vent.

Description and Purpose

The retractable footsteps on the exterior function to increase speed and reduce drag because the landing gear is retractable. The lower air vents serve for cooling purposes to the interior of the plane. Lastly, the propeller serves to push the aircraft forward through the air. The propeller has a constant speed of 3400 VDM and an HA-43 type 42 18-cylinder radial air-cooled propulsion. The lift-off output is 2,030HP.



External Overview



Internal Overview

Concluding Discussion

Assessment- Availability, Advantages, Disadvantages, Optional uses, and equipment

The Kyushu J7W Shinden was one of only two of its kind to be manufactured. Although it was issued for large-scale manufacture, the atomic bombs were dropped, and the war was already over. This aircraft is one of the top fifteen fastest propeller-driven fighter planes, ranking number three. This was designed to intercept the B-29, a plane that was nearly impossible to intercept during the war. The Kyushu J7W Shinden also has significantly less drag than traditional combat aircraft due to its canard design. However, the design makes the aircraft more vulnerable to stalls and causes instability during harsh wind conditions. The wings and the tail of the aircraft will dip downwards making recovery unrecoverable and unstable. The Kyushu J7W Shinden can hold up to four 66 lbs. bombs or two 132 lbs. bombs, in addition to four preinstalled type-five cannons.

WORK CITED

<https://www.aiaa.org/about/History-and-Heritage/History-Timeline>

<https://www.hotcars.com/the-15-fastest-propeller-driven-airplanes-of-all-time/>

<https://www.google.com/search?q=kyushu+j7w&sxsrf=AOaemvJ8ovpW9nb7Q2K5SAcgQn-OPx3fUg:1631036651822&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiR9fyBte3yAhVEn->

[AKHbY7CdMQ_AUoAnoECAEQBA#imgsrc=JMIBS9Mpjzt4mM](https://www.google.com/search?q=kyushu+j7w&sxsrf=AOaemvJ8ovpW9nb7Q2K5SAcgQn-OPx3fUg:1631036651822&source=lnms&tbm=isch&sa=X&ved=2ahUKEwiR9fyBte3yAhVEn-AKHbY7CdMQ_AUoAnoECAEQBA#imgsrc=JMIBS9Mpjzt4mM)

<https://tanks45.tripod.com/Jets45/Histories/Shinden/Shinden.htm>

https://world-war-2.wikia.org/wiki/Kyushu_J7W_Shinden

https://www.militaryfactory.com/aircraft/detail.php?aircraft_id=770

https://airandspace.si.edu/collection-objects/kyushu-j7w1-shinden-magnificent-lightning/nasm_A19600333000

<http://www.combinedfleet.com/ijna/j7w.htm>

https://nineteenforty.fandom.com/wiki/Kyushu_J7W_Shinden

[https://en.wikipedia.org/wiki/Canard_\(aeronautics\)](https://en.wikipedia.org/wiki/Canard_(aeronautics))

<https://www.youtube.com/watch?v=6UTv70mEhOo>

https://twitter.com/ace_combat_fan/status/1127321051413733377

<https://www.boldmethod.com/learn-to-fly/aircraft-systems/canards/>

<https://www.grc.nasa.gov/www/k-12/airplane/airplane.html>