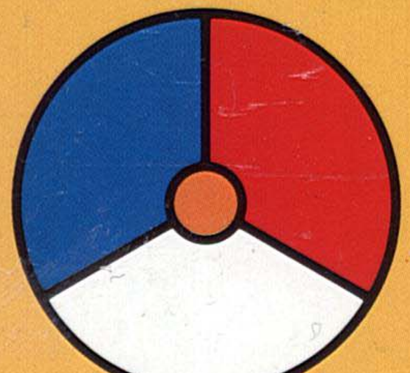
INTERNATIONAL SQUADRON

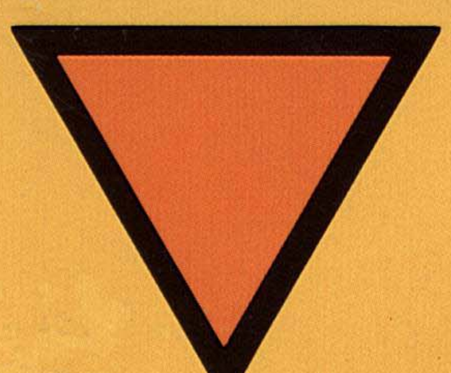
MONOGRAPH NO. 1

Fokker

D-XXI

Dutch & Danish Service





Written and Illustrated by
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PHALANX

Fokker

D·XXI

Volume 1
Dutch & Danish Aircraft

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PHALANX
Publishing Co., Ltd.
1051 Marie Avenue
St. Paul, MN 55118 U.S.A.
612/454-0607

ISBN: 1-883809-05-3

Text and Illustrations by: Warren Eberspacher

Published by:

Phalanx Publishing Co., Ltd.
1051 Marie Avenue West
St. Paul, MN 55118-4131 USA

Printed and bound in Hong Kong

Fokker D-XXI

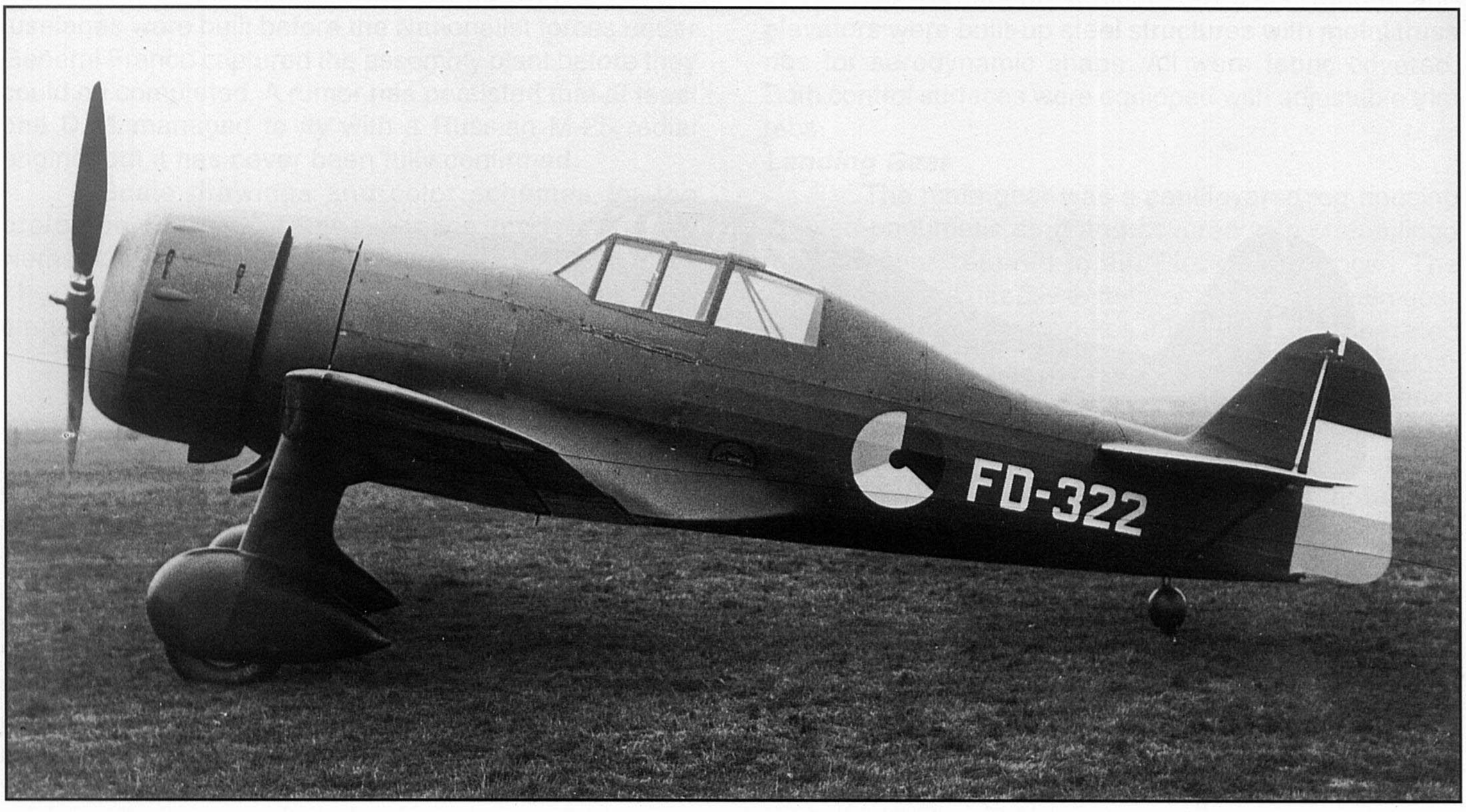
Design Genealogy

Anthony Fokker and Fokker Aircraft solidly made their name known during WWI in the hands of the German Air Force. If an Allied pilot ran up against a Fokker DR.1 triplane, D.VII biplane, or D.VIII parasol, he knew he had his hands full with an average pilot, and probably a fight for his life if the Fokker was piloted by an experienced veteran. Fokker was automatically equated to top quality fighter design. The Fokker D-XXI (D.21) covered in this monograph is the 21st fighter design in that proud lineage.

Aside from the better known Fokker Universal and Trimotor transports, Fokker did little in creative fighter aircraft design between the wars. As war clouds once again began building on the horizon, Fokker Aircraft presented a new fighter design to the Netherlands Army Air Division - Luchtvaartafdeling or LVA for short. It was November 1934 and company founder Anthony Fokker had died at age 49, leaving the design team to be headed by Dr. Ir. E. Schatzki. Early in 1935, LVA contracted one prototype for evaluation and possible service use out in the Pacific in the Netherlands East Indies.

The D.21 was one of the transitional designs seen around the world at this time as designers and air forces shifted to the new monoplane configuration to replace the old drag producing biplanes. The D.21 was also a compromise design - a new monoplane with fixed gear using the older steel tube, wood, and fabric structure rather than making the full transition to the new all-metal monocoque structures, let alone retractable gear. Fokker was well versed in their old technology and chose not to go the the expense of the extensive jigs and tooling required by the new monocoque structures at this time. It is said that they hoped to provide an adequate fighter for European air arms making the transition to monoplanes and thereby stimulate sales to their traditional customers in Scandinavia and Finland. Emphasis was therefore placed on adequate performance, low purchase cost, the ability to operate under primitive conditions, and ease of maintenance in the field. As we shall see in Volume II, the Finns exploited all of these design factors.

At the same time, other nations were introducing all-metal monocoque fighters like the PZL P.11c in Poland, the Loire 45/46 and Dewointine D.500/510 in France, Mitsubishi A5M Claude and Nakajima Ki.27 Nate in Japan, and Curtiss Hawk 75, P-36, and Seversky P-



Fokker D.21 Prototype FD-322 (Fokker Aircraft)

35 in the U.S., to name a few. By the time the D.21 reached production, it was competing with early model Spitfires, Hurricanes, P-40s, Zeros, Messerschmitt 109s, MIG-3s, LAGG-3s, Polikarpov I-16s, and Fiat G-50s, to name a few.

Accepting that the D.21 was a transitional design, Schatzki's team had the foresight to design the airframe so it could exploit the power of just about any liquid or air cooled engine in the 600-1100 HP range. While some sources say the D.21 was originally designed in close liaison with Rolls Royce Ltd. to use the liquid cooled Kestrel IV engine, Fokker factory material also shows a number of other configurations that were investigated besides the one finally selected:

* A Gnome-Rhone 14 radial powered design with full vision canopy and wheel pants similar to our old Northrop attack aircraft or the Seversky BT-8.

* A Hispano-Suiza 12 Vcrs inline design with the D.21 gear and a nicely faired in radiator placed below the center section.

* A Wright Cyclone G-3 radial version that looked like the final D.21.

* A Hispano-Suiza inline version with retractable gear.

* A Bristol Hercules radial version with retractable gear.

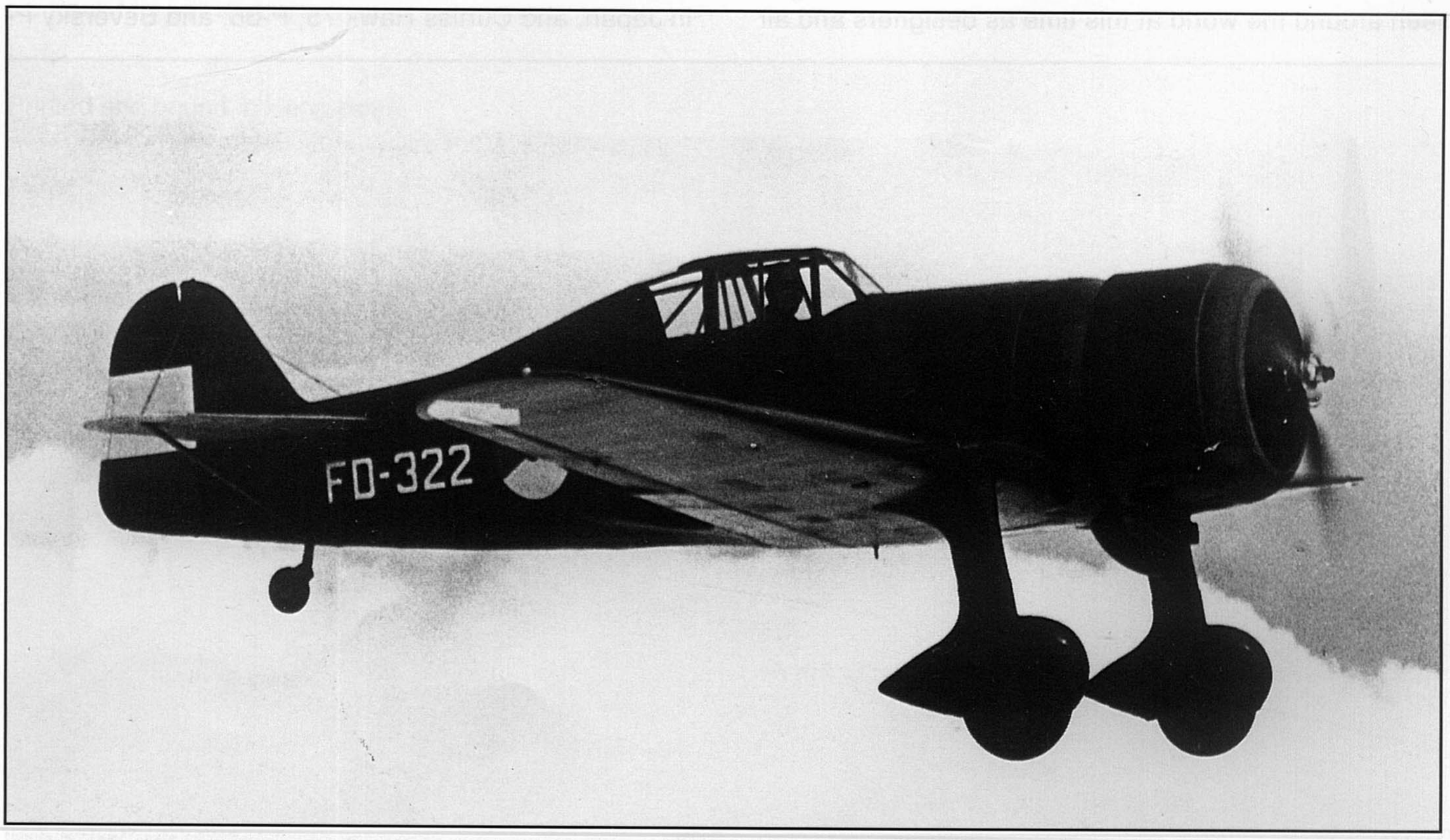
* A Rolls Royce Merlin inline version with retractable gear.

Schatzki's team finally settled on the fixed gear configuration powered with a 645 HP Bristol Mercury VI-S radial air cooled engine. Specs and projected performance were as follows:

Span	36'0" (11m)
Length	25'11" (7.915m)
Height	9'10" (3 m)
Wing Area	174 ft.^{2} (16.2 m^2)
V max	245.5 mph (345 km/hr)
V cruise	207 mph (333 km/hr)
Service Ceiling	29,502 ft (9,000 m)
Absolute Ceiling	30,830 ft (9,400 m)
Empty Weight	2,695 lbs (1225 kg)
Loaded Weight	3,800 lbs (1750 kg)
Range	560 mi (900 km)
Armament	(2) 7.9 mm MG in cowl and (2) 7.9 mm MG in wings

The prototype was coded FD-322 and flew for the first time on 27 March 1936 at Welschap airfield near Eindhoven with Fokker's Czech test pilot Emil Meinecke at the controls. Meinecke came back elated with the excellent handling characteristics and felt that the D.21 met or exceeded all the design specifications.

At almost the same time, the Royal Netherlands Indies Army (Kominklijk Nederlands Indisch Leger, or KNIL for short) decided that small quantities of single seat fighters spread out over the vast area of the Dutch East Indies would offer no effective defense and that the emphasis should therefore be placed on attack as



Prototype FD-322 in flight (Fokker Aircraft)

the best form of defense. This almost killed the D.21 project and development. However, during 1937, the Netherlands Government saw the world situation deteriorating and voted funds to expand the LVA. This led to an order of 36 D.21 fighters to be powered by either the Bristol Mercury VII or VIII radial engines. The 36th D.21 was delivered on 8 September 1939, one week after Germany invaded Poland.

With the advantage of 20-20 hindsight and the very effective use made of the D.21 in the hands of both Dutch and Finnish pilots, it is speculated that the D.21 would have been a serious opponent for Japanese Zeros and Oscars out in the Dutch East Indies had they been present in any quantity.

The Dutch decision to produce the D.21, in turn, stimulated other orders:

*Finland purchased 7 aircraft powered with the Bristol Mercury VIII engine and were coded FR-76 to FR-82. They also purchased the rights to manufacture the D.21 at the State Aircraft Factory at Tampere and 93 aircraft were eventually built between 1939 and 1944. All these aircraft will be covered in Volume II.

*Denmark purchased 2 pattern aircraft powered by the Bristol Mercury VI-S engine and purchased the right to build aircraft at their Royal Army Aircraft Factory at Copenhagen. Ten aircraft were eventually built with the Bristol Mercury VIII engine before Denmark was overrun, and eight of these aircraft were serving with No. 2 Eskadrille of the Danish Aviation Troops when Germany occupied Denmark the second week of April 1940.

*The Spanish Republican Government purchased the manufacturing rights and about 50 fuselages were built before the Nationalist forces under General Franco captured the assembly plant before they could be completed. A rumor has persisted that at least one D.21 managed to fly with a Russian M-25 radial engine, but it has never been fully confirmed.

Scale drawings and color schemes for the prototype FD-322 and the service models for the Netherlands and Denmark are covered in this volume. The scale drawings and color schemes for all Finnish aircraft are covered in Volume II.

BASIC CONSTRUCTION

The D.21 was a straight forward conventional design using combinations of well proven technology and materials.

Fuselage

The internal fuselage frame was chrome molybdenum steel tubing shaped out with bulkhead "rings" and aluminum paneling up front, and bulkhead "rings" and longitudinal stringers covered with fabric aft of the cockpit area. The cylindrical fuel tank was mounted between the firewall and cockpit in typical fashion of the time.

The cockpit canopy was a built-up framework with plexiglas panels. The windscreen was not bulletproof. The canopy did not slide. Cockpit entry was from the left side where the canopy hinged downward from where it split top center above the pilot's head. The whole canopy assembly aft of the windscreen could be jettisoned in emergencies. The cockpit area was braced with a turnover pylon just aft of the seat to protect the pilot in case the aircraft flipped onto its back.

Wing

The one-piece wing was built with two box spars that tapered toward the tip in both planform and spar height. Plywood ribs provided the aerodynamic shape and longitudinal stringers were run between the ribs to further strengthen the system into a tight structural grid when the surface skin was bonded in place. The whole wing was skinned with an impregnated bakelite-type plywood that was tacked and bonded to the ribs, providing a clean, smooth aerodynamic surface and strong "D" section forward of the front spar. For those not familiar with bakelite, about the closest approximation today would be Masonite sheeting with its smooth surface.

Ailerons were built-up steel structures and fabric covered. While ailerons had trim tabs built in, they were only ground adjustable and could not be re-trimmed in flight. Plain split flaps were interconnected, hydraulically operated, spanned from aileron to aileron, and were either "up" or "down" like the Spitfire with no intermediate settings. Metal fairings covered the leading edge around the gear and gun barrel openings.

Tail Assembly

Horizontal and vertical stabilizers, rudder, and elevators were built-up steel structures with metal truss ribs for aerodynamic shape. All were fabric covered. Both control surfaces were equipped with adjustable trim tabs.

Landing Gear

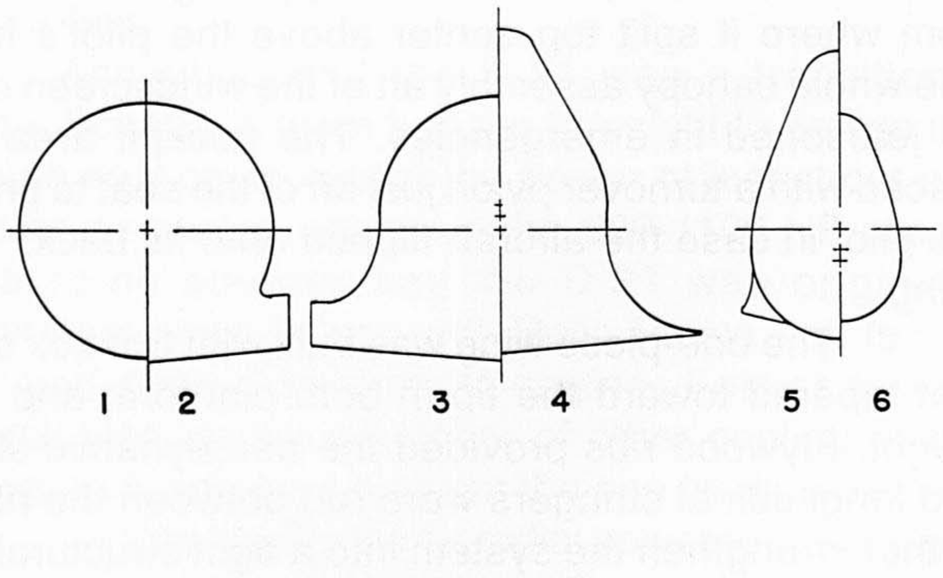
The main gear was a cantilevered leg housing an oleo-pneumatic strut and covered with streamlined metal fairings referred to as "Elecktron fairings". The gear unit bolted directly to the front spar. The main gear had compressed air brakes that could be operated together or differentially in conjunction with the rudder and tailwheel steering for ground control. The tailwheel, while coupled into the rudder control system, could be disengaged for full swivel turnarounds and other tight ground maneuvers. It was locked on center for takeoff, flight, and landing.

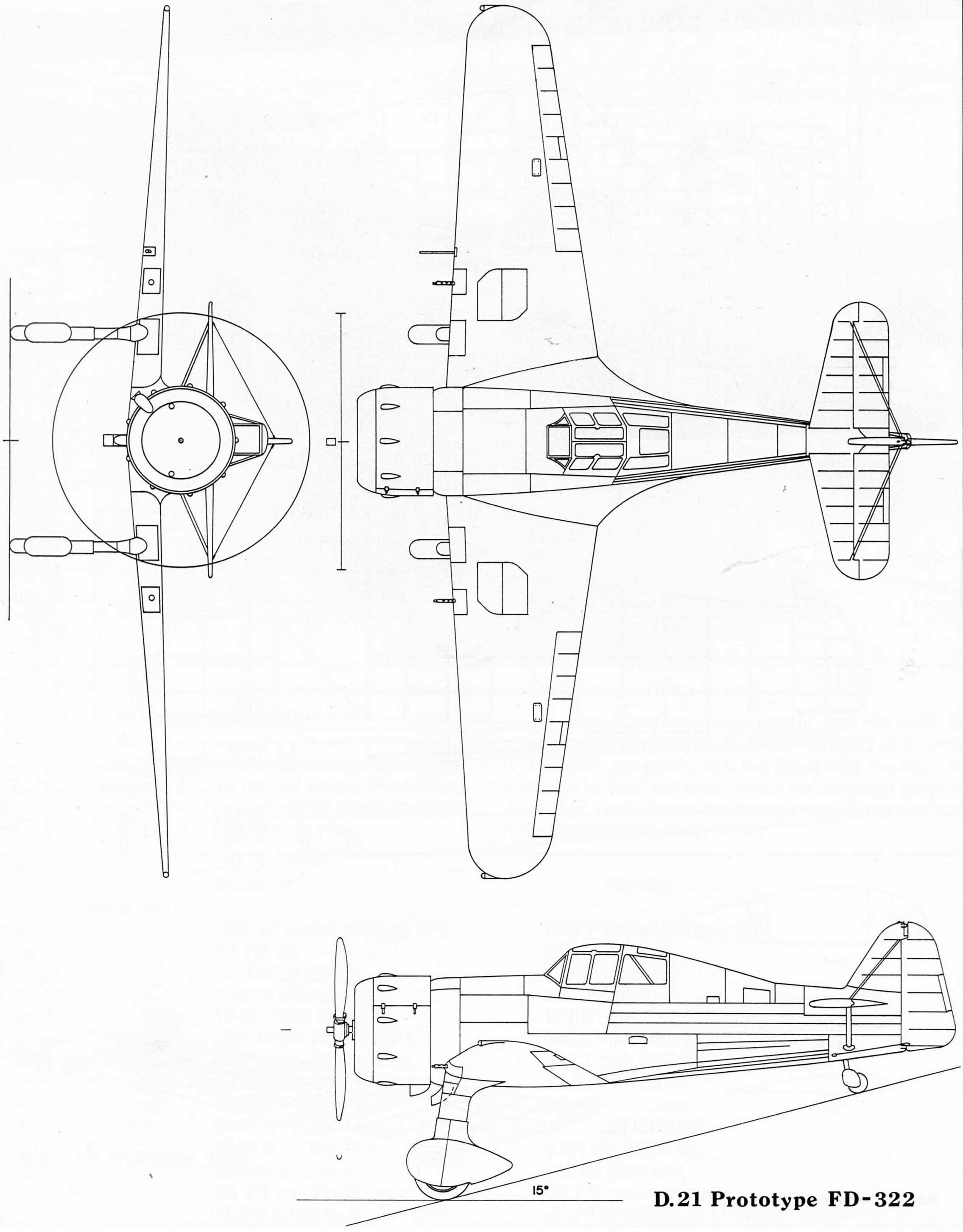
Pre-War Production

Pre-war production runs were as follows:

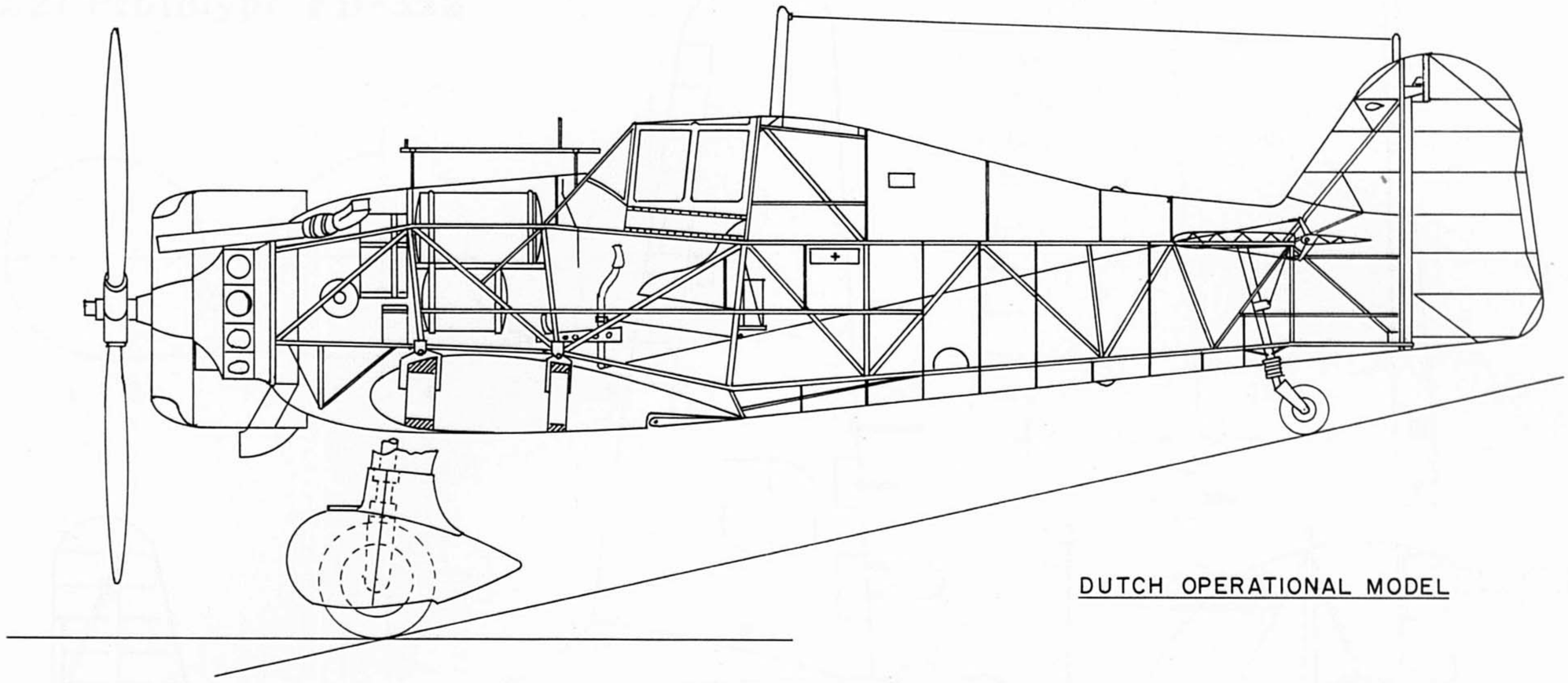
Netherlands:	FD-322 prototype (1)
	Nos. 212-247 (36)
Denmark:	J-41 and J-42 pattern aircraft (2)
	J-43 through J-52 (10)
Finland:	FR-76 through FR-82 (7)

D.21 Prototype FD-322

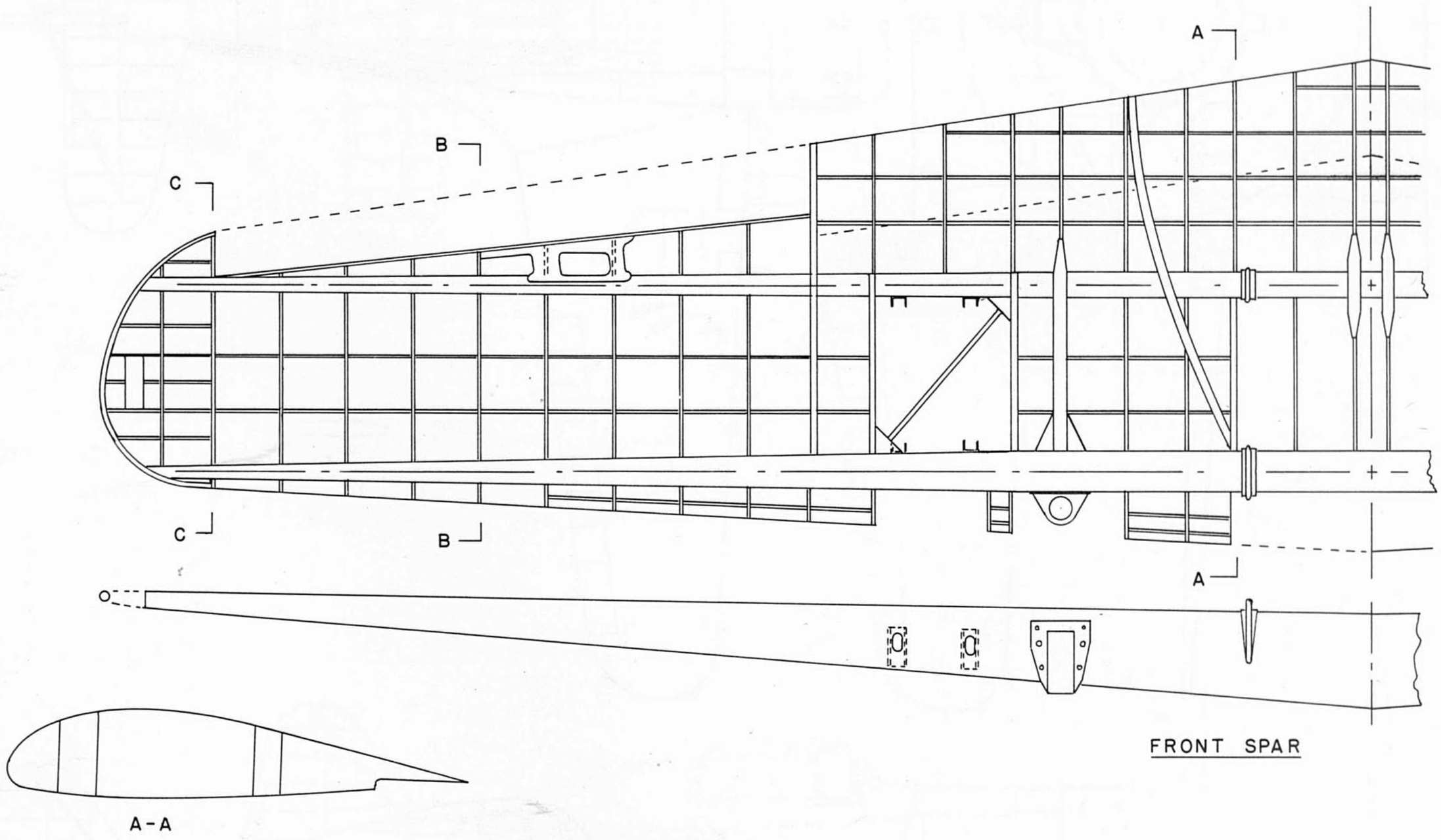




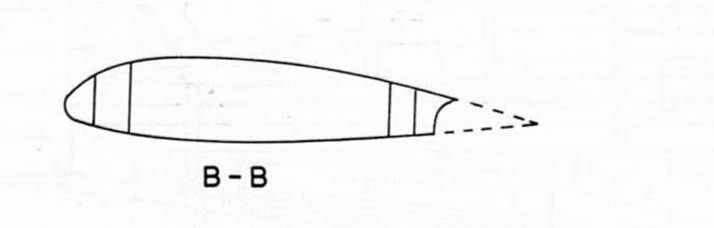
D.21 Prototype FD-322

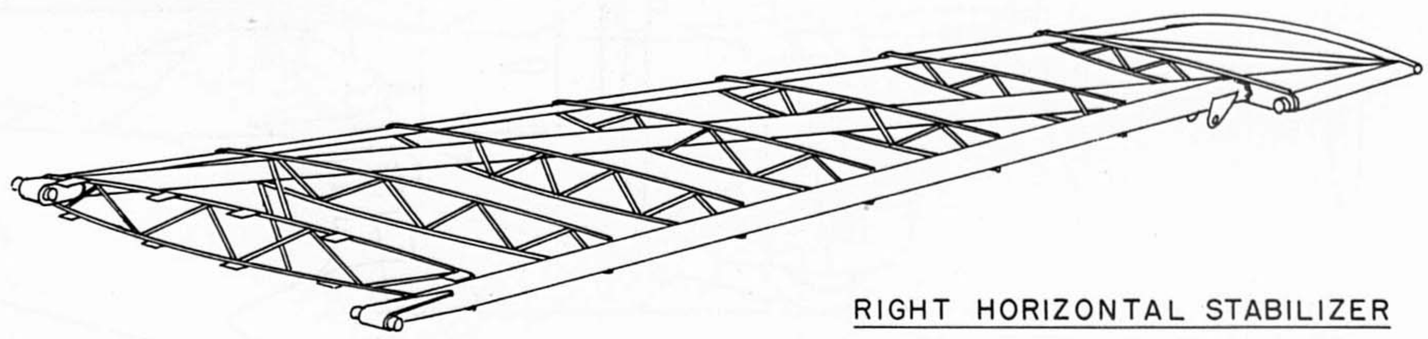


DUTCH OPERATIONAL MODEL



FRONT SPAR





RIGHT HORIZONTAL STABILIZER

Basic Construction

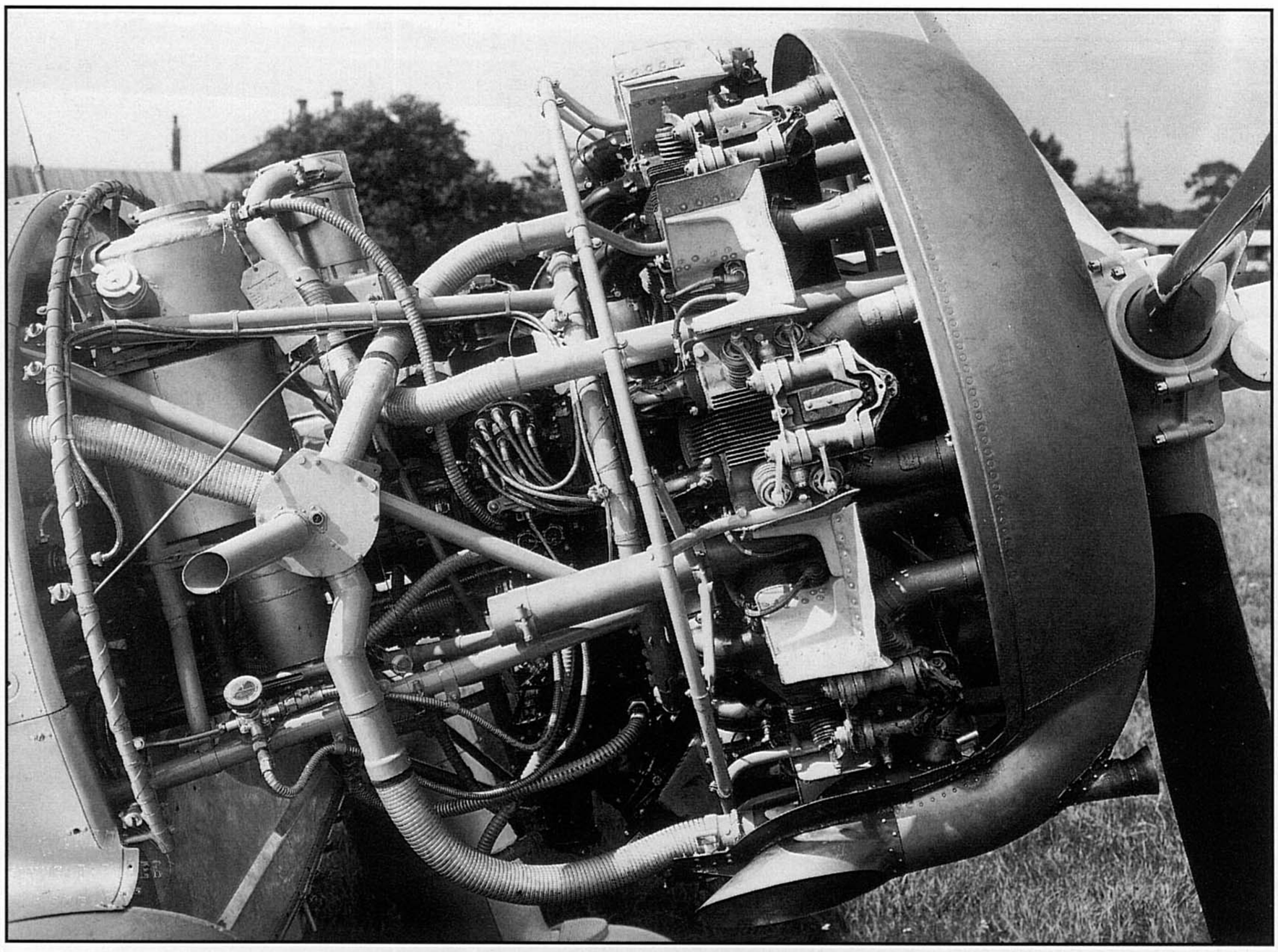
First Production Dutch Aircraft in Pre-October 1939 markings. (Fokker Aircraft)

PERFORMANCE

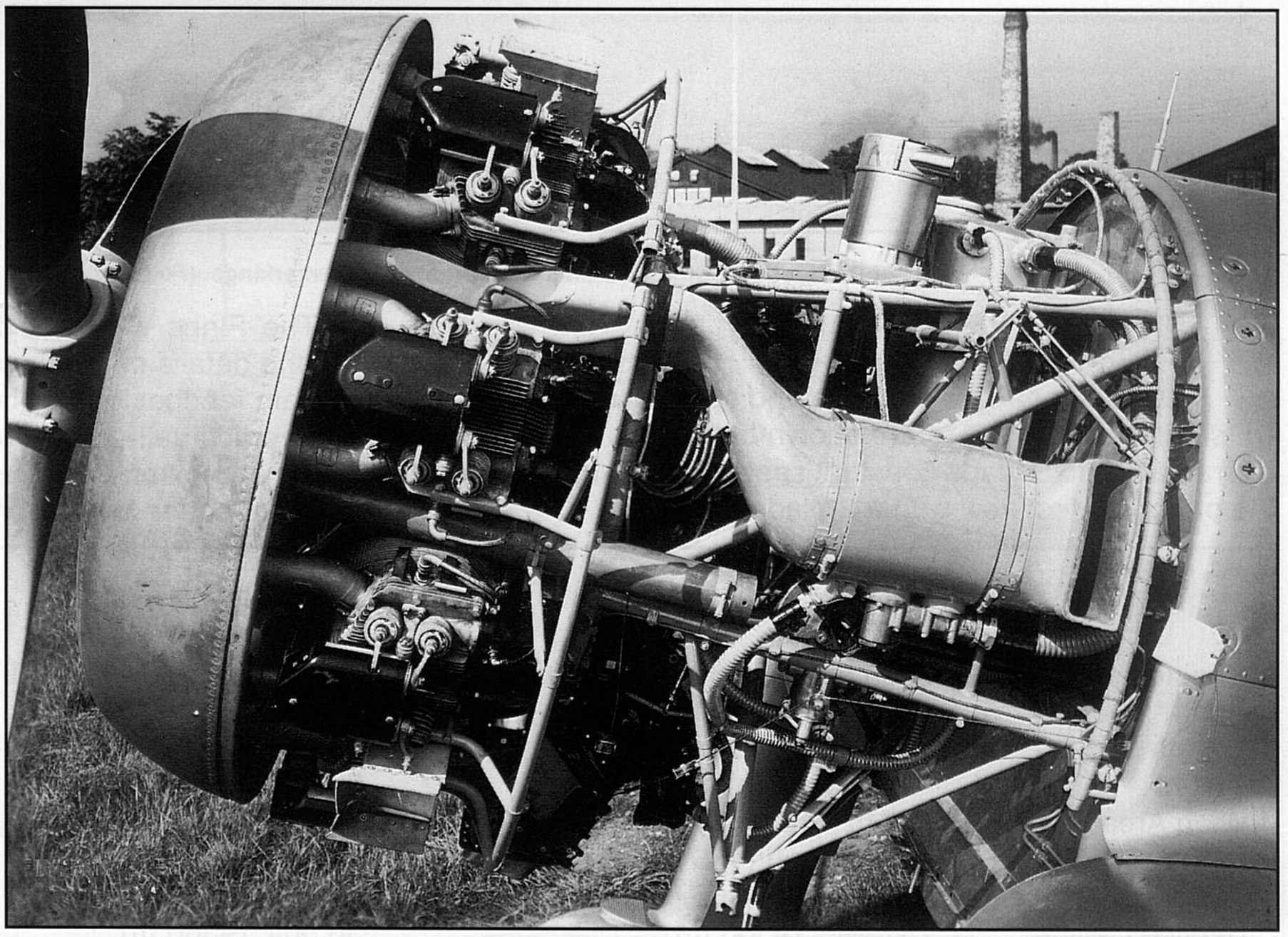
Operational performance and specs quoted for Dutch and Danish D.21s are shown below. Production aircraft all used 3-blade constant speed props whereas the prototype first flew with a 2-blade prop.

The Finns were the first to use the D.21 in combat, the details of which will be covered in Volume II. The main feedback from the Finns was the need to increase vertical tail area, move the fuselage guns to the wings, and extend the transparent cockpit panels further aft for better rear vision.

	Dutch	Danish
Engine	760 HP Bristol Mercury VIII	760HPBristol Mercury VIII
Span	36' (11 m)	36' (11 m)
Length	27' 1/2" (8.25 m)	26' 11" (8.21 m)
Height	9' 8" (2.92 m)	9' 8" (2.92 m)
Wing Area	174ft^2 (16.2 m^2)	174 ft ^{2} (16.2 m^2)
V max	270.3 mph (435 km/hr.)	285.9 mph (460 km/hr.)
V Cruise	226.8 mph (365 km/hr.)	223.7 mph (360 km/hr.)
Service Ceiling	31,160' (9500 m)	30,504' (9300 m)
Absolute Ceiling	31,820' (9700 m)	31,160' (9500 m)
Empty Weight	3190 lbs (1450 kg)	3520 lbs (1600 kg)
Loaded Weight	4510 lbs (2050 kg)	5060 lbs (2300 kg)
Range	590 mi (950 km)	497 mi (800 km)
Armament	(4) 7.9 mm FN-Browing M-36 MG in wings with 300 RPG	(2) 7.9 mm cowl guns (2) 20 mm Madsen cannonin pods under wing



The Bristol Mercury installation on the D.21 from either side. (Lennert Ege)



Letters from two Dutch D.21 combat pilots had the following observations:

H. J. van Overvest

Mr. van Overvest used the D.21 well. He destroyed a Bf-109 and damaged another (May 1940), destroyed a Heinkel He.111 bomber (19 November 1939 prior to the war while defending Holland's neutral airspace), damaged a Junkers Ju.88 bomber, and damaged a twin engine Dornier flying boat.

Mr. van Overvest remembers the D.21 as a difficult aircraft to fly because it stalled "viciously" and you had to bring it in at around 150-160 km/hr. (93.2-99.4 mph); 175 km/hr. (109.2 mph) was considered safer for full control.

The flaps were the "all or nothing" type and were effective. The tailwheel had to be locked for takeoff and landing because the airplane had a "nasty" tendency to ground loop.

Forward view was practically nil because of the large Mercury engine up front. He had his gun bay covers come off twice during dives and that increased the safe landing speed to about 200 km/hr. (124.3 mph) which he felt was excessive on the small grass fields that they operated from.

Flick rolls were "simply marvelous", single or double, and even triple. Slow rolls were considered easy because of the good aileron control. He said they did slow rolls from ground level upwards twice in succession.

The Fokker was rugged and could withstand 12-14g. He did several perpendicular dives from 5,000 meters to 1,000 meters (16,400' down to 3,280'). Below 1,000 meters one could hardly recover as the speed built up to over 700 km/hr. (435 mph). They liked to end their dives at at least 100 meters (328').

Mr. van Overvest had about 600 hours in the D.21 and had about 35,000 hours at the time he wrote the author on more than 190 different types of aircraft.

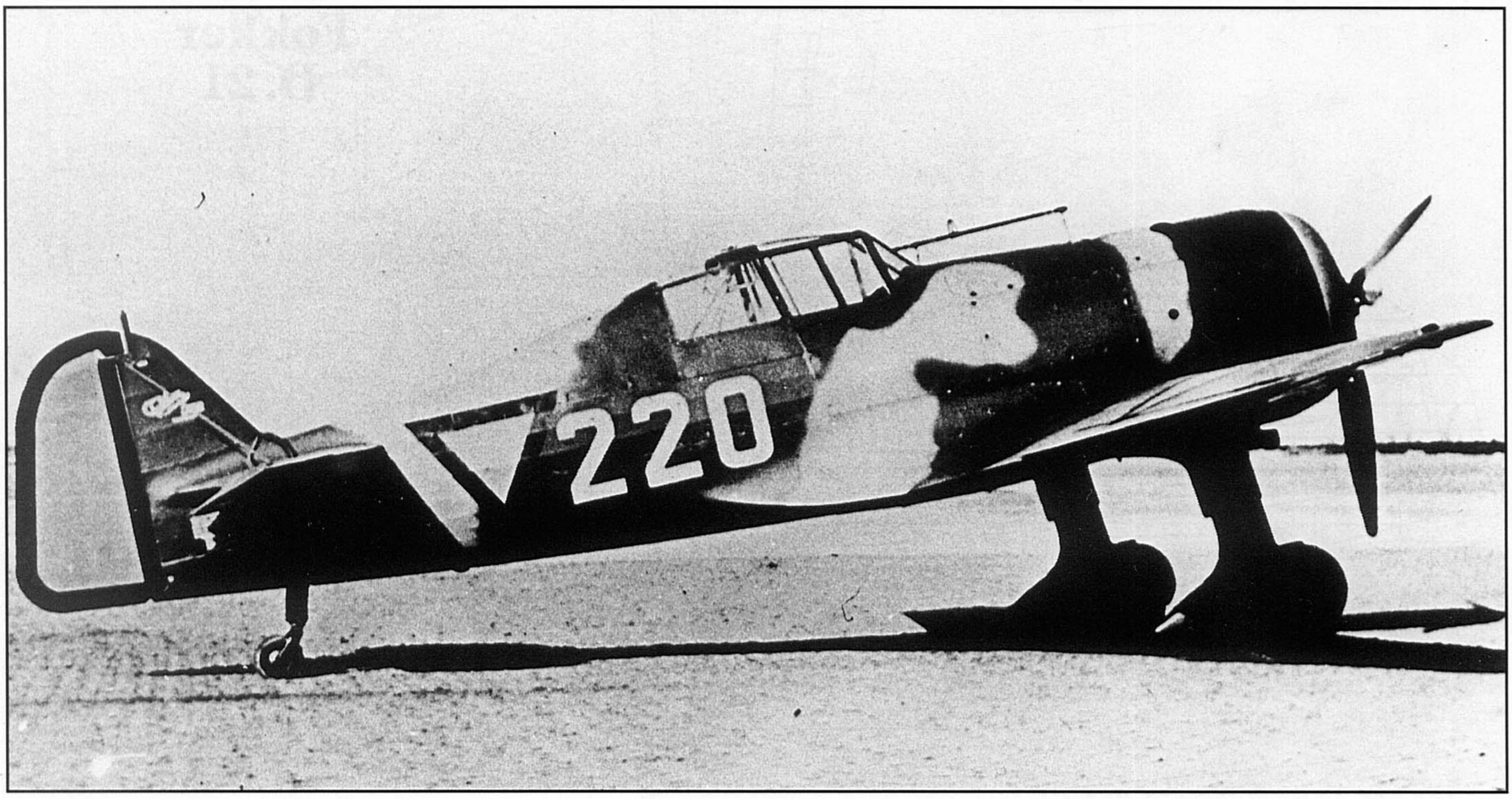
Ir. H. Doppenberg

In the few days that Dutch pilots were able to fight, Mr. Doppenberg shot down a Messerschmitt Bf-109 (May 1940).

He considered the D.21 to be "sharp" getting into a stall and was rather tricky at making a 3-point landing. If your approach was too fast, the flaps didn't have too much effect. The D.21 provided his first encounter with a high speed stall. You couldn't pull it through a loop like in a biplane and the combination made it difficult to fly formation. But in general, he considered the D.21 to be a delightful plane to fly if you know the "tricks".

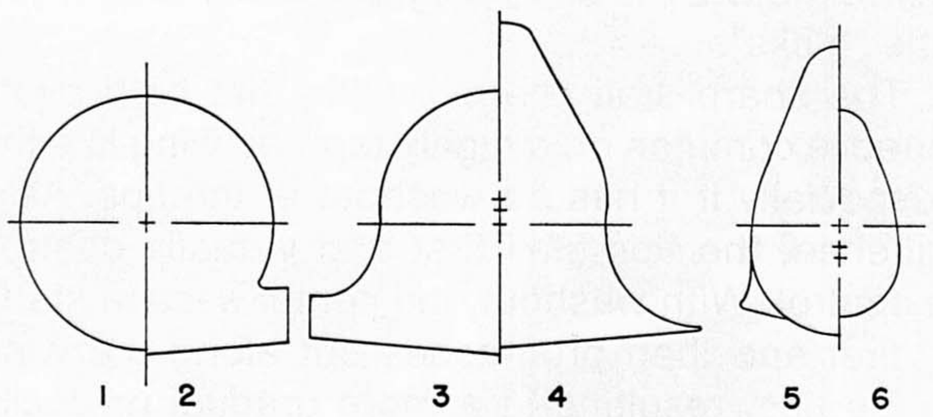
The sharp stall characteristic that both pilots mentioned is common on a highly tapered wing like the D.21, especially if it has no washout at the tips. As a consequence, the tips stall first and virtually destroy aileron control. With washout, the center section starts to stall first and then progresses out along the wing toward the tips, resulting in a more gradual or docile stall characteristic. This was a new phenomenon for pilots the world over who were used to flying biplanes, and early U.S. monoplane pilots and instructors had the same complaint. The Finns, as you will see in Volume II, went so far as to add fixed leading edge slots near the tips to correct the problem like we did on the Lockheed Hudson bombers and the Douglas Dauntless divebombers.

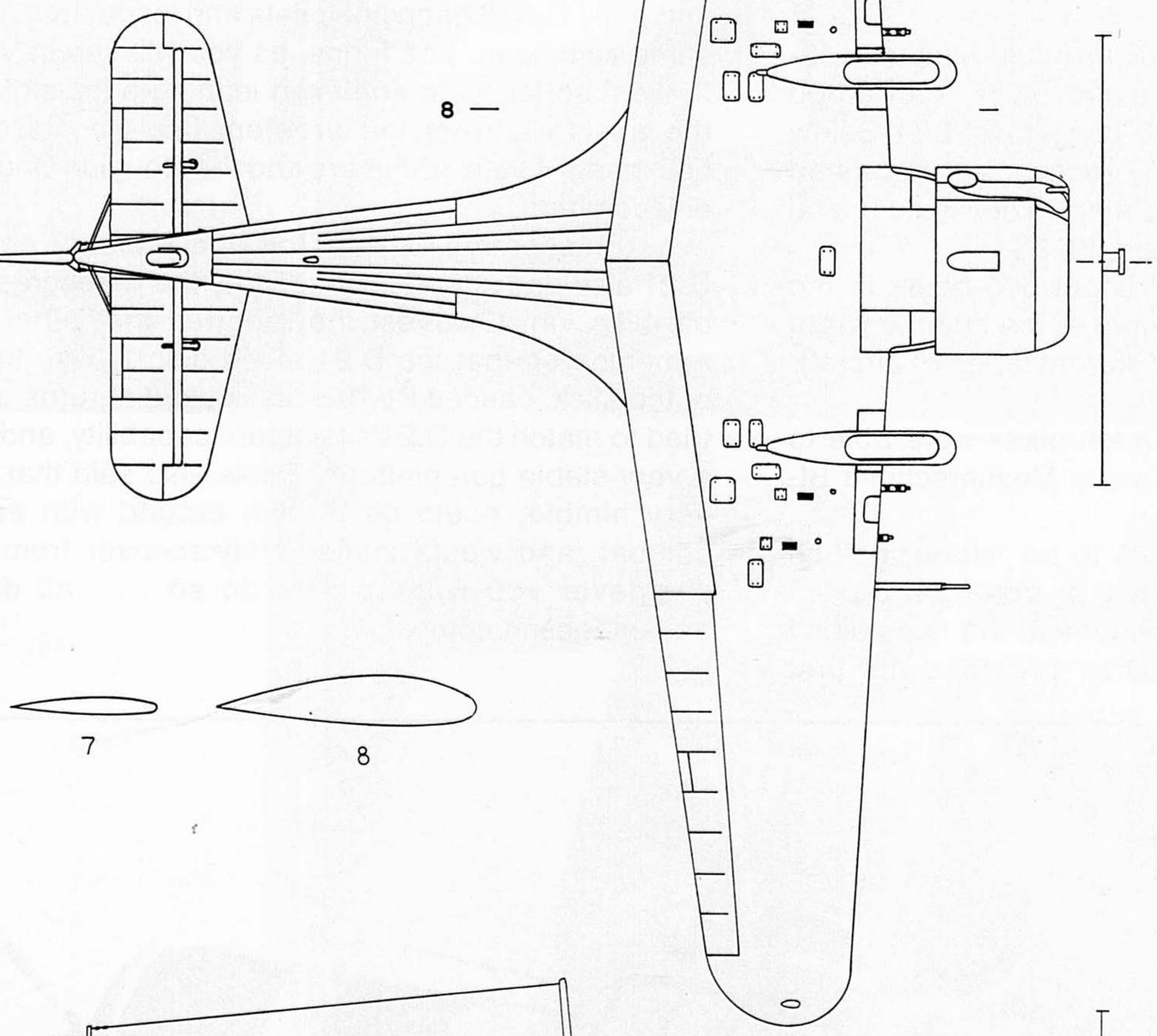
According to Karl Toll, the Mercury powered D.21 also had a tendency to spray the windscreen with oil. Like van Overvest, he reported that other pilots remembered that the D.21 rolled quickly with the flick of the stick, caused Bf-109s to skid out of turns as they tried to match the D.21's tight turn capability, and it was a very stable gun platform. Pilots also said that it was very nimble, could be thrown around with ease in combat, and would immediately recover from spins whenever you wanted it to do so . . . all distinct advantages in combat.

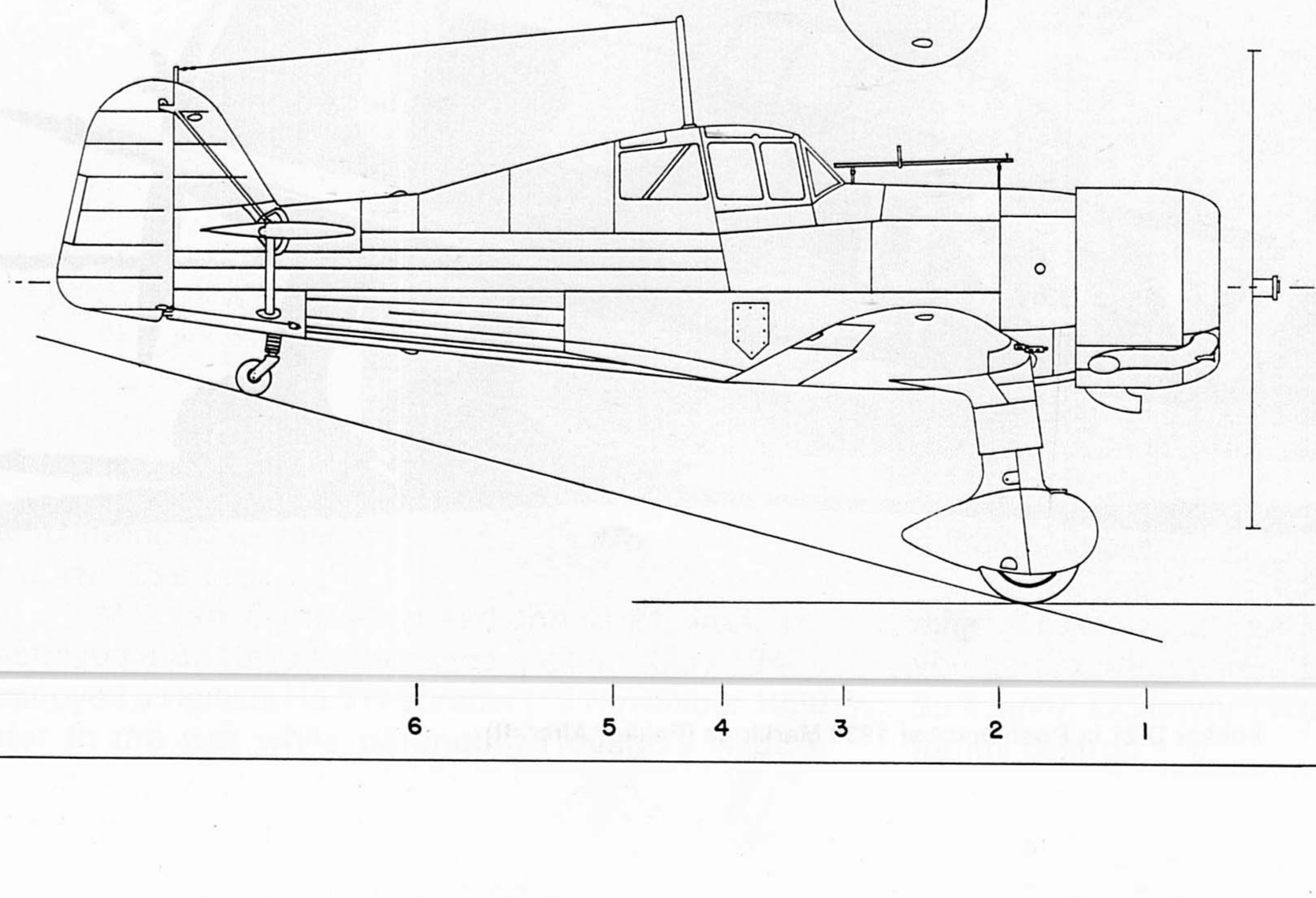


Fokker D.21 in Post-October 1939 Markings (Fokker Aircraft)

Dutch Operational Model







Fokker D. 21

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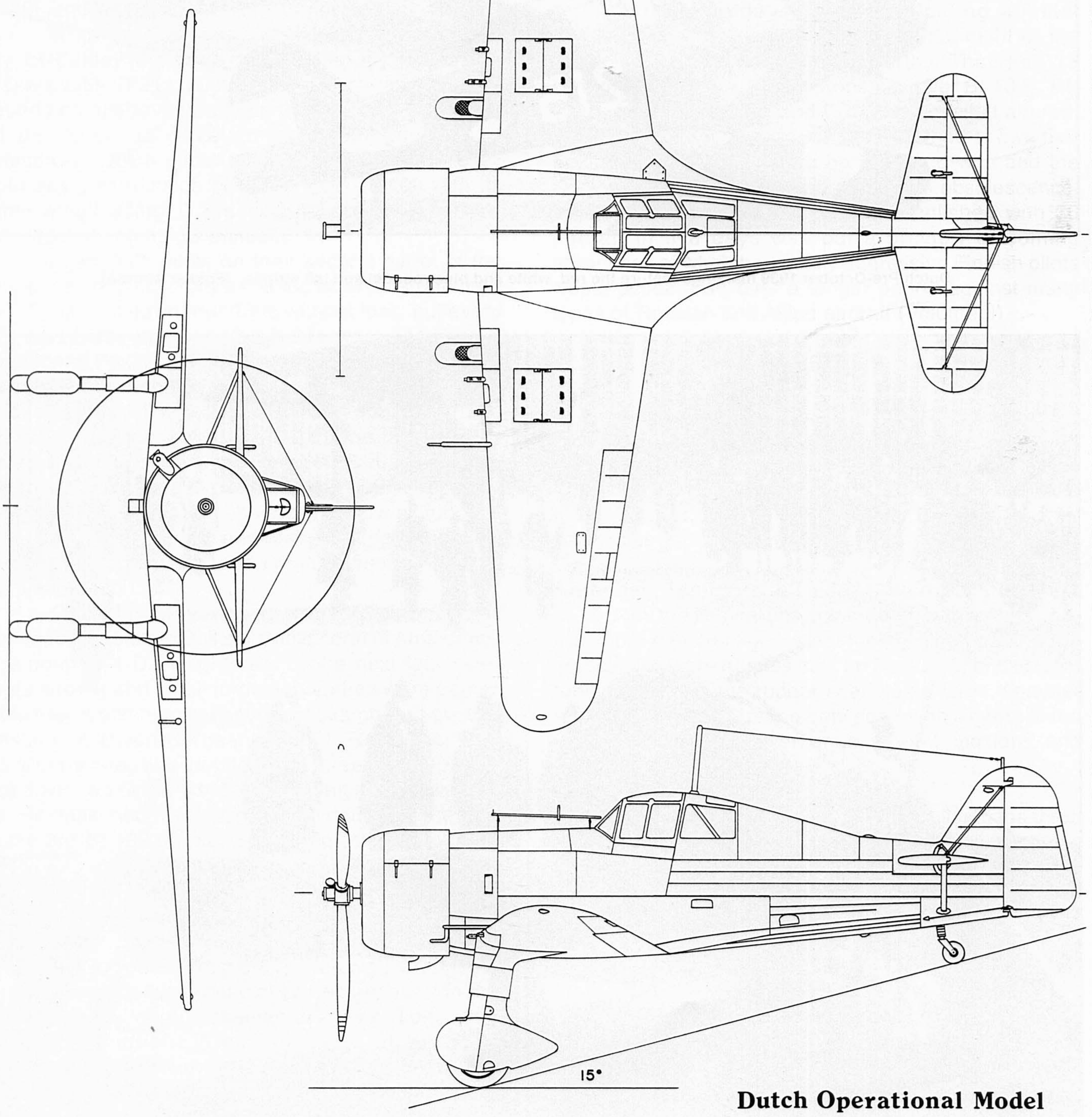
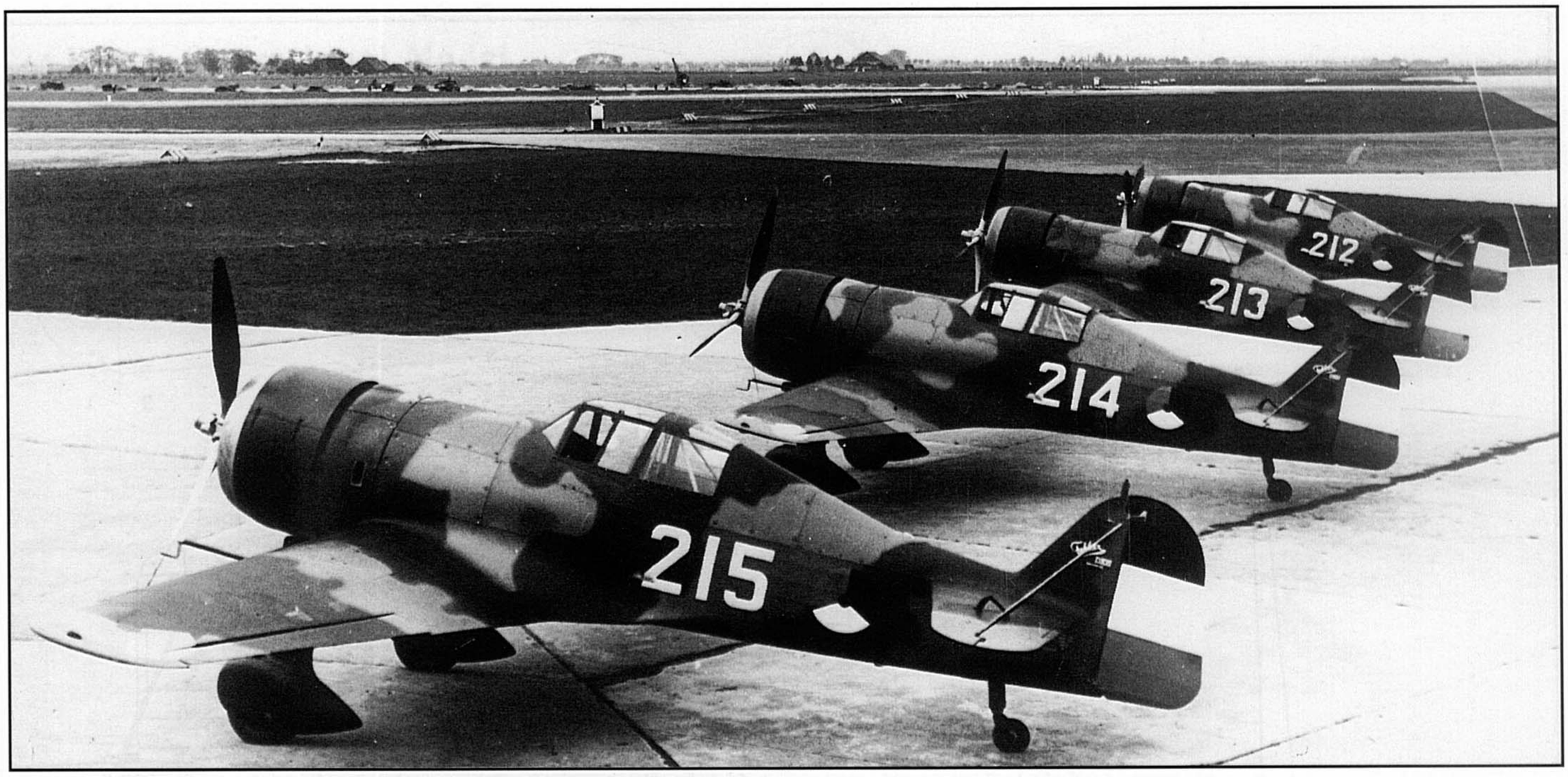


Dutch Operational Model



Dutch Pre-October 1939 markings feature the red, white and blue roundel and tail stripes. (Fokker Aircraft)

1e JaVa Squadron conducts a military review after October 1939. (Fokker Aircraft)

OPERATIONAL HISTORY

During the "Phoney War" between September 1930 and May 1940, the officially neutral Dutch pilots patrolled their airspace bounded by five national borders coming together in a triangle centered at Luxembourg (i.e., France, Germany, Holland, Belgium, and Luxembourg). They took their neutrality seriously and scrambled for intercepts 5-6 times a day. Many attempted intercepts were high flying Spitfires on reconnaissance which they couldn't reach, but they did shoot down a Junkers Ju.88 (9/30), a Heinkel He.111 (11/39), and a British Armstrong Whitley bomber (2/40).

When the Germans blitzed Holland early on 10 May 1940, they found themselves officially at war with 28 serviceable D.21s. While several were caught on the ground and destroyed early on the first day, those that did get airborne gave an excellent account of themselves. Dutch pilots quickly found that the D.21 could easily turn inside of the heavier Bf-109 with its higher wing loading. D.21s invariably came out ahead when dogfighting at low altitude.

Eight D.21 pilots on their second patrol of the day ran into eight Bf-109Es coming down to strafe their field. They shot down four 109s without loss, but every D.21 had battle damage. Six D.21s were escorting a formation of Fokker T.V bombers on their way to knock out the Meuse bridge near Rotterdam and were jumped by nine Bf-109s. The D.21s shot down one 109 for the loss of two bombers and one D.21. One large victory occurred at 0645 hours when 37 out of 55 Junkers Ju.52/3m troop transports escorted by Bf-110s were intercepted by D.21s and shot down at low altitude set up for paratroops. By the end of the first day's fighting, only one D.21 had escaped combat damage and no pilots had been lost.

One 11 May, Headquarters moved all serviceable aircraft to Buiksloot field north of Amsterdam to regroup - 11 D.21 fighters. For the next four days, single aircraft and small formation sorties were carried out to escort bombers or to conduct search-and-destroy missions. A Dutch Sergeant Pilot J. Roos, who was patrolling alone, was bounced by three Bf-109Es. He shot down two of them before being hit by his own AAA fire. He jettisoned his canopy which damaged the prop on the 3rd Bf-109 on his tail, forcing the 109 to break off.

On the last day of the war for the Dutch, the 14th of May 1940, only five D.21s were still serviceable at Buiksloot. Four carried out a fighter sweep and diverted to Schipol. Eight more aircraft were brought up to readiness and five carried out a second mission that morning. Pilots were exhausted and other fields were out of ammunition. When the news of Holland's surrender came through, ground crews immobilized the eight remaining D.21s by shooting holes in the fuel tanks, and then systematically destroyed the airstrip so the Germans couldn't use it.

Pre-October 1939 Dutch Markings (Fokker Aircraft)

After five days of heavy fighting against overwhelming and rather hopeless odds, eight of the original 28 D.21s were still airworthy. They had 15 confirmed victories and 17 probables over Bf-109s, Bf-110s, Ju.88s, He.111s, and Do.17s as combat aircraft, and 37 Ju.52/3m transports. The D.21 had shown that Fokker was still a name to be reckoned with and the D.21 was a worthy opponent despite its obsolescence. What the Dutch fighter pilots accomplished with 36 aircraft in five days was but a preview of coming attractions of what the equally aggressive Finnish pilots would accomplish over a longer period against many types of Russian and Allied aircraft (Volume II).

DESIGN DETAILS

In this section, we shall go down to the fine details peculiar to the various D.21 models. Some are common, while others set the different models apart. These fine details are the things that set you apart as a D.21 "expert". In Volume II, you will find further similarities as well as differences incorporated in Finnish D.21s.

Antennas, Taillights, & Rudder Overhangs

All the vertical fins and rudders were of basically the same construction - steel tubing. The spars in the vertical fins were trusses built up from smaller diameter tubing, whereas the rudder spar was a large diameter tube. The main difference between models came in the rudder aerodynamic overhangs, taillight positions, and antenna connections.

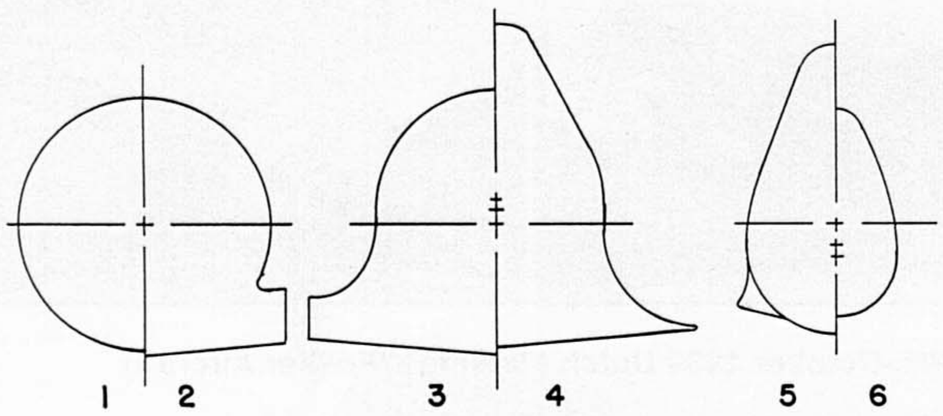
Prototype

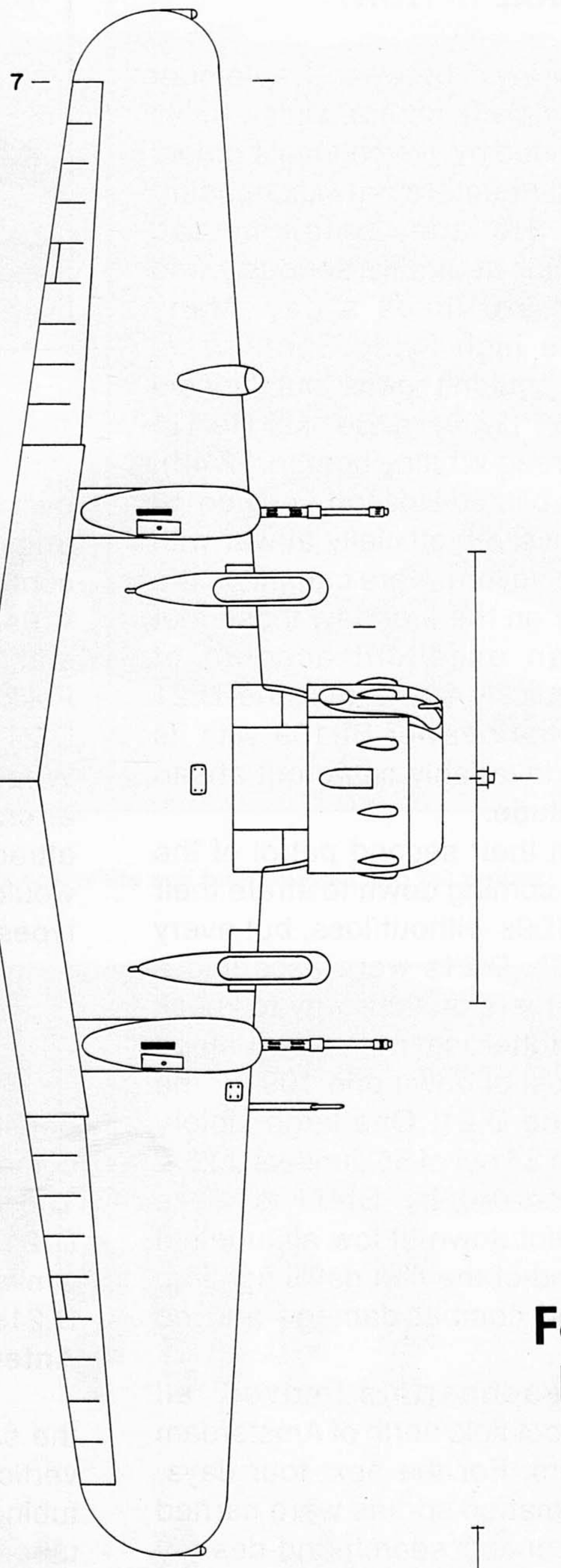
This was probably the most peculiar of the three models covered in this volume in that the taillight was positioned in the slot ahead of the rudder and over the upper hinge. One would surmise that it was partially blanked out when viewed tail-on. The antenna connection was a fairly small stub above the rear spar.

Dutch Operational Model

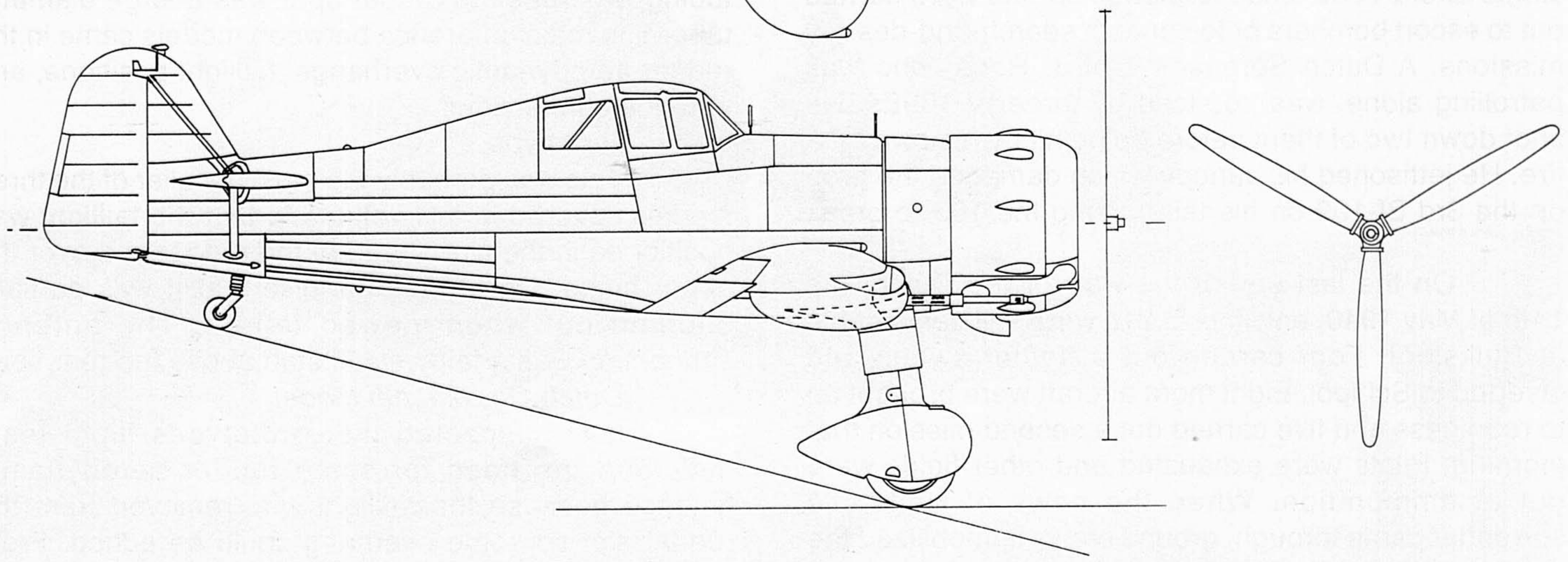
It is suspected that prototypes flight tests indicated the need for some rudder aerodynamic balance because the taillight was removed from the rudder slot so some overhang could be added. From what can be gathered from photos, the overhang could have been shaped out of wood or light gauge sheet metal and fabric covered with the rest of the rudder.

Danish Operational Model

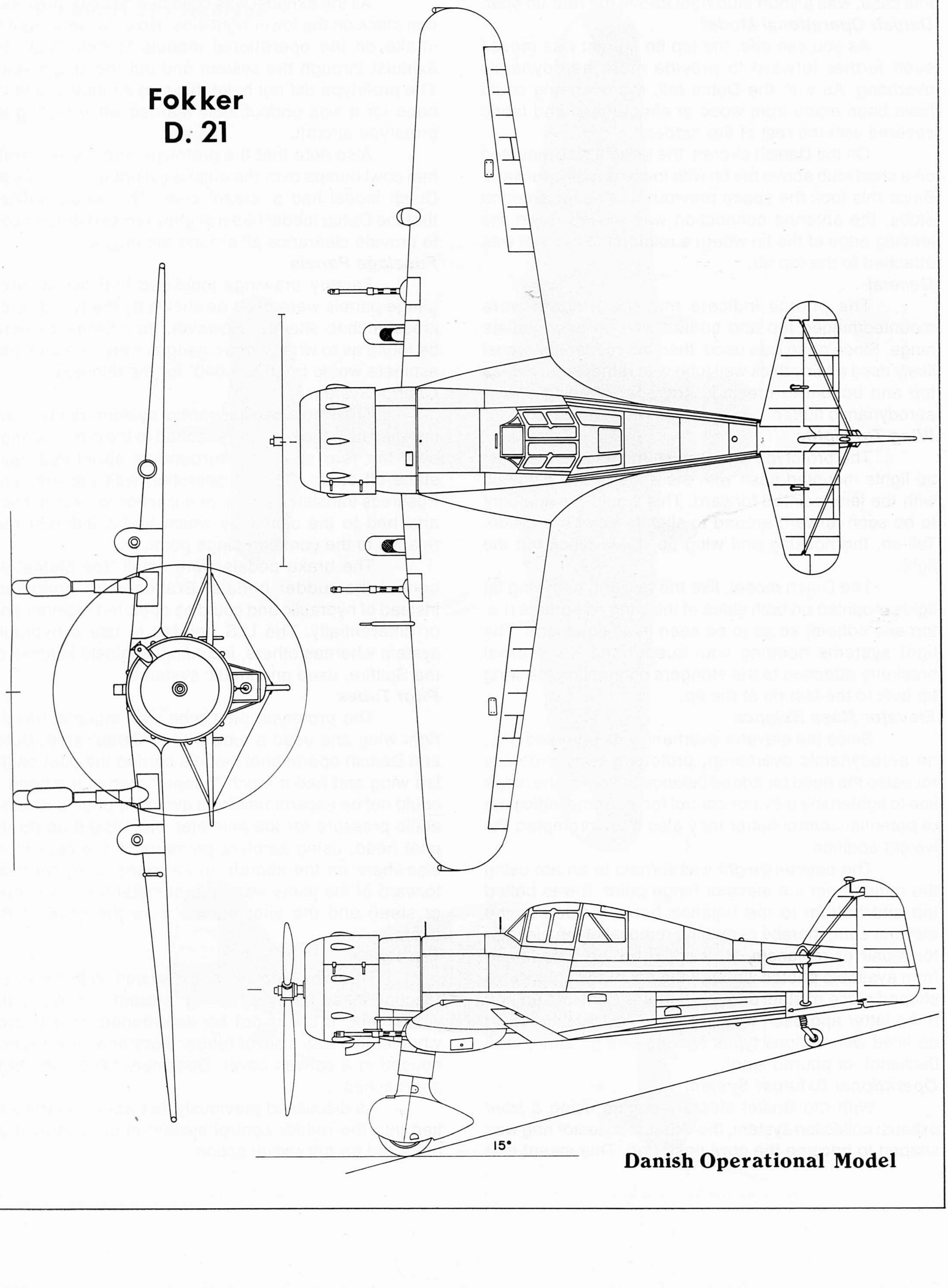




Fokker D. 21



Fokker D. 21



Danish Operational Model

The prototype's single taillight was replaced by two side-mounted lights as shown. The antenna attachment, in this case, was a short stub right above the rear fin spar.

Danish Operational Model

As you can see, the top fin upright was moved even further forward to provide more aerodynamic overhang. As with the Dutch tail, the overhang could have been made from wood or sheet metal and fabric covered with the rest of the rudder.

On the Danish aircraft, the taillight was mounted on a short stub above the fin with the lens facing forward. Since this took the space previously used for antenna stubs, the antenna connection was moved down the leading edge of the fin where a reinforcing bracket was attached to the top rib.

General

The photos indicate that the rudders were mounted/hinged top and bottom with no intermediate hinge. Since none was used, then the rudder spar most likely used a fairly thick wall tube with rather stout hinges top and bottom to preclude any spar bending and/or aerodynamic flutter.

Wing Tip Lights

The prototype and Danish model had the wing tip lights mounted flush with the ends of the wing tips with the lens pointed forward. This would provide light to be seen forward around to slightly aft of broadside. Tail-on, the housing and wing tip would block out the light.

The Dutch model, like the taillight, had wing tip lights mounted on both sides of the wing tip surface (i.e. top and bottom) so as to be seen in all directions. The light systems housing was suspended on internal bracketry attached to the stringers connecting the wing tip bow to the last rib at the tip.

Elevator Mass Balance

Since the elevator overhang was reversed (i.e., no aerodynamic overhang), prototype tests probably revealed the need for added balance in front of the hinge line to lighten the elevator control force. Some indication of potential control flutter may also have prompted the weight addition.

The counterweight was formed in an arc using the radius from the elevator hinge point. It was bolted top and bottom to the balance horns welded to the elevator spar, thereby permitting removal of the elevator for repair or replacement. It could not be determined from available photos whether the counterweight was a shaped piece of steel or aircraft tubing bent into an arc. If the latter approach was used, the hollow tube could be filled with various types of weight (e.g., sand, lead buckshot, or poured lead).

Operational Exhaust System

With the Bristol Mercury engine using a front exhaust collection system, the exhaust collector ring was shaped to become the cowl nose ring. This meant that it remained attached to the engine and cowl panels aft of the ring were removable to service the engine.

All the exhaust was collected and exhausted out one stack on the lower right side. Note the small ram air intake on the operational models to help "pull" the exhaust through the system and out the single stack. The prototype did not have this ram air intake, and the need for it was undoubtedly learned while testing the prototype aircraft.

Also note that the prototype and Danish model had cowl bumps over the engine cylinders, whereas the Dutch model had a "clean" cowl. This would indicate that the Dutch model had a slightly larger diameter cowl to provide clearance all around the engine.

Fuselage Panels

Factory drawings indicated that two different gauge panels were used as shown by the two different crosshatched shades. However, no information could be found as to what the two gauges were. A reasonable estimate would be .032"-.040" for the thinnest.

Control System

The whole cockpit control system was built and installed as a "boxed" unit attached to the cross-member over the rear spar and surounding structures using stand-off stubs. Control operation was conventional. Pushrods translated rudder pedal action to a control horn attached to the assembly which had a different radii relative to the common hinge point.

The brake pedals were small "toe plates" set behind the rudder pedals. Brakes were pneumatic instead of hydraulic and could be operated together and/or differentially. The U.S. tended to use a hydraulic system whereas others, including Reginald Mitchell on the Spitfire, used pneumatic systems.

Pitot Tubes

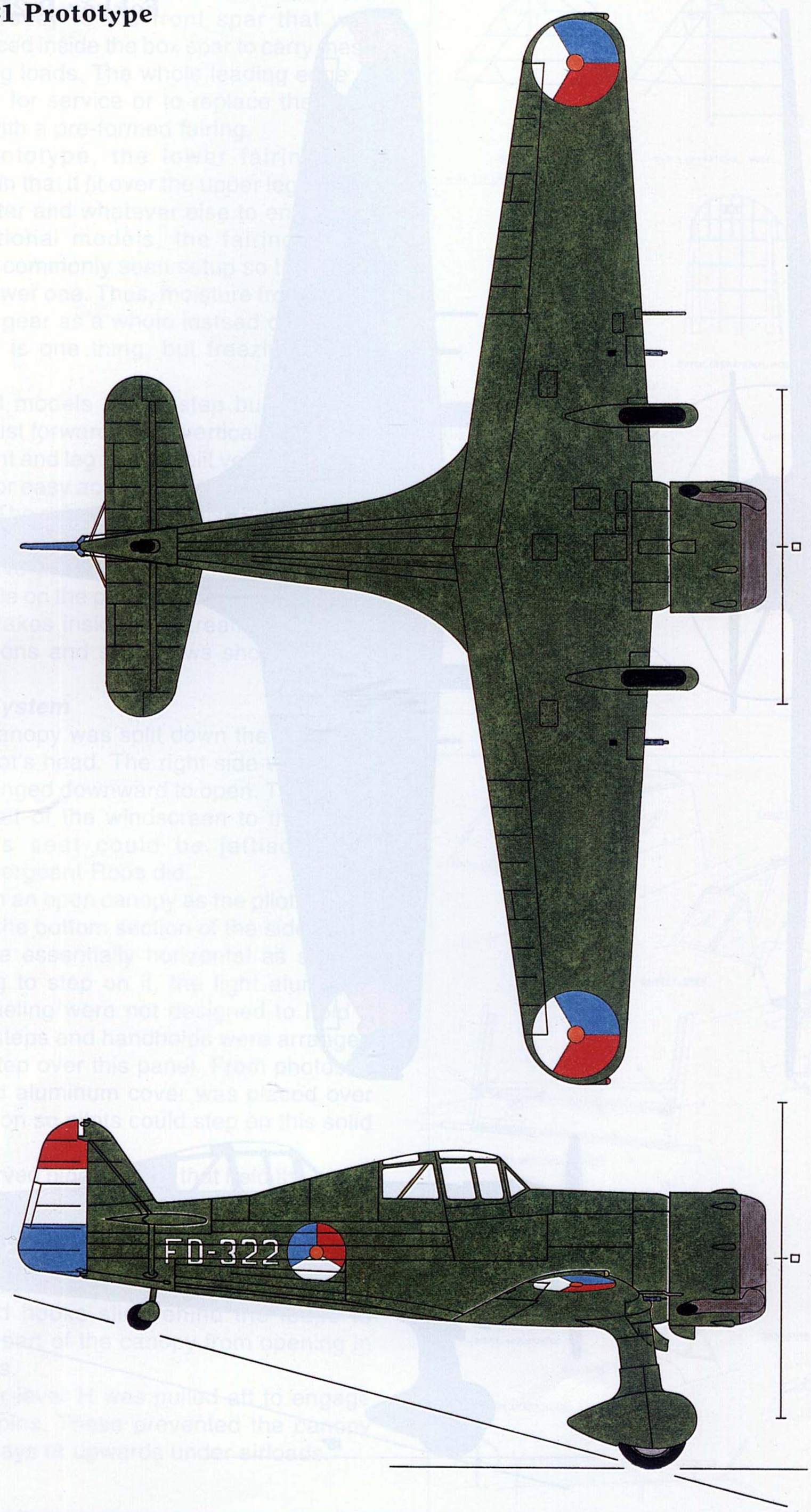
The prototype pitot tube was mounted on the right wing and used a tube with a "flatter" step. Dutch and Danish operational models carried the pitot on the left wing and had a much "deeper" step in the head. It could not be ascertained from available photos whether static pressure for the altimeter was picked up on the pitot head, using ambient pressure in the cockpit, or elsewhere on the aircraft. In all cases, the pitot head forward of the joints was natural metal (i.e., aluminum or steel) and the pitot booms were the color of the aircraft.

Tail Wheel

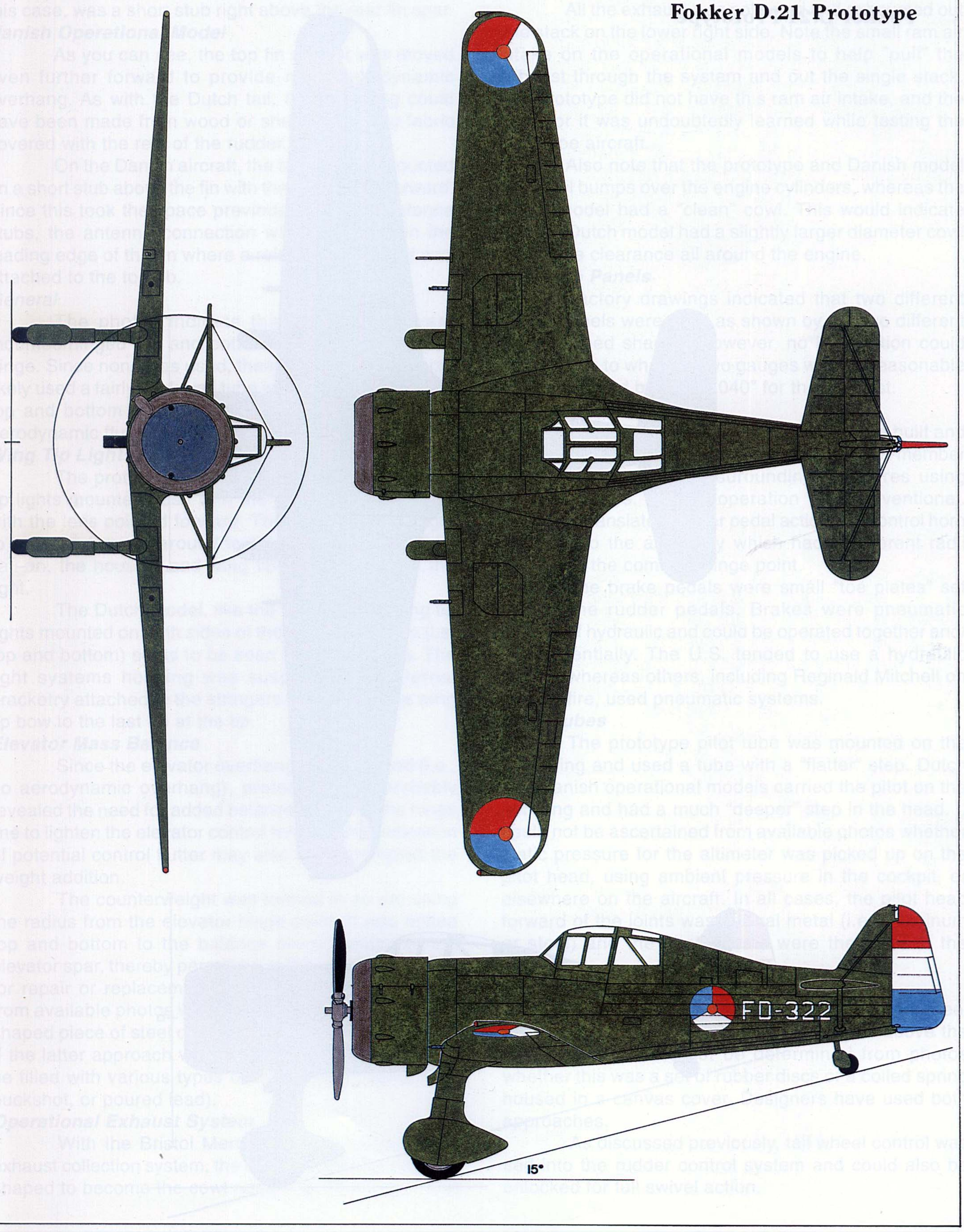
This was a conventional system with tail wheel reaction taken up by a "spring" system just above the wheel fork. It could not be determined from photos whether this was a set of rubber discs or a coiled spring housed in a canvas cover. Designers have used both approaches.

As discussed previously, tail wheel control was tied into the rudder control system and could also be unlocked for full swivel action.

Fokker D.21 Prototype



Fokker D.21 Prototype



Operational Main Gear

The main gear leg fit into a cast-machined housing bolted directly to the front spar that was undoubtedly reinforced inside the box spar to carry these vertical and bending loads. The whole leading edge of the wing was open for service or to replace the gear, and was covered with a pre-formed fairing.

On the prototype, the lower fairing was somewhat unusual in that it fit over the upper leg fairing, thereby inviting water and whatever else to enter from above. On operational models, the fairings were reversed to a more commonly seen setup so the upper fairing fit over the lower one. Thus, moisture from above would drain off the gear as a whole instead of into the lower fairing. Rain is one thing, but freezing rain is another.

Operational models had a step built into the wheel pant on top just forward of the vertical leg fairing. The whole lower pant and leg fairing split vertically along the leg center line for easy access to wheel, brake, oleo strut, scissors, etc. The scissors could also be inspected and lubricated through an access door built into the upper leg fairing. No information, photos, or factory details were available on the physical form or installation of the main gear brakes inside the streamlined pants. Factory cross-sections and side views show no such details.

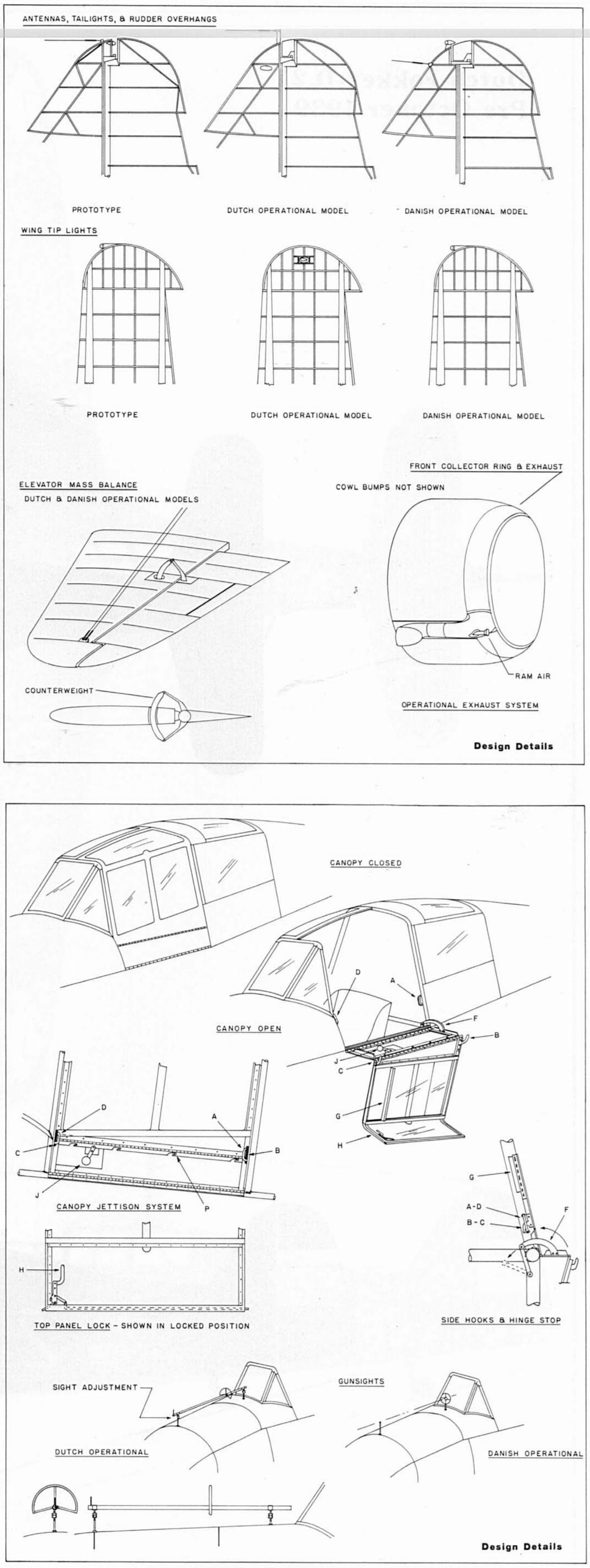
Cockpit Canopy System

The D.21 canopy was split down the middle at the top over the pilot's head. The right side was fixed, while the left side hinged downward to open. The whole canopy assembly aft of the windscreen to the frame behind the pilot's seat could be jettisoned in emergencies - as Sergeant Roos did.

Starting with an open canopy as the pilot enters, hinge stop F holds the bottom section of the side panel hinged to the frame essentially horizontal as shown. While it is tempting to step on it, the light aluminum framework and paneling were not designed to hold a pilot's weight. Footsteps and handholds were arranged so the pilot could step over this panel. From photos, it shows that a ribbed aluminum cover was placed over the top entry longeron so pilots could step on this solid frame member.

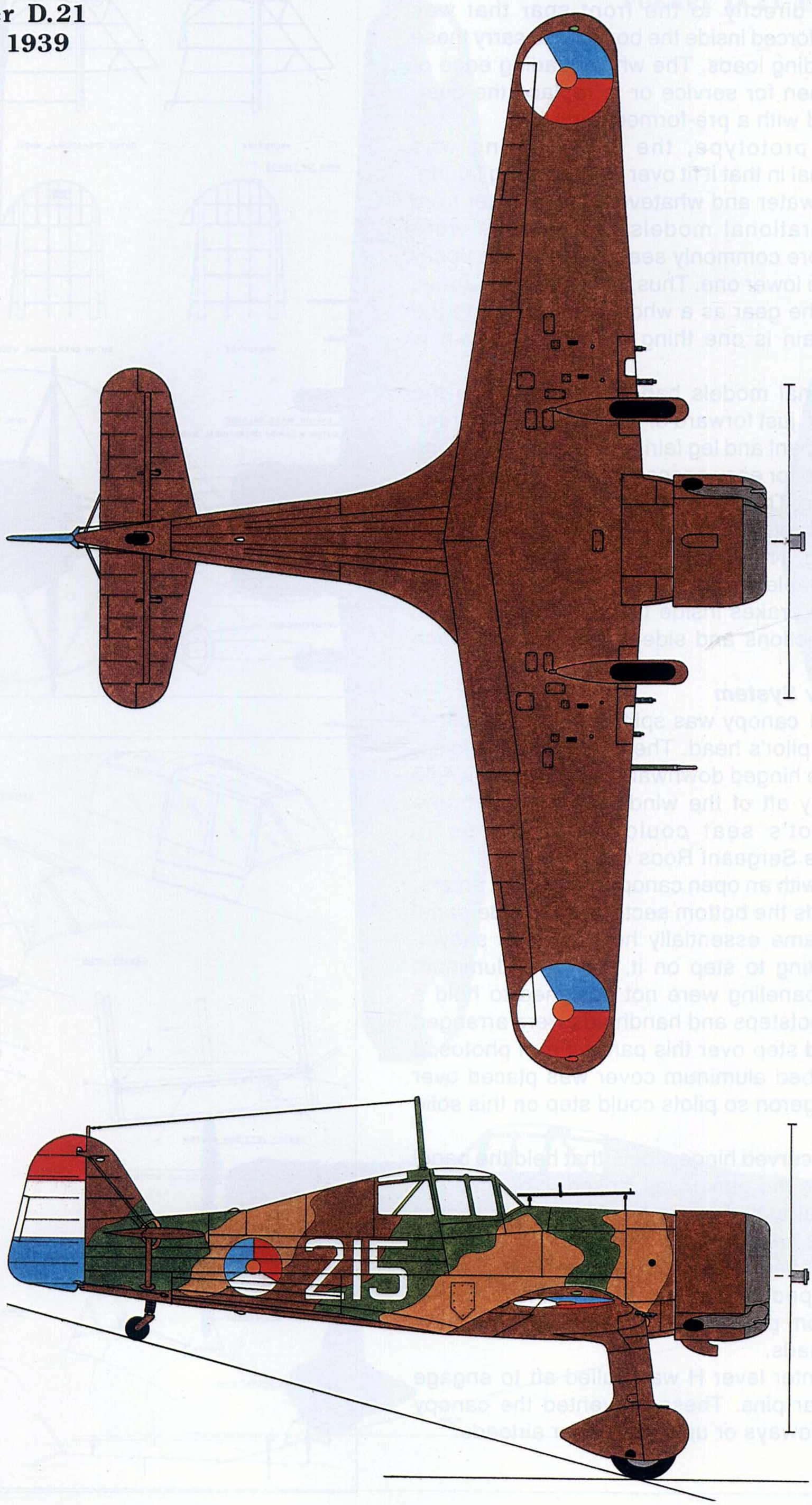
Note the curved hinge stop F that held the panel horizontal. When the panel was closed, it pushed the small lever arm attached to the fuselage frame inward behind the pilot's seat. Also as the panel closed, side hooks B and C engaged side loops A and D and, when closed, the shaped hooks slid behind the loops to prevent the bottom part of the canopy from opening in flight under air loads.

A top center lever H was pulled aft to engage the front and rear pins. These prevented the canopy from opening sideways or upwards under airloads.

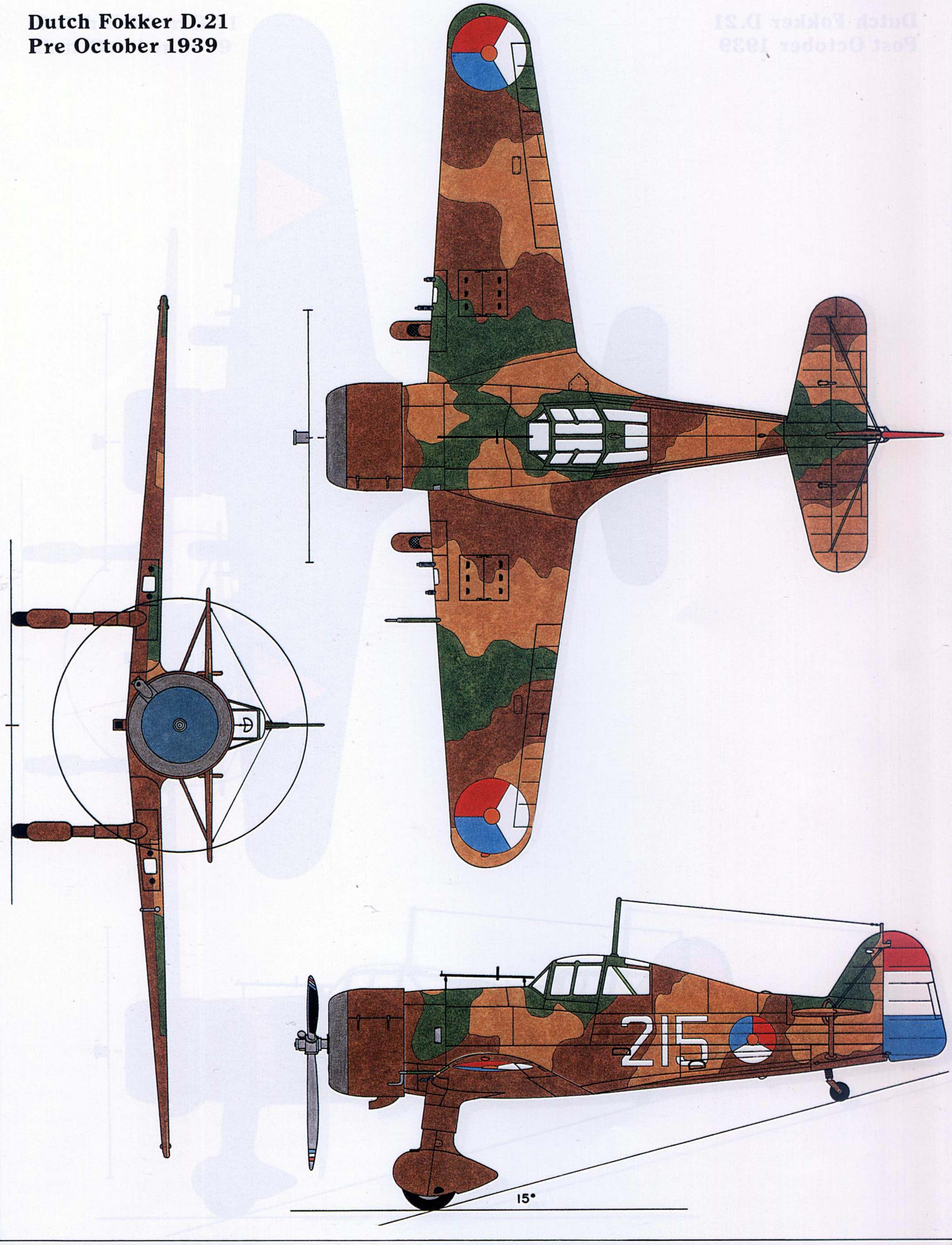


Reproduced in larger scale on page 47.

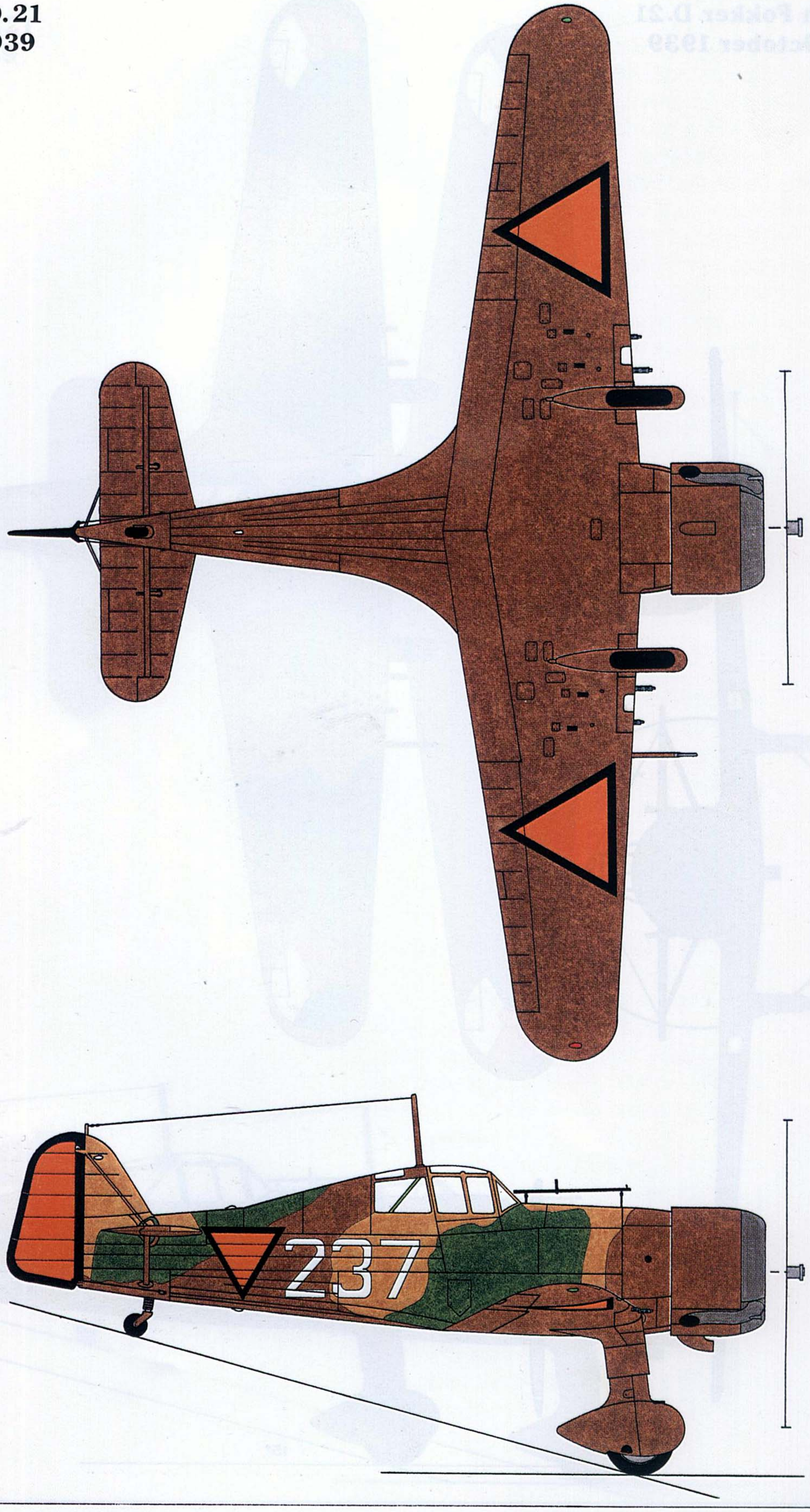
Dutch Fokker D.21
Pre October 1939



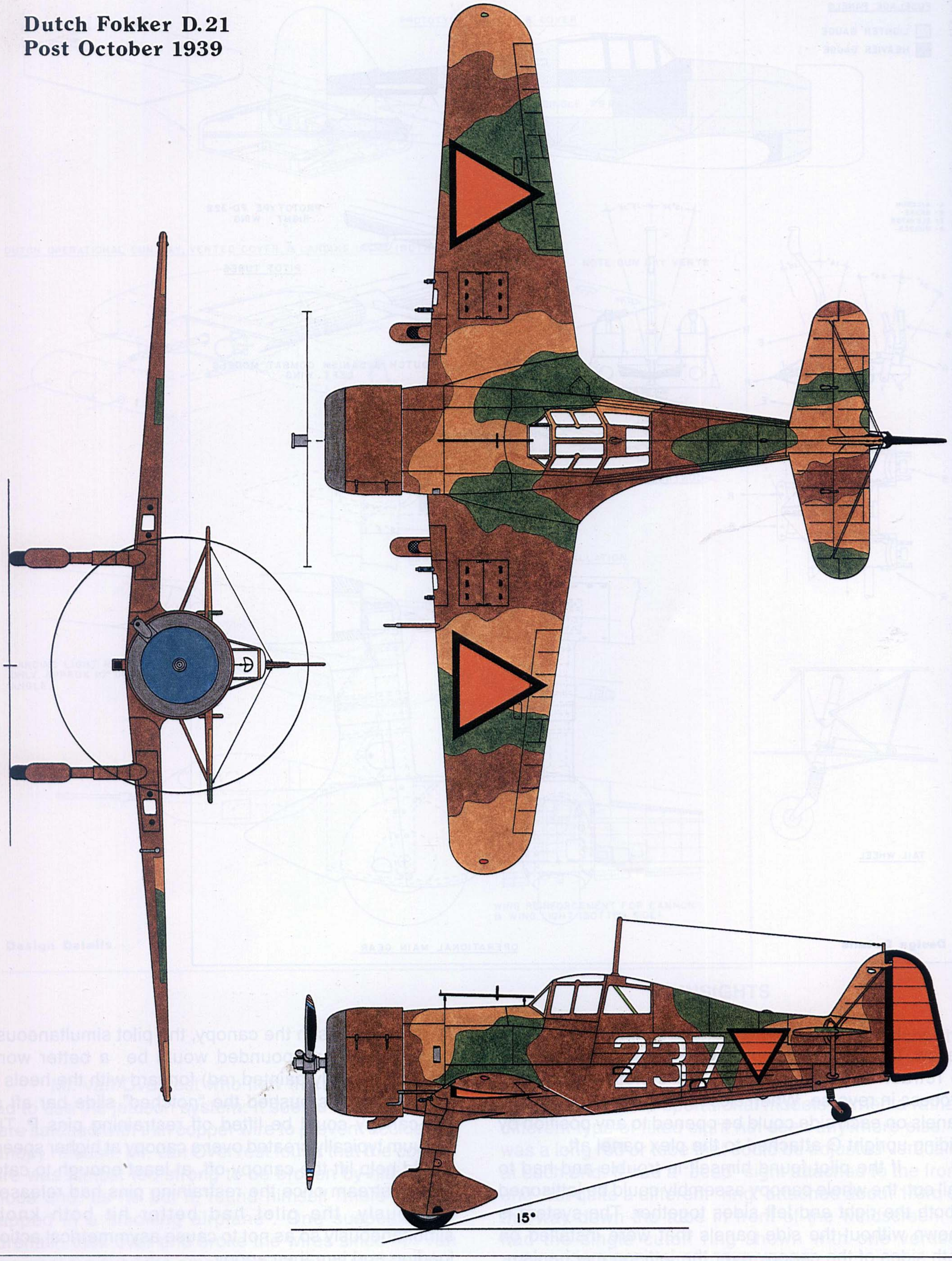
Dutch Fokker D.21
Pre October 1939



Dutch Fokker D.21
Post October 1939



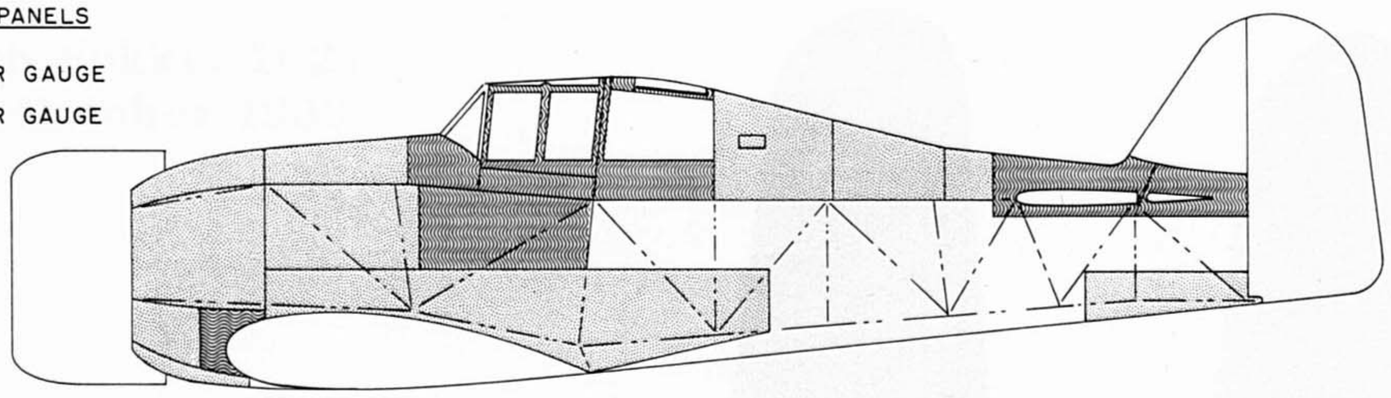
Dutch Fokker D.21
Post October 1939



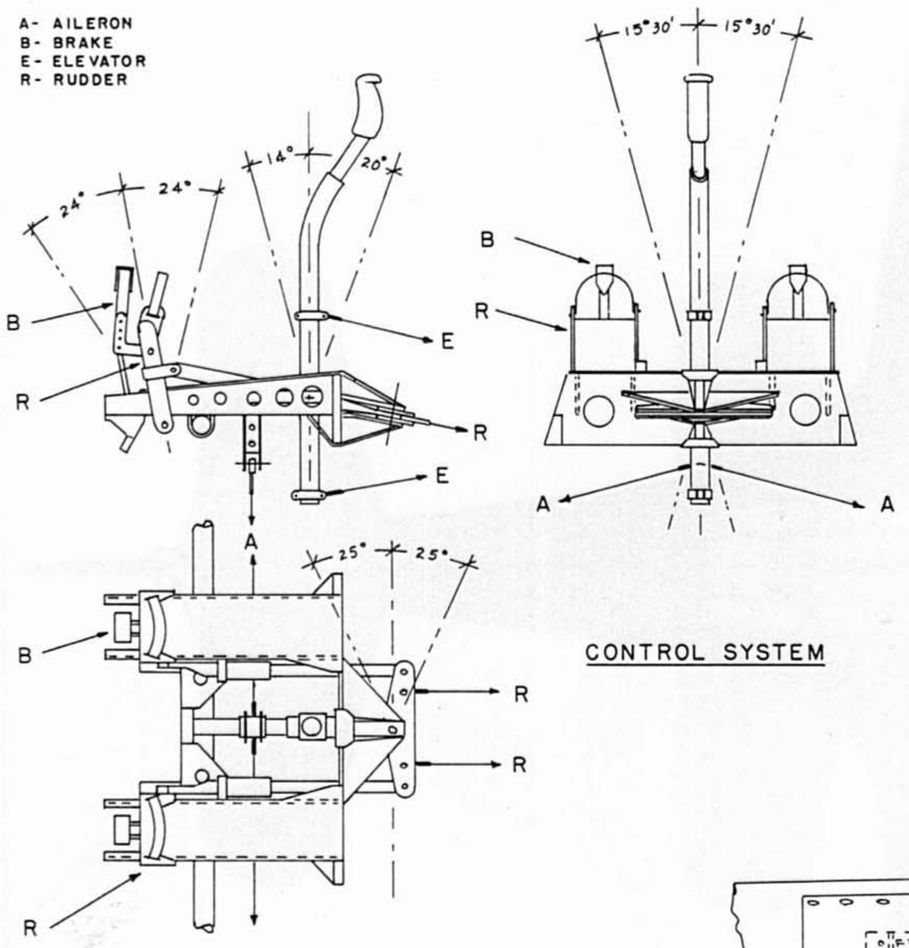
FUSELAGE PANELS

LIGHTER GAUGE

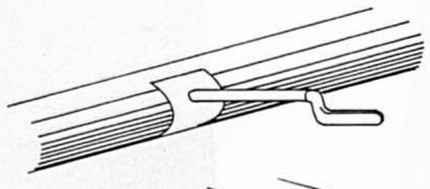
HEAVIER GAUGE



A- AILERON
B- BRAKE
E- ELEVATOR
R- RUDDER

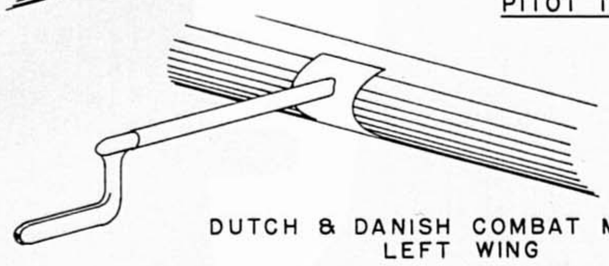


CONTROL SYSTEM

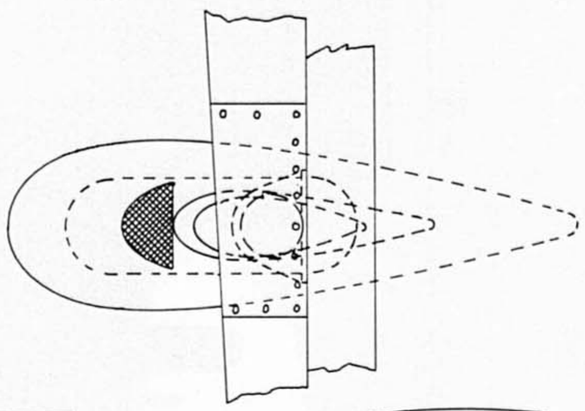


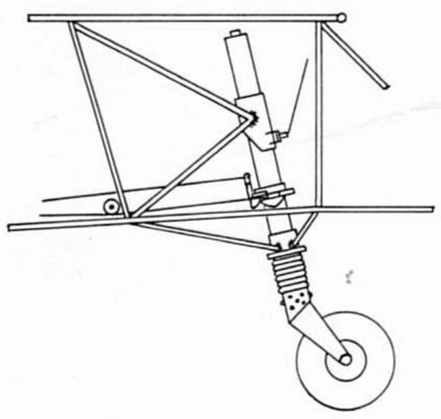
PROTOTYPE FD-322
RIGHT WING

PITOT TUBES

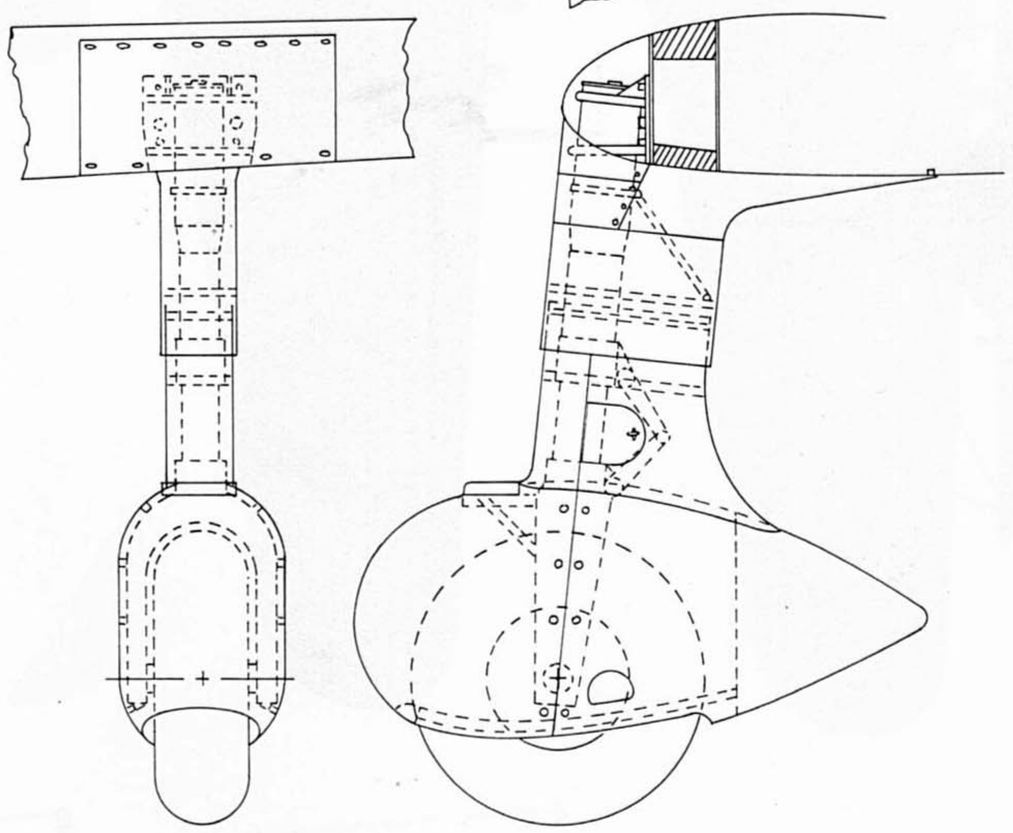


DUTCH & DANISH COMBAT MODELS
LEFT WING





TAIL WHEEL



OPERATIONAL MAIN GEAR

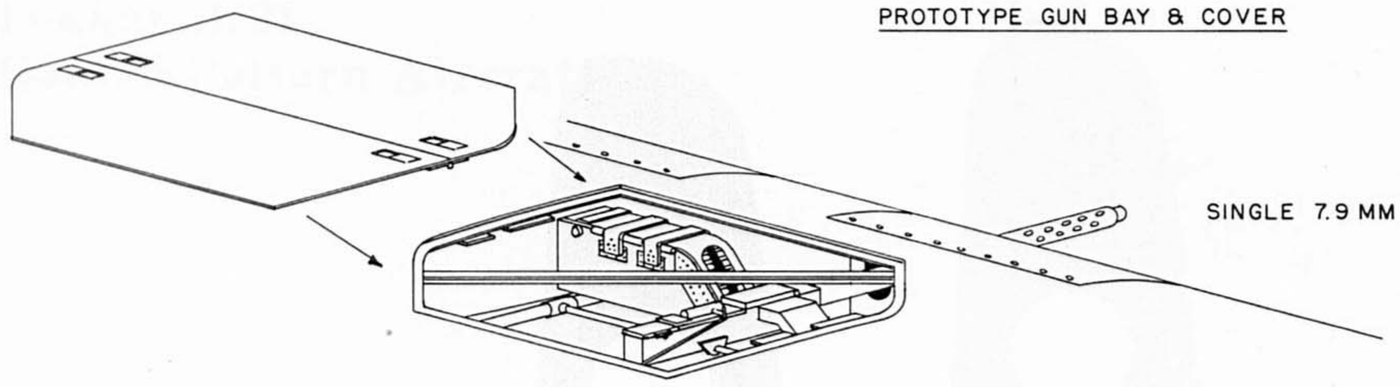
Design Details

Mr. Doppenberg remembered this handle to be yellow. To open the canopy, lever H was pushed forward to retract the pins and start the canopy "unfolding" process in reverse. When closed, the forward side plex panels on each side could be opened to any position by sliding upright G attached to the plex panel aft.

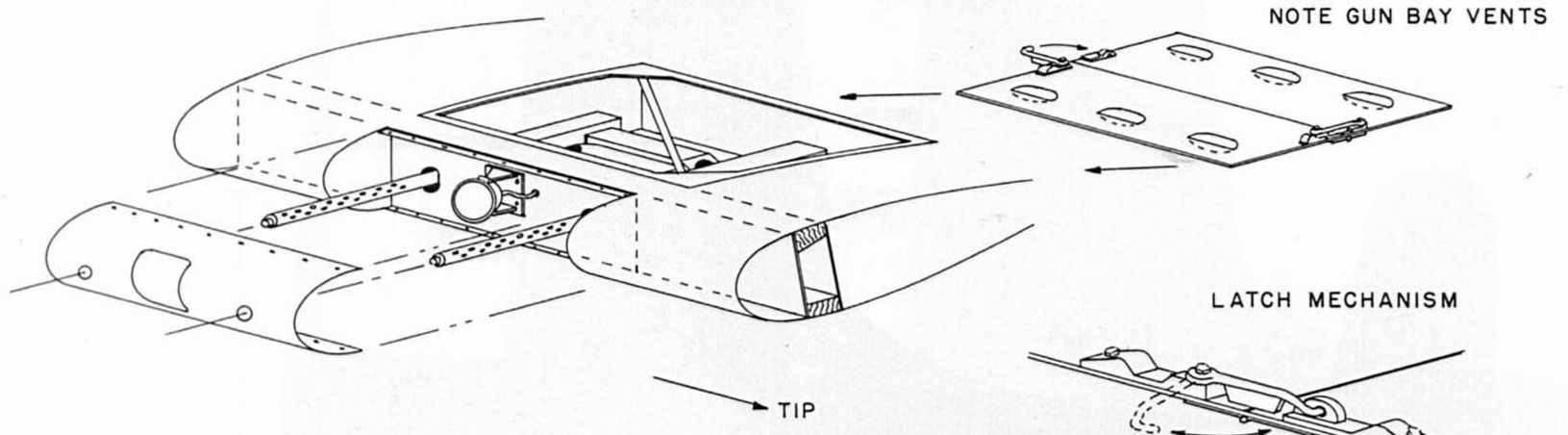
If the pilot found himself in trouble and had to bail out, the whole canopy assembly could be jettisoned - both the right and left sides together. The system is shown without the side panels that were installed on both sides of the canopy over the jettison mechanism.

To jettison the canopy, the pilot simultaneously pushed (perhaps pounded would be a better word) knobs J (usually painted red) forward with the heels of his hands. This pushed the "notched" slide bar aft so the canopy could be lifted off restraining pins P. The vacuum typically created over a canopy at higher speeds would help lift the canopy off, at least enough to catch the slipstream once the restraining pins had released. Obviously, the pilot had better hit both knobs simultaneously so as not to cause asymmetrical action/ loading and jam the canopy.

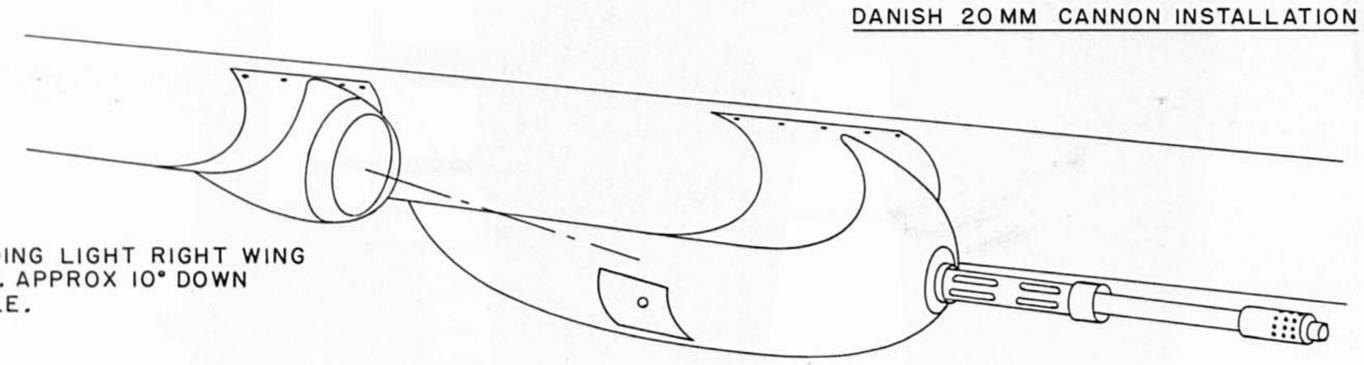
PROTOTYPE GUN BAY & COVER

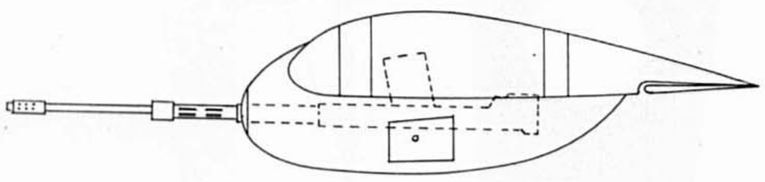


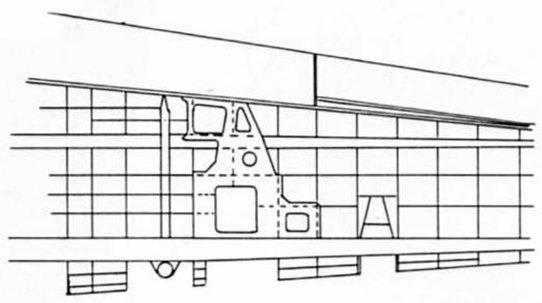
DUTCH OPERATIONAL GUN BAY, VENTED COVER, & LANDING LIGHT (BOTH SIDES)



DANISH 20 MM CANNON INSTALLATION







WING REINFORCEMENT FOR CANNON
& WING LIGHT (BOTTOM SIDE)

Design Details

Mr. van Overvest who flew the D.21 in combat had to use the jettison system. It seems that the knobs were safetied with thin copper wire to prevent accidental canopy release. Mr. van Overvest found that the copper wire was almost too strong to be broken by hitting the knobs and, as he put it, found himself "more or less trapped in a smoking airplane". One suspects that adrenalin took over and broke the wires since Mr. van Overvest survived the emergency to recall the incident.

GUNSIGHTS

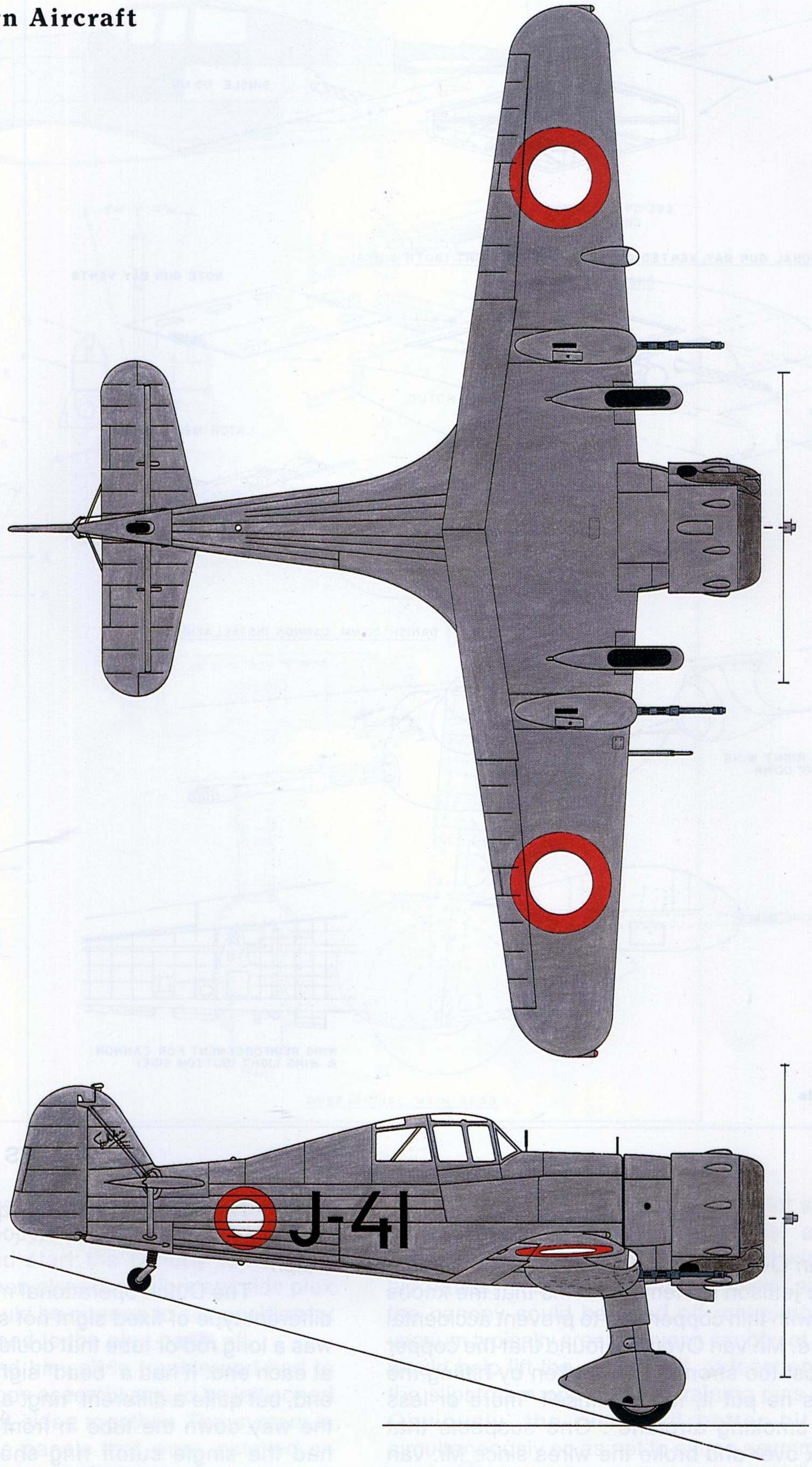
Prototype

The prototype was not equipped with a gunsight in any available photo.

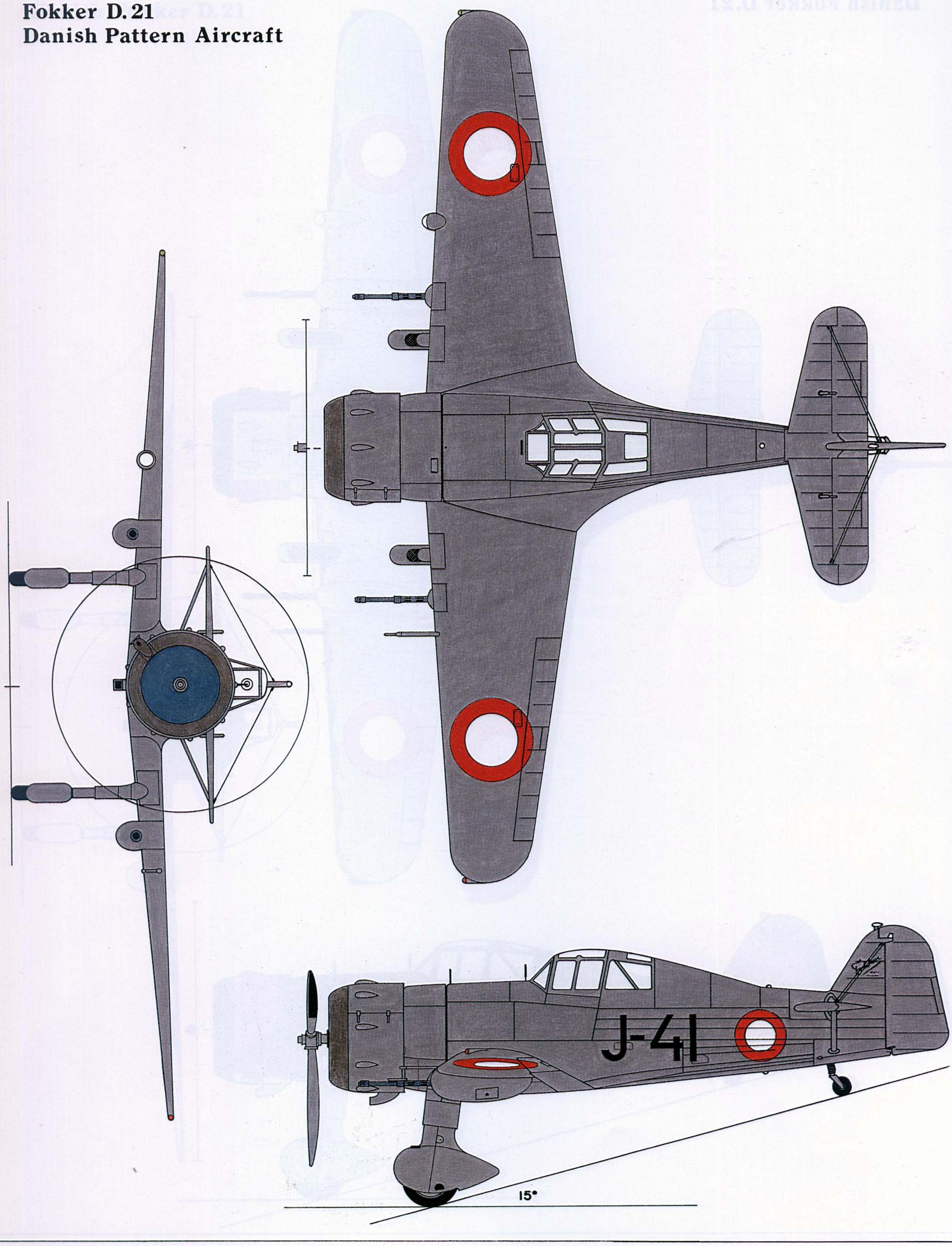
Dutch

The Dutch operational models carried a rather different type of fixed sight not seen anywhere else. It was a long rod or tube that could be adjusted vertically at each end. It had a "bead" sight attached to the front end, but quite a different "ring" attached about 1/3rd of the way down the tube in front of the windscreen. It had the single cutoff ring shown with one vertical element to align with the front bead.

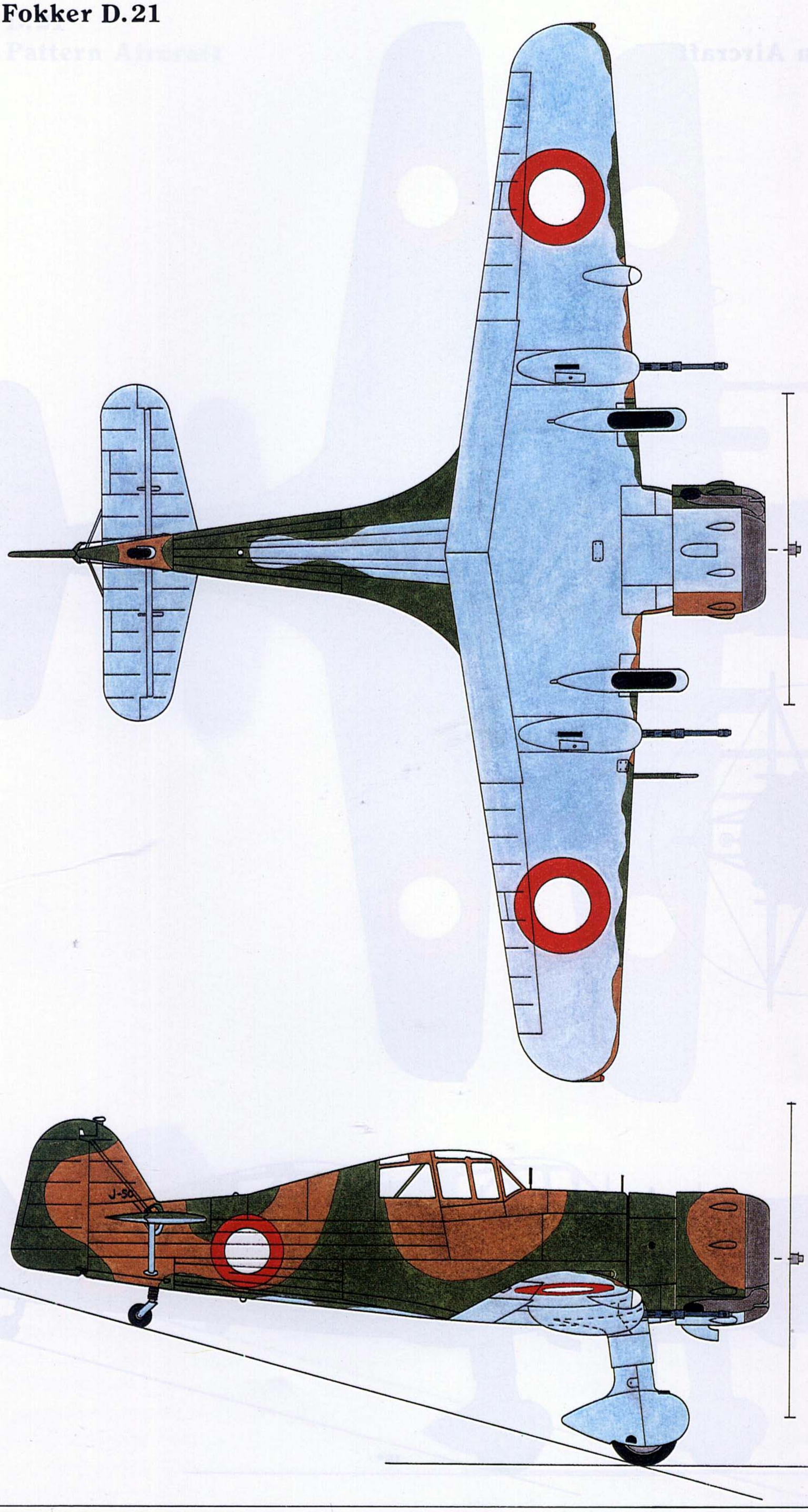
Fokker D.21
Danish Pattern Aircraft



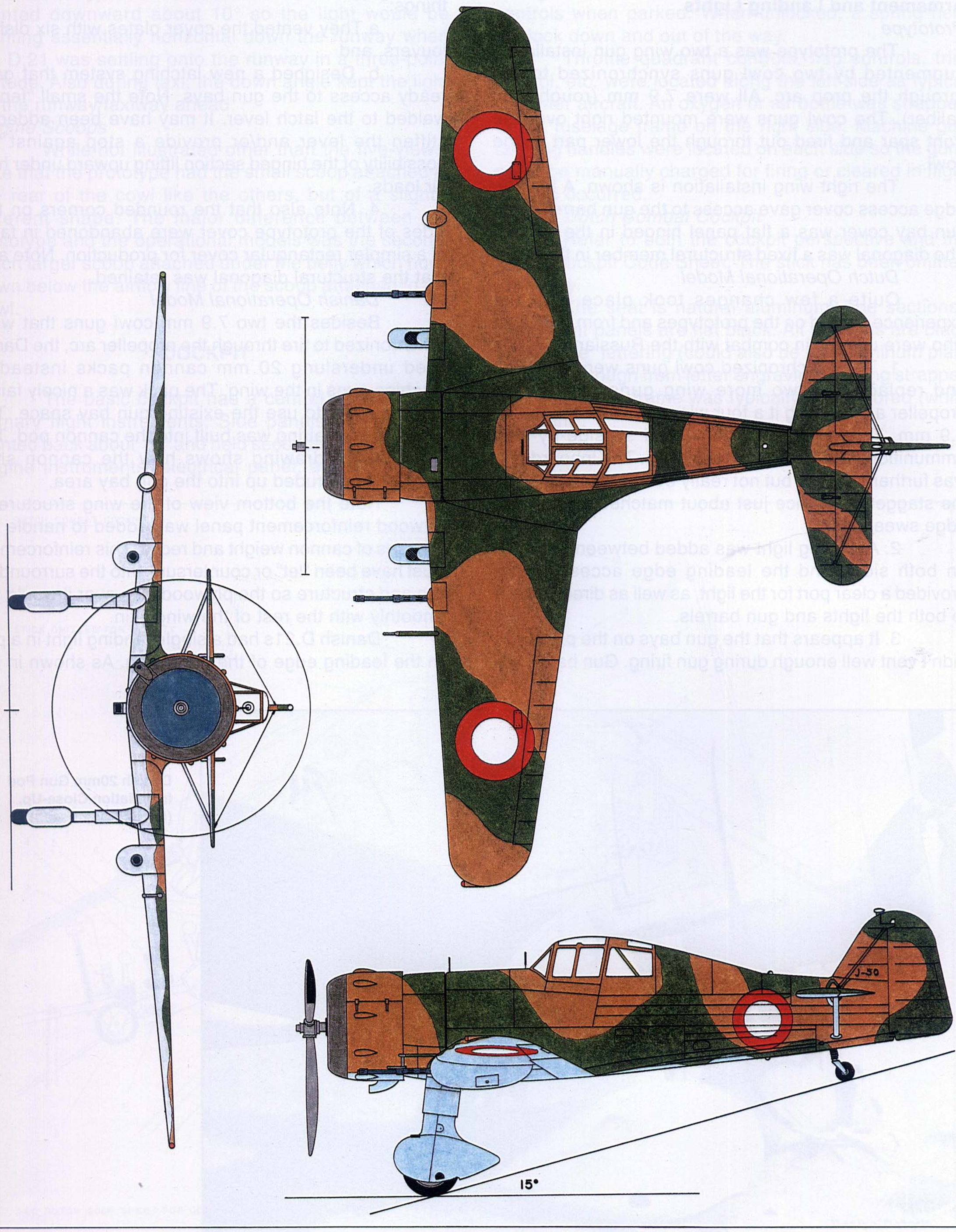
Fokker D.21
Danish Pattern Aircraft



Danish Fokker D.21



Danish Fokker D.21



Danish

The Danes used a conventional fixed ring-and-bead sight not all that different from those used in WWI.

Armament and Landing Lights

Prototype

The prototype was a two wing gun installation augmented by two cowl guns synchronized to fire through the prop arc. All were 7.9 mm (roughly 30 caliber). The cowl guns were mounted right over the front spar and fired out through the lower part of the cowl.

The right wing installation is shown. A leading edge access cover gave access to the gun barrels. The gun bay cover was a flat panel hinged in the middle. The diagonal was a fixed structural member in the wing.

Dutch Operational Model

Quite a few changes took place with the experience gained on the prototypes and from the Finns who were using it in combat with the Russians:

1. The synchronized cowl guns were removed and replaced by two more wing guns outside the propeller arc, making it a four wing gun installation - all 7.9 mm. The guns were staggered so side-by-side ammunition cans could feed the guns. The inboard gun was further forward, but not really evident outside since the stagger difference just about matched the leading edge sweepback.

2. A landing light was added between the guns on both sides and the leading edge access fairing provided a clear port for the light, as well as direct access to both the lights and gun barrels.

3. It appears that the gun bays on the prototype didn't vent well enough during gun firing. Gun bay cover doors were also lost during high speed maneuvers, as commented on by Mr. van Overvest in the Performance Section. As you can see, Fokker designers did two things:

a.They vented the cover plates with six dished louvers, and

b. Designed a new latching system that gave ready access to the gun bays. Note the small "fence" welded to the latch lever. It may have been added to stiffen the lever and/or provide a stop against the possibility of the hinged section lifting upward under high air loads.

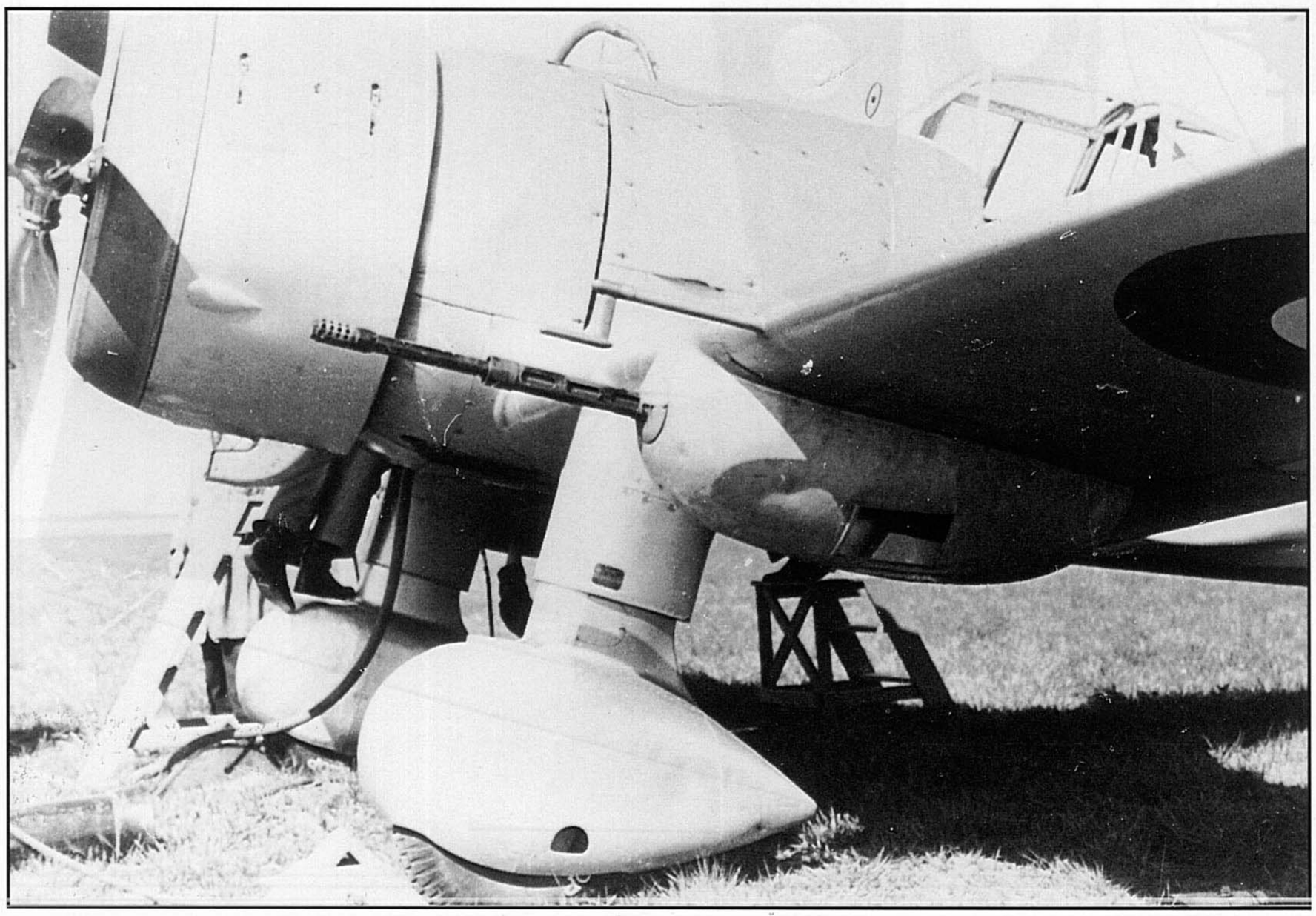
4. Note also that the rounded corners on two sides of the prototype cover were abandoned in favor of a simpler rectangular cover for production. Note also that the structural diagonal was retained.

Danish Operational Model

Besides the two 7.9 mm cowl guns that were synchronized to fire through the propeller arc, the Danes used underslung 20 mm cannon packs instead of machine guns in the wing. The pack was a nicely faired pod designed to use the existing gun bay space. The leading edge fairing was built into the cannon pod. The small profile drawing shows how the cannon shell magazine protruded up into the gun bay area.

Note the bottom view of the wing structure. A plywood reinforcement panel was added to handle the stresses of cannon weight and recoil. This reinforcement must have been "let" or countersunk into the surrounding ribs and structure so the plywood skin over it would fair smoothly with the rest of the wing skin.

Danish D.21s had a single landing light in a pod on the leading edge of the right wing. As shown in the



Danish 20mm Gun Pod Installation Close-Up. (Herluf Rasmussen)

bottom view of the wing structure, the leading edge was cut out and the structure behind it reinforced to handle the heavier type of installation. The landing light was pointed downward about 10° so the light would be pointing essentially horizontal down the runway when the D.21 was settling onto the runway in a three-point attitude. Also during taxi, the down angle kept the light on the runway/taxiway ahead.

Engine Scoops

While not illustrated other than the five-views, note that the prototype had the small scoop attached at the rear of the cowl like the others, but of a slightly different shape. The major difference between the prototype and the operational models was the second, much larger scoop attached under the belly which hung down below the airflow line of the scoop attached to the cowl.

COCKPIT

The basic cockpit had a central panel holding primary flight instruments. Side panels on each side slanted back about 15° and held secondary instruments, engine instruments, electrical panel, etc. The panels were flat black and instrument faces were typically black with white lettering and needles. A centrally located spring-loaded control lock locked the elevator/aileron controls when parked. When unlocked, a spring held the lock down and out of the way.

Throttle quadrant controls, flap controls, trim control, etc. were located along the left side as typical in fighter aircraft. An oxygen or air bottle was strapped to the fuselage frame on the right side. Machine gun cocking handles were located on each side so the guns could be manually charged for firing or cleared in flight if a jam occurred.

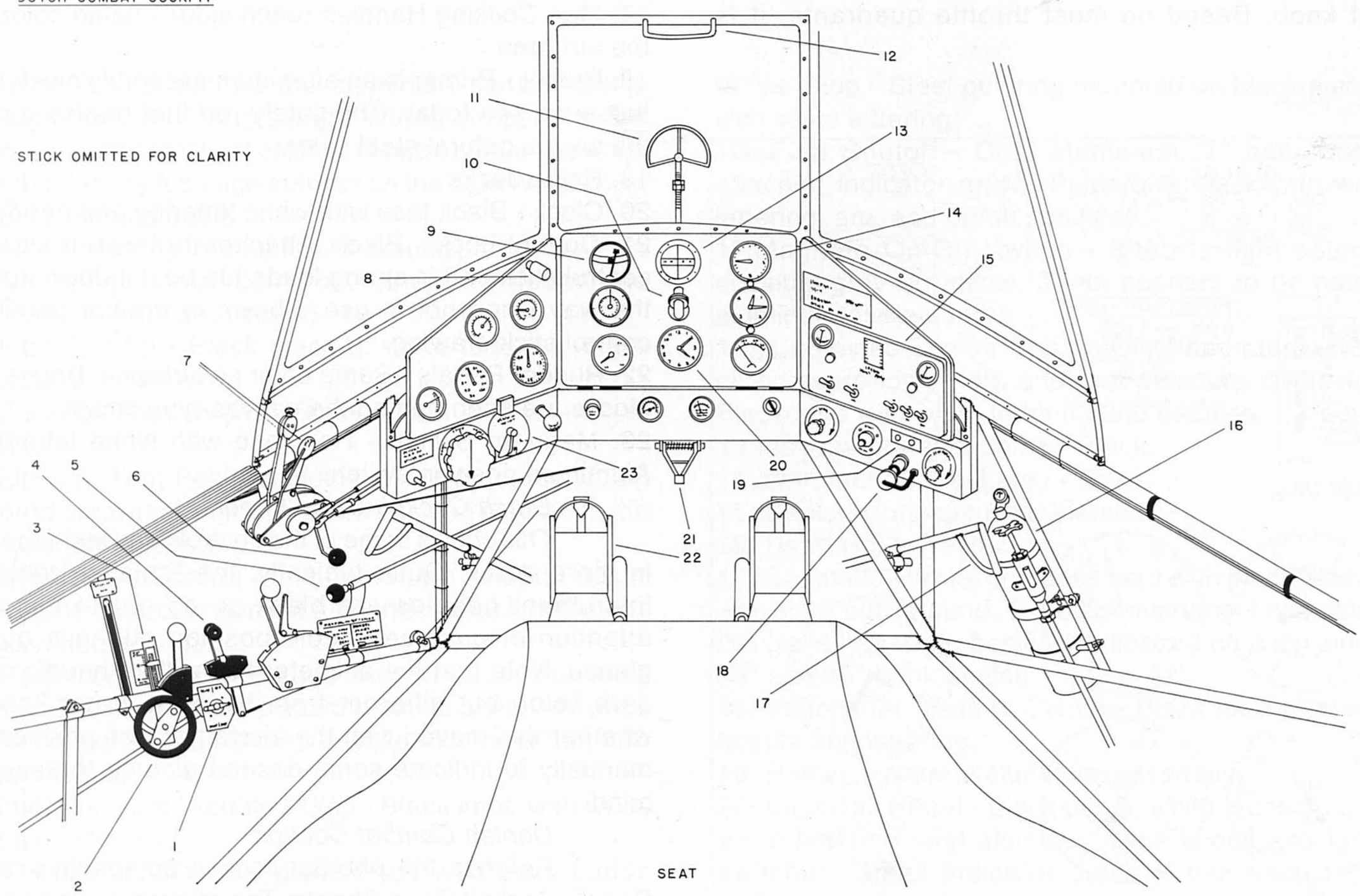
Dutch Combat Cockpit

Refer to both the cockpit perspective and the Dutch Cockpit Code Sheet. The stick has been omitted for clarity.

The seat is natural aluminum. The sectioned instrument panels are flat black. All placards are black with "white" lettering (could also be the aluminum plate showing through from letter engraving). Wiring strapped to the fuselage frame was typically light colored (white or cream).

DUTCH COMBAT COCKPIT

STICK OMITTED FOR CLARITY

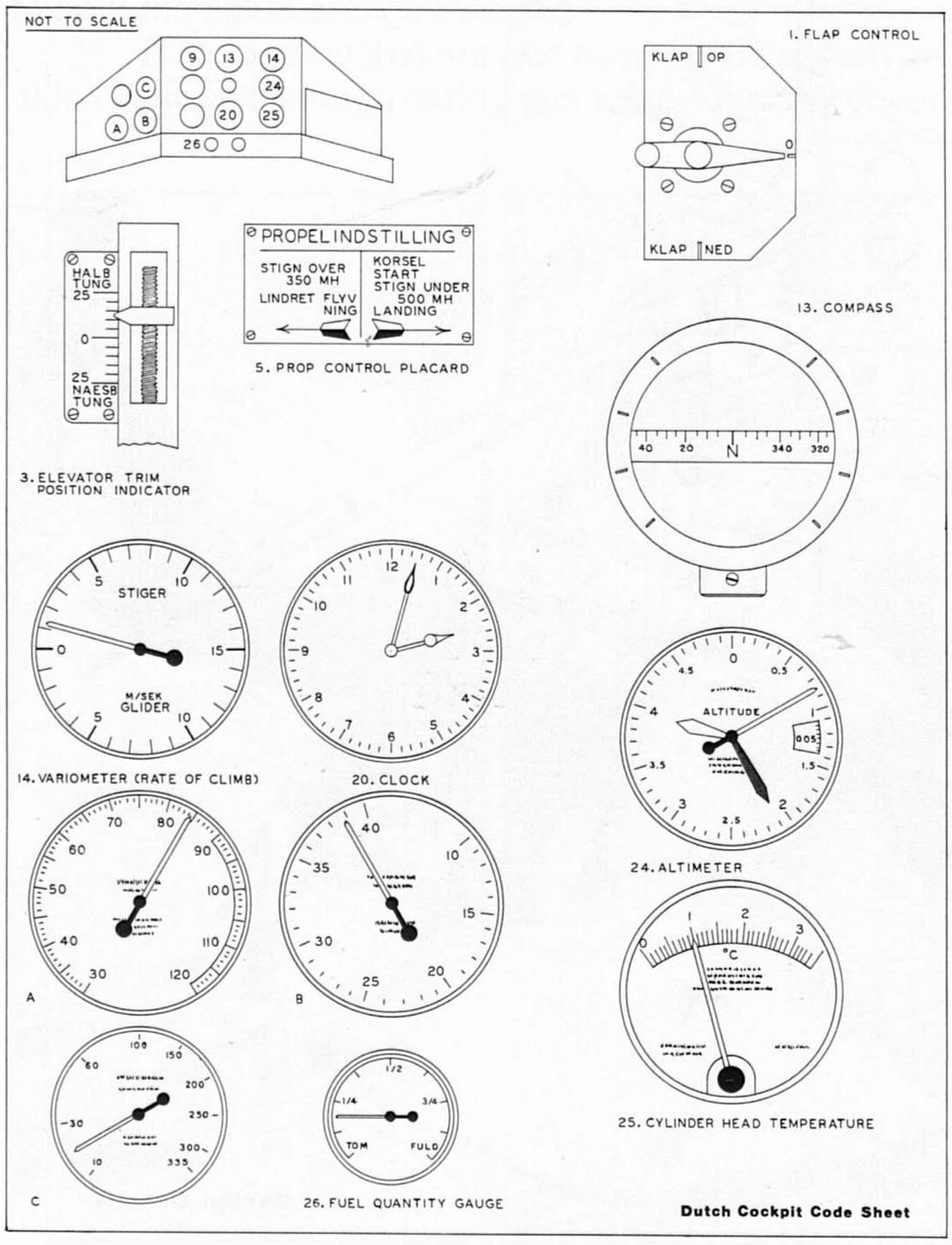


SEAT

SEE DUTCH CODE SHEET FOR COCKPIT DETAILS

Following the numbers around the cockpit for known components (see Code Sheet for added unknown instrument details):

1. Flap Control - Black placard, white lettering, black knob, silver center.
2. Elevator Trim Wheel - Black wheel with aluminum spoke.
3. Elevator Trim Position Indicator - (see Code Sheet for enlarged details). Gray or aluminum colored screwjack unit with black position card to left with white lettering.
4. Hot/Cold Air Control - While known to be called as such, it is not known whether this is an engine control or cockpit air control. Black two-piece knob with black unit.
5. Propeller Control - Black knob with white or aluminum center. Based on current propeller controls, one would surmise that it was screwthread adjustable with a quick release for vernier setting control. The prop setting placard below is black with white lettering and arrows outlined in white with the lower "feather" filled in white.
6. Fuel Pressure Wobble Pump - Black knob with white dot and lettering.
7. Power Controls - Control to the left has a push-button release and is a dark colored split knob. Control knob to the right is labeled "GAS" in white on a dark colored split knob. Based on most throttle quadrants, it is surmised that the push-button control is the throttle and the other labeled "GAS" is the mixture control. Throttle knobs are typically black and mixture controls red. The discs separating quadrant sections are natural aluminum, as are the control handles.
8. Instrument Panel Lamp - Black.
9. Turn and Bank Indicator - Black face, white background on ball tube, and white needle.
10. Instrument Panel Lamp - Black.
11. Dutch Gunsight (rear element).
12. Hand Hold - Yellow.
13. Compass - White compass card with black lettering with black background. The black instrument ring around the glass has white position indicators on each side at 15 ° and 45° bank angels.
14. Variometer (Rate of Climb) - Black face with white needle and lettering.
15. Electrical Panel - Black panel, white faces on dials, white lettering, and toggle switches natural aluminum or steel. What appears to be a square instrument top center is a rivet pattern. This is detailed on the Danish Code Sheet.
16. Oxygen or Air System - Bottle is red or black as is the "+" control handle. The pressure gauge has a black face with white lettering and needle. The two lower clamps are the same color as the airframe.
17. Gun Cocking Handles (each side) - same color as the airframe.
18. Primer - Primer is an aluminum assembly much like those we see today. The safety rod that rotates out of the way is natural steel color.
19. Radio Jacks
20. Clock - Black face with white lettering and needles.
21. Control Lock - Black. Attaches to forward side of control stick and is spring loaded to hold it down out of the way when not in use. Shown in greater detail in control stick drawing.
22. Rudder Pedals - Same color as airframe. Brake toe blocks are seen behind the canvas-type straps.
23. Magneto Switch - Red face with white lettering. Aluminum position switch.



Dutch Cockpit Code Sheet

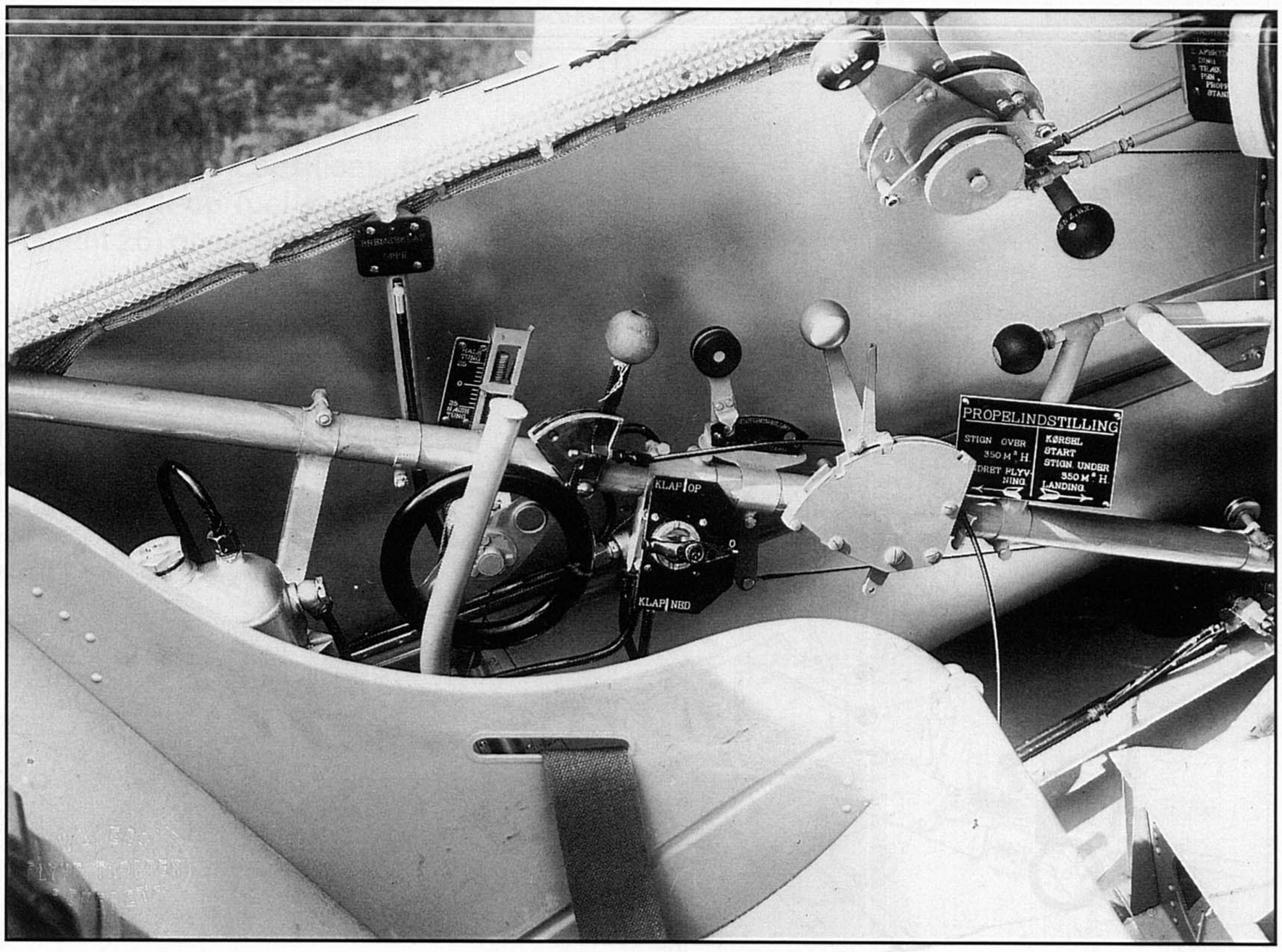
This shows some of the controls and instruments in more detail. Quite typically, the "balance" end of instrument needles are black so as not to distract attention or confuse needle position during a quick glance. Note that the altimeter has a third needle of a dark color, but different from black. It is not known whether this moved with the aircraft or was positioned manually to indicate some desired altitude to keep in mind.

Danish Combat Cockpit

Refer to the photos, cockpit perspective, and Danish Cockpit Code Sheets. The stick was omitted for clarity.

The seat is of aluminum construction painted to match the cockpit interior. The sectioned instrument panels are flat black. All placards are black with white

Danish Cockpit Left Side.
(Lennert Ege)



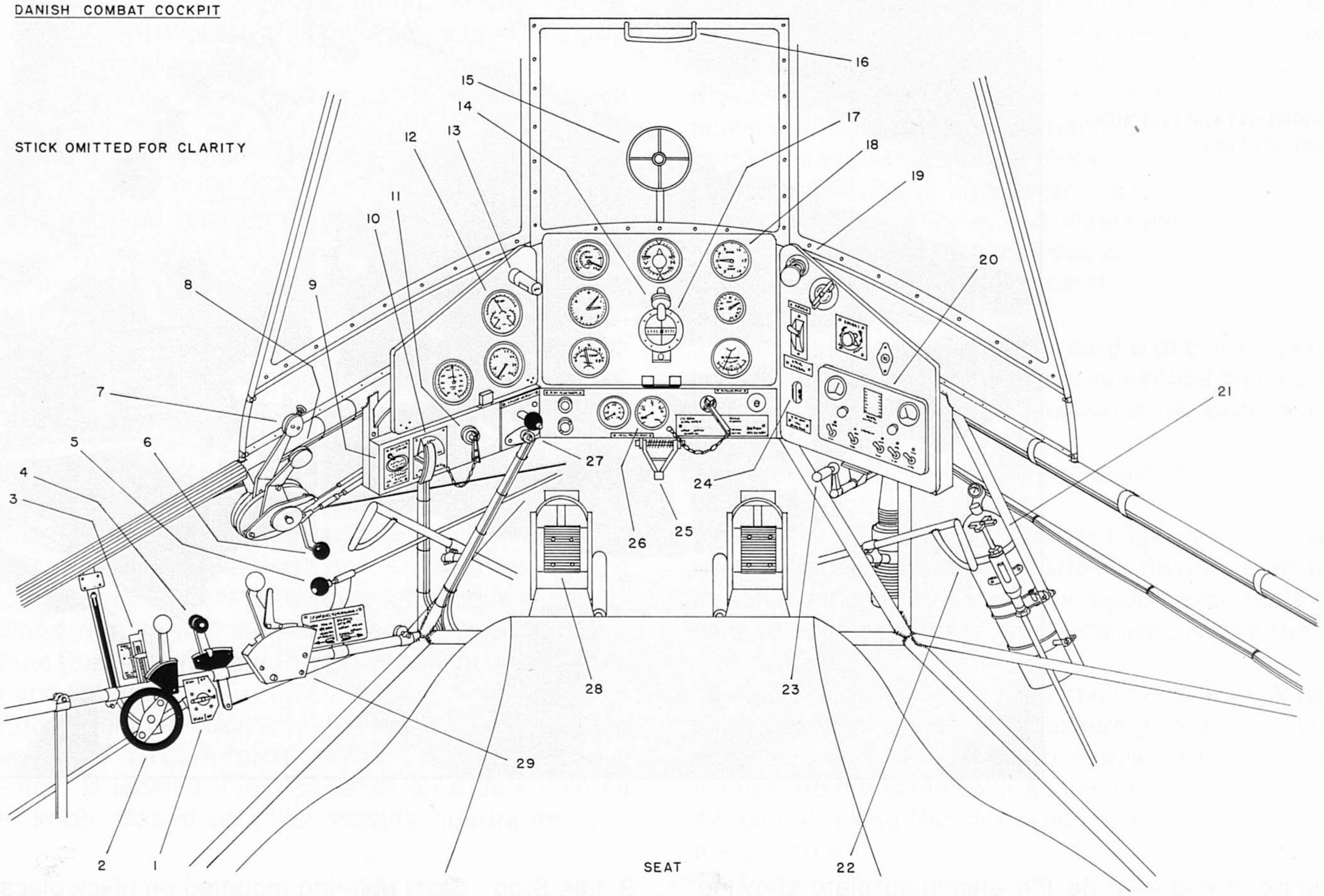
lettering (could also be the aluminum plate showing through from letter engraving). Wiring strapped to the airframe is typically light colored (white or cream), except that the dummy fuselage stringer on the right holds silver colored braided cable.

Following the numbers around the cockpit for known components (see Code Sheet for added and unknown instrument details):

1. Flap Control - Black placard, white lettering, black knob, silver center.
2. Elevator Trim wheel - Black wheel with aluminum spoke.
3. Elevator Trim Position Indicator - Gray or aluminum colored screwjack unit with black position placard to the left with white lettering.
4. Hot/Cold AirControl - It is not known whether this is an engine control or cockpit air control. Black two-piece knob with black unit.
5. Prop Control - Black knob with white or aluminum center. The prop setting placard below is black with white lettering and arrows outlined in white with lower “feather” filled in white.
6. Fuel Pressure Wobble Pump - Black knob with white dot and lettering.
7. Throttle - Black two-piece knob with push-button release. Handle is natural aluminum, as are the discs separating quadrant elements.
8. Mixture Control - Red two-piece knob with natural aluminum handle and “GAS” in white.
9. Idle Stop - Steel pull-ring mounted on black placard with white lettering.
10. Fuel Shutoff - Cast aluminum “T” handle with attached indicator arrow. Placard is black with white lettering, arc, and on/off positions.
11. Magneto On/Off Switch - Knob is light colored, possibly gray or yellow. Chain appears to be natural aluminum or steel links.
12. Combined Engine Group - Oil temperature on top, oil pressure lower left, and fuel pressure lower right. Black face with white lettering and needles.
13. Instrument Panel Lamp - Black.
14. Instrument Panel Lamp - Black.
15. Danish Gunsight (rear element)
16. Hand Hold - Yellow.
17. Compass - White compass card with black lettering with black background. The black instrument ring around the glass has white position indicators on each side at 15° and 45° bank angles.
18. Variometer (Rate of Climb) - Black face with white needle and lettering.
19. Primer - Natural aluminum assembly.
20. Electrical Panel - Black panel, white faces on dials, white lettering, and aluminum/steel knobs and toggle switches. Small indicator bulbs above each toggle switch.
21. Oxygen or AirSystem - Bottle is red or black as is the “+” control handle. The pressure gauge has a black face with white lettering and needle. The two lower clamps are the same color as the airframe.

DANISH COMBAT COCKPIT

STICK OMITTED FOR CLARITY



SEE DANISH CODE SHEET FOR COCKPIT DETAILS

22. Gun Cocking Handles (each side) - Same color as airframe.
23. Crank Handle For Startmagneto - An all-steel/aluminum crank system mounted under the panel in black bracket. Aluminum "thermos bottle" looking device under the panel was a vacuum equalizer for the variometer instrument and vacuum system. Similar ones were carried on German-built Klemm Kl.35 trainers purchased by the Swedish government.
24. Radio Jacks - Indented plug-in holes.
25. Control Lock - Black. Attaches to forward side of control stick and is spring loaded to hold it down out of the way when not in use. Shown in greater detail in control stick drawing.
26. Fuel Quantity Gauge - Indicates Empty, 1/4, 1/2, 3/4, and Full with intermediate tick marks in white on black face. White needle.
27. Electric Start - Knob could be red with white or steel push button in black housing underneath.
28. Rudder Pedals - Frame and pedals are same color as airframe. Ridged black rubber pads are screwed or riveted to pedals. Stirrup straps are medium brown leather with buckles much like a belt buckle. Brake toe pads are tubular/cylindrical on operating posts and same color as airframe.
29. Function Unknown - Same color as airframe. Pointed out because one photo shows this unit re-positioned to lie "flat" up under the side panel plex. The control lever was pointed aft such that it was about even with the rear edge of the side windscreen/forward fuselage panel.

Danish Cockpit Code Sheet

This shows some of the controls and instruments in more detail. Quite typically, the "balance" end of the instrument needles was black so as not to distract attention or confuse needle position during quick glances. While some instrument details could be presented, instrument function remains unknown (i.e., those without titles).

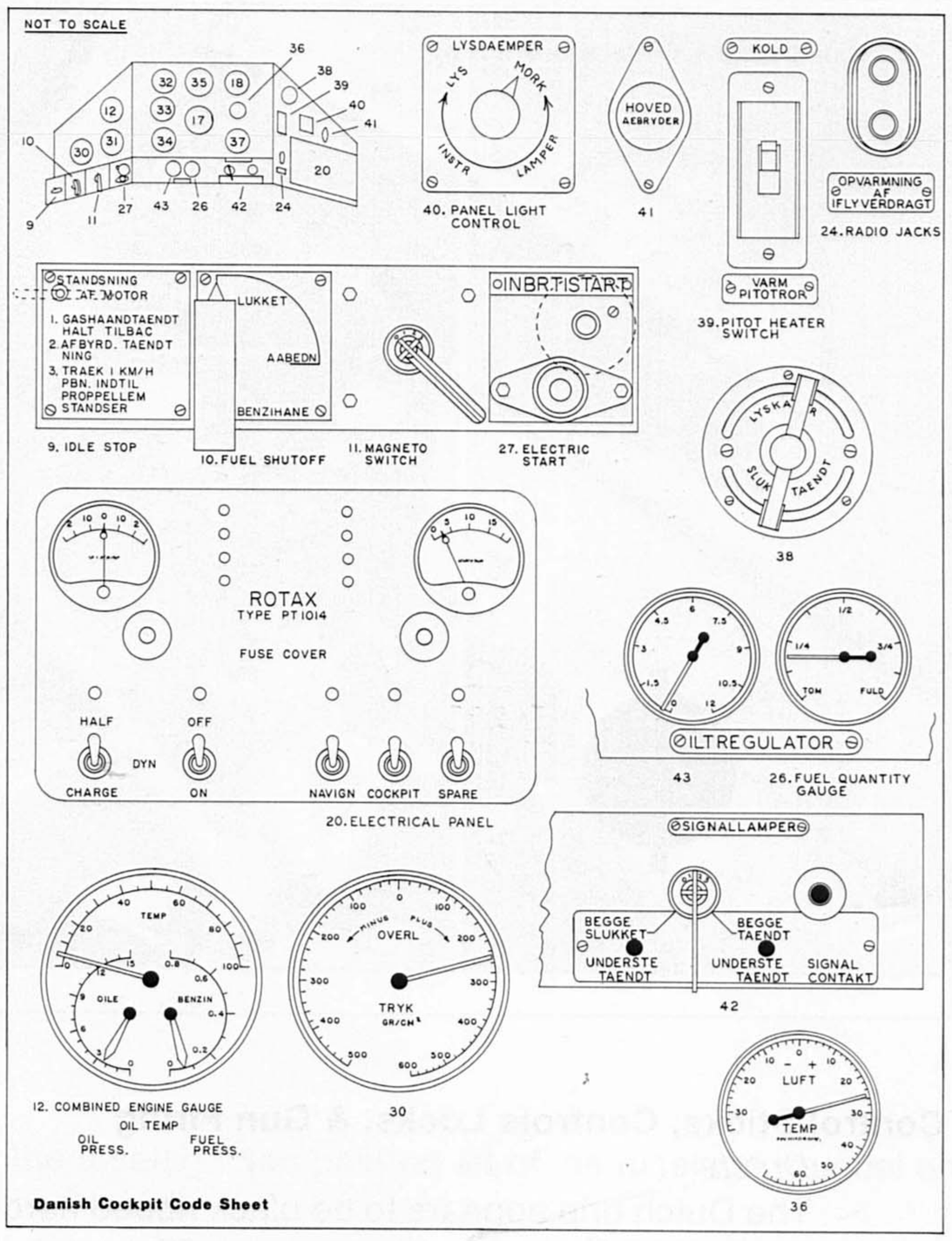
Instrument 35 - This appears to be some type of gyro-driven bank angle indicator or heading indicator tied into the radio/navigation system. The instrument face is black, as is the large center disc which covers the top and bottom needles bases.

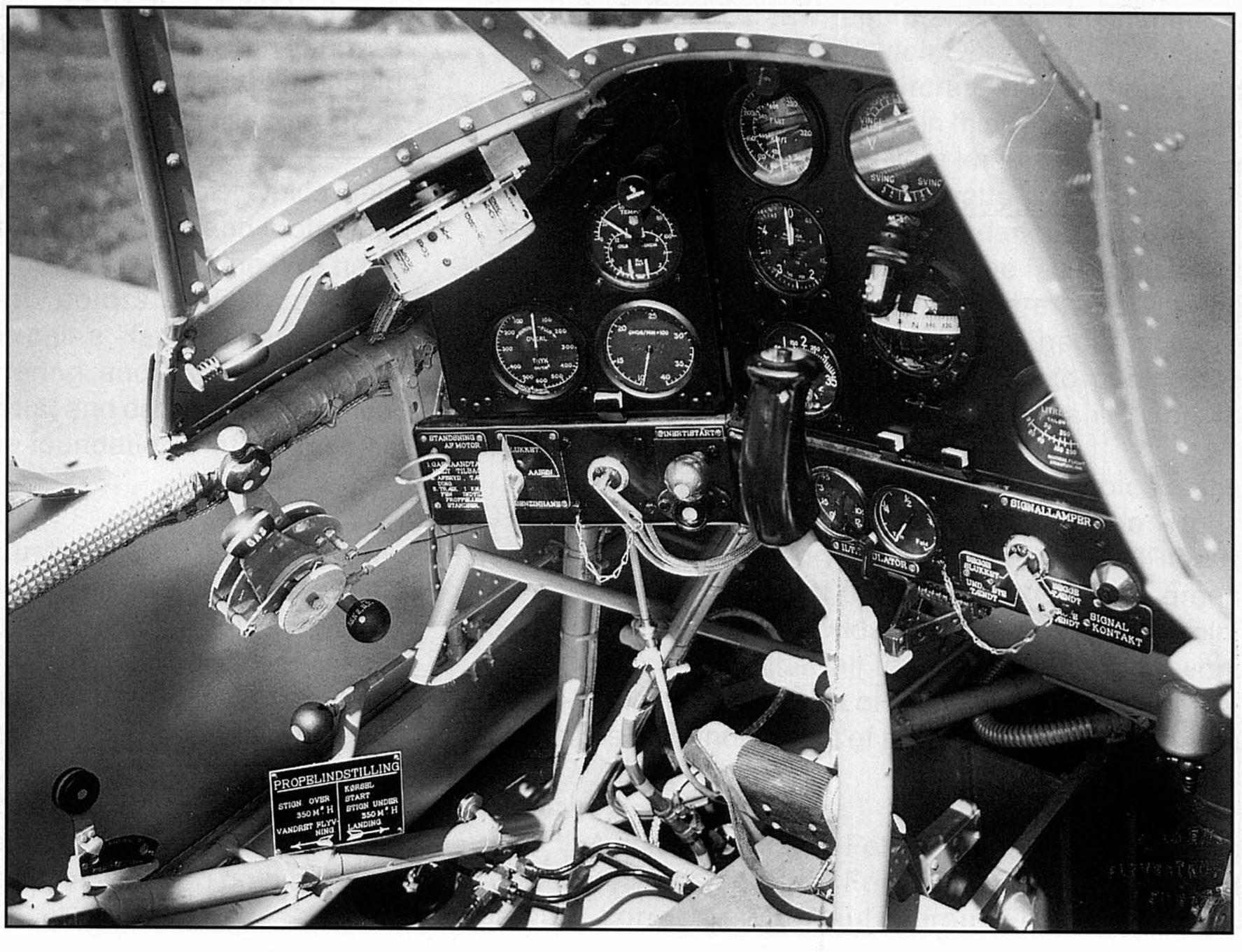
Solid white triangular indicators are shown covering the zero positions top and bottom. It is suspected that the two outer arrows are either placed manually or driven by the instrument while the center

arrows follow the aircraft's motion so heading/alignment differences become obvious for correction.

Instrument 37 - This instrument has an all-white needle on a black face. It is related to fuel quantity that shows levels during both parked and flight positions. It is not known whether this is a back-up fuel quantity gauge (i.e., back-up to Instrument 26) or serves another purpose.

Control 42 - The two black dots appear to be small push-buttons on the placard. They could be used to hold the switch in those positions. It appears that the switch was used to select a signal lamp position (e.g., wing tip light) and the large push button to the right would activate the lamp, permitting a coded signal to be "tapped out" in flight.



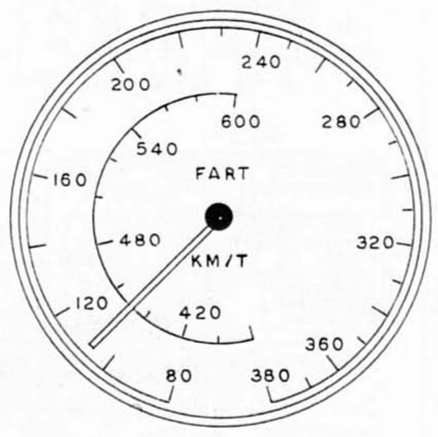


Danish pattern aircraft cockpit, left side. (Lennert Ege)

Danish Cockpit Code Sheet (cont)

NO.17- COMPASS. SEE DUTCH NO.13.
NO.18- VARIOMETER. SEE DUTCH NO.14.
NO.33-ALTIMETER. SEE DUTCH NO.24.

31



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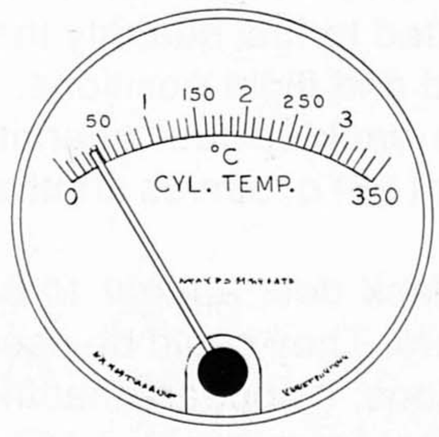
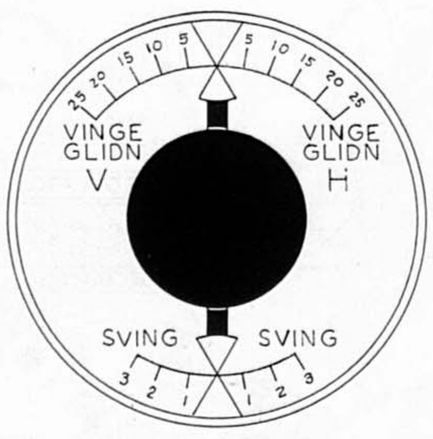


34. CYLINDER HEAD TEMPERATURE



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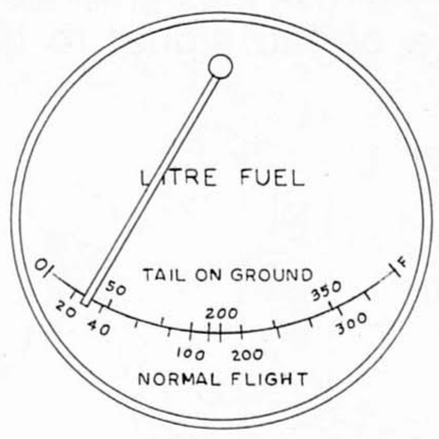


37

Control Sticks, Controls Locks, & Gun Firing

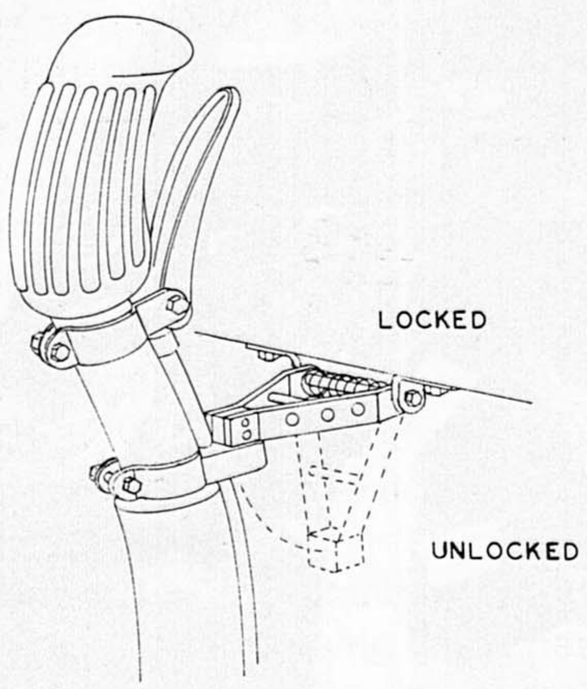
Dutch

The Dutch grip appears to be black ribbed hard rubber, much like a motorcycle grip, but with a pistol grip shape. The control lock (not seen on the prototype) seems to have been added as an afterthought in the design by using a clamped fitting. The spring-loaded gun firing trigger was also clamped to the stick and firing commenced when the trigger was squeezed aft.

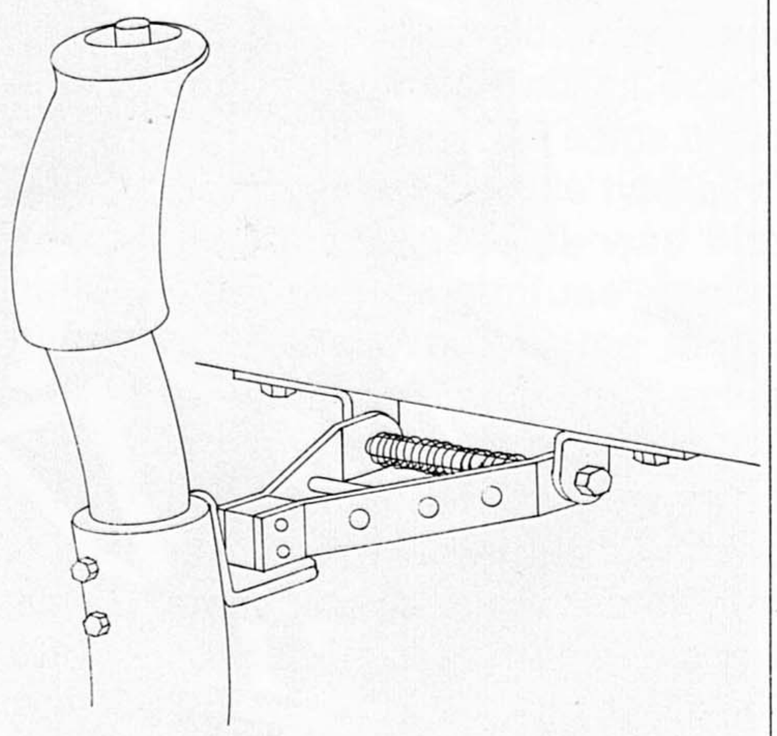
Danish

The Danish control lock fitting was a steel or aluminum angle bolted to the stick. The pistol grip was either smooth molded rubber or early black plastic. The grip has a shiny appearance typically seen when either material has been worn smooth by a lot of handling. The guns were fired using a thumb button on top of the stick. The firing button is in a recess to prevent accidental firing. It could not be determined if there was a type of gun selector switch to enable the pilot to select machine guns, cannon or both.

CONTROL STICKS, CONTROL LOCKS, & GUN FIRING



DUTCH



DANISH

Design Details

Danish pattern aircraft cockpit (Lennert Ege)

COLOR SCHEMES

The colored artwork in this monograph is as accurate as we could make it with the information available for all the aircraft covered. Fokker Aircraft provided paint chips for the standard camouflage scheme used on their full size D.21 replica. Federal Standards are referenced to help pinpoint the shades should the printing process cause any shade deviations. The Berol Prismacolor pencils used to create the artwork are also referenced by number and shade as a further guide to color accuracy. A color key is also provided with color samples and both color references for each sample.

No attempt has been made to depict typical field wear (e.g., paint chipping around panels and footsteps) or operational stains like exhaust or gun firing. We have concentrated on accurate colors and shade and presented what you might call a "factory fresh" paint job. We leave the "weathering and wear" to aircraft artists, serious replica builders, and detailed scale model builders to embellish on the foundation that we present here.

Fokker D.XXI

All Dutch aircraft carried Fokker's logo "Fokker D.XXI Mercury VIII" in white on the vertical stabilizer as seen in the colored photos of Fokker's full size D.21 replica. The Danish pattern aircraft carried it in black on the aluminum paint scheme, whereas the operational aircraft in camouflage colors didn't carry it at all.

D.21 Prototype FD-322

This aircraft was dark olive green overall with the red-white-blue tail tricolor and national roundel with an orange center. FD-322 was in white on both sides of the fuselage and painted aft of the fuselage roundel on both sides.

The main thing to note on D.21s is the cowl nose ring. Because the Bristol Mercury used a front exhaust collector ring built into the nose of the cowl, it picked up the typical exhaust pipe color . . . sort of rusty stainless with heat coloration blended in. The Danes called it "burnt metal" for modeling purposes.

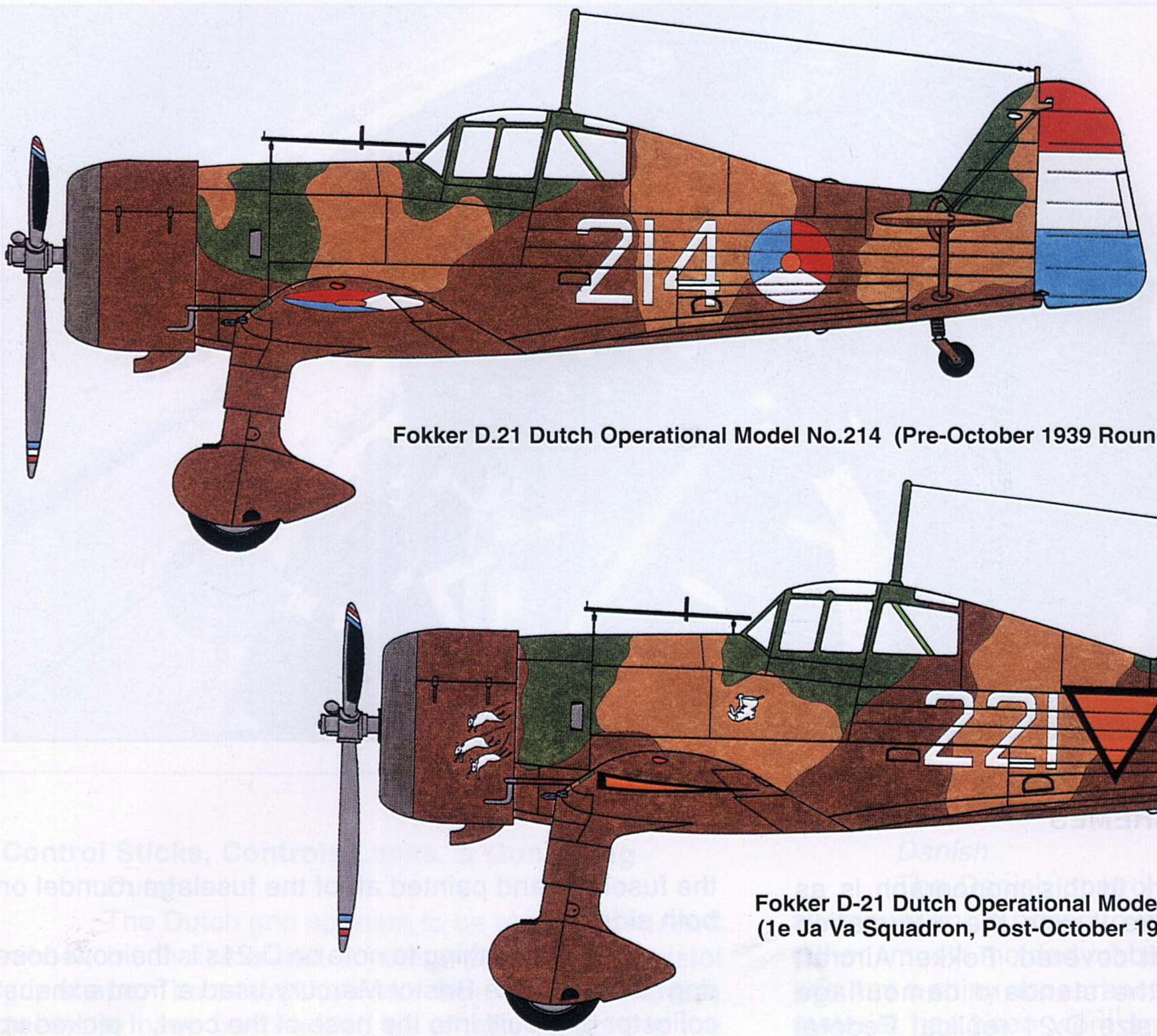
Pre-October 1939 Dutch Operational Models

Like most air forces, aircraft were camouflaged with a specified color pattern . . . in this case dark reddish brown, dark olive green, and light khaki topside. Unlike most nations of the period, the bottom side of D.21s was NOT light or sky blue. It was the dark reddish brown. The camouflage pattern appears to be fairly consistent up through aircraft No. 220, and then started varying around the general pattern. As war became more imminent, emphasis most likely shifted to getting the aircraft painted and marked rather than trying to duplicate the exact pattern.

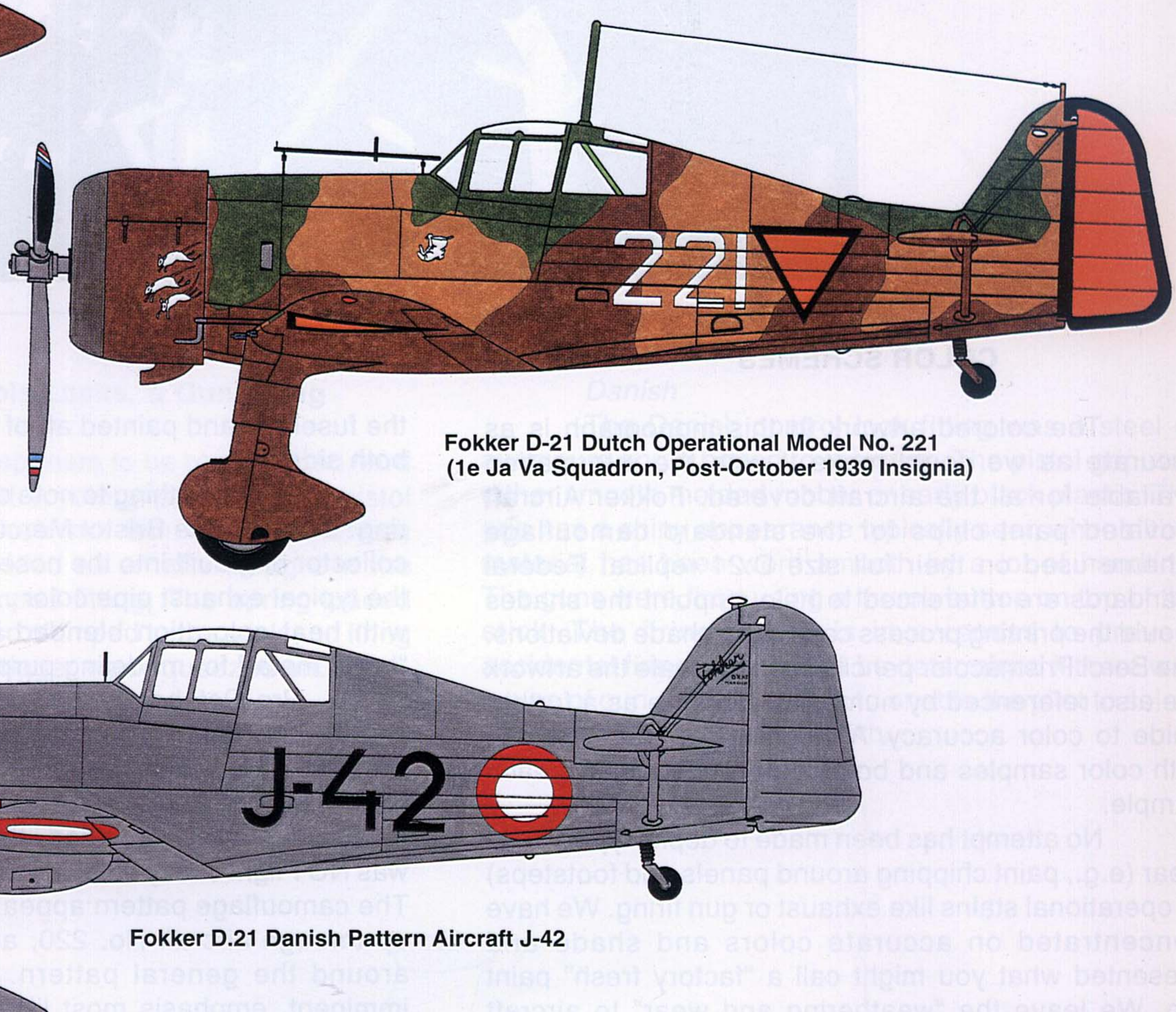
When Fokker Aircraft sent colored photos of the D.21 replica, a "startling discovery" was made - their engine cowl was painted THE SAME REDDISH BROWN color as the underside of the aircraft, NOT olive green like all the previous worldwide references up to this point in time. This meant that all the colored Dutch artwork had to be done over in light of the new evidence - which, after all, is the whole point of historical aircraft research

Accuracy

A quick check with Fokker Aircraft to confirm this "discovery" revealed that Fokker's replica was indeed painted correctly. Mr. Paul Moreu, Fokker Aircraft's

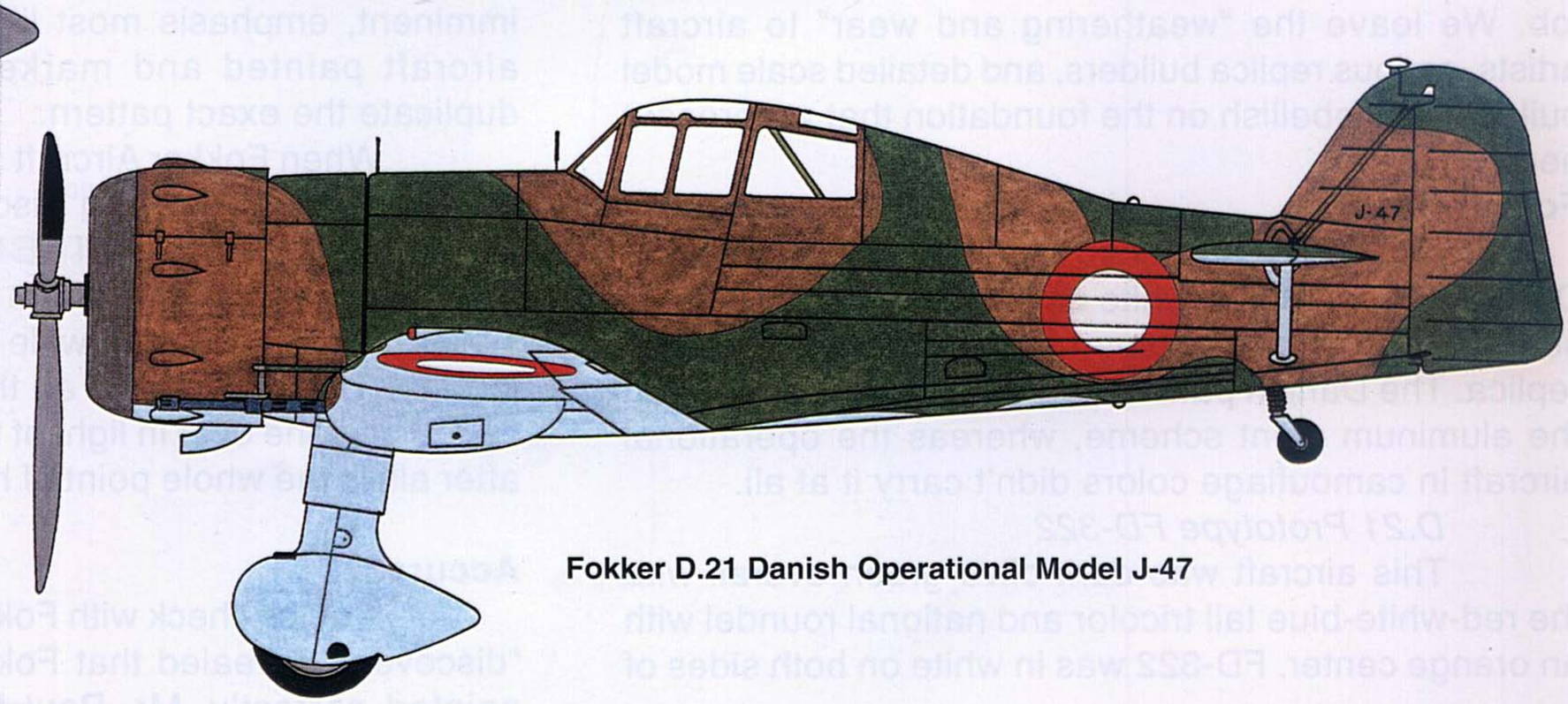


Fokker D.21 Dutch Operational Model No.214 (Pre-October 1939 Roundel)



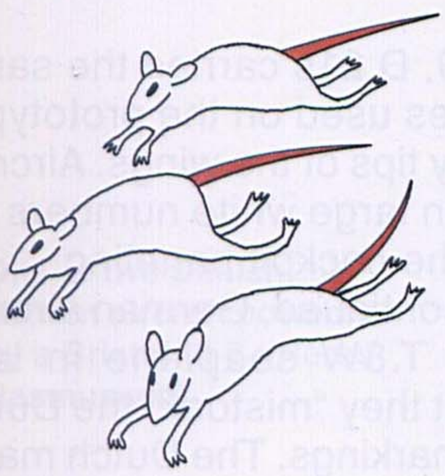
Fokker D-21 Dutch Operational Model No. 221
(1e Ja Va Squadron, Post-October 1939 Insignia)

Fokker D.21 Danish Pattern Aircraft J-42



Fokker D.21 Danish Operational Model J-47

D. 21 Replica, also shown on cover. (Fokker Aircraft)



Three White Mice

Boots With Points

1e JaVa Squadron Insignias

Insignia of 1e JaVa Squadron

Color Key

PC: Berol Prismacolor

FS: Federal Standard No.595a

- PC949 Silver FS17178
- PC1028/PC949 Medium Heavy Bronze Over Silver
- PC1023 Cloud Blue FS35550
- PC918 Orange FS22510
- PC926 Crimson Red FS21105
- PC904 Light Cerulean Blue FS35250
- PC911 Olive Green FS34138
- PC948/PC1034 Medium Heavy Sepia Over Goldenrod FS30257
- PC948/PC945 Medium Heavy Sepia Over Sienna Brown FS20100

Color Key

Pre-October 1939
Dutch markings
(Fokker Aircraft)

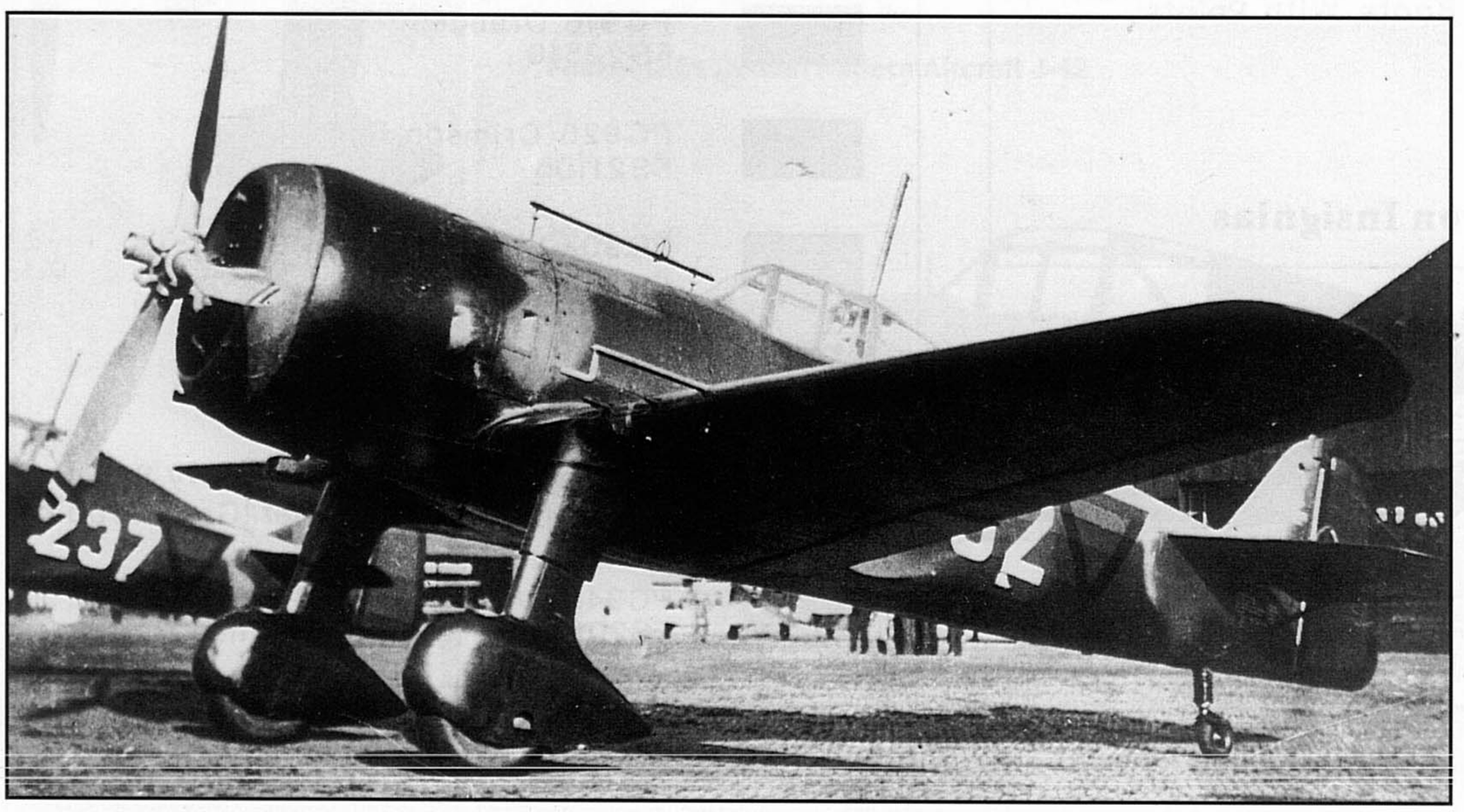
Corporate Historian (to whom the author is deeply indebted) was first given to understand that D.21s left the factory with BOTH green and brown cowlings so both schemes were correct. Almost immediately after notifying the author of this "fact", an expert on Royal Netherlands Air Force external paint schemes provided new information that cowlings were painted ONLY brown. Such is the nature of historical research. This necessitated re-doing all the Dutch artwork and even Fokker's documentation had to be corrected. As a consequence of this collaboration, you have the most accurate, up-to-date color information in hand in this monograph.

The artwork for aircraft Nos. 214 and 215 reflect the earliest paint schemes having had the advantage of photos of both sides of these aircraft. Aircraft No. 221 documents the paint scheme on Fokker Aircraft's replica. Aircraft No. 237 reflects a later paint scheme. The right side of 237 documents that seen on a good side photo of No. 237, whereas the left side is a fairly logical composite of aircraft Nos. 232 and 233 in what appears to be the same series. No good photo of No. 237's left side is known to exist as the international situation was getting too touchy to waste time photographing aircraft getting ready for or already involved in a shooting war.

When you examine black and white photos of the D.21 in different sun positions, the shade on the cowl is darker than the dark one behind it, leading to the "conclusion" that the darker shade was green rather than brown. It appears that when the particular 1939-1940 film used to capture wartime photos was developed, it leaned toward the redder side and brown came out looking darker than green on black and white photos. The U.S. had an early 1930 film that appeared to reverse insignia colors when developed as black and white photos, so this erroneous "conclusion" is not too surprising.

Up until October 1939, D.21s carried the same national roundel and tail stripes used on the prototype. Wing roundels were at the very tips of the wings. Aircraft serial numbers were painted in large white numbers on each side starting just aft of the cockpit paneling.

As the "Phoney War" continued, German aircraft shot down a Dutch Fokker T.8W seaplane in late September 1939, claiming that they "mistook" the Dutch orange "bullseye" as English markings. The Dutch made the quick decision to change insignia to prevent further "mistakes". Needles to say, it took a finite time before all aircraft were converted to the new orange national markings.



Post-October 1939
Dutch markings.
(Fokker Aircraft)

Post-October 1939 Dutch Operational Models

As a consequence of the insignia change decision, D.21s were repainted with an inverted orange triangle (i.e., flat part of the triangle on top or facing forward on the wings) with a black border for the fuselage and wings, and the entire rudder was painted orange and surrounded with a black border. The standard three-color camouflage scheme was left untouched.

The only known Dutch squadron insignias are also illustrated in this monograph.

Danish D.21s

J-41 and J-42 Pattern Aircraft

Both aircraft were painted aluminum overall. Both aircraft carried the red-and-white Danish roundel on the fuselage and wings. The Fokker factory logo tail markings were in black. J-41 and J-42 were painted on the fuselage sides in large black characters just aft of the cockpit paneling. Because these aircraft also used the Mercury engine with the front exhaust collector ring, Danish aircraft had the same color nose ring on the cowl.

Operational Models

Danish D.21s also used a prescribed two-color camouflage pattern on the upper surfaces . . . khaki and olive green. While the pattern on each wing differed, the pattern on each side of the aircraft was almost the same. Whereas the Dutch D.21s were painted brown on the underside, Danish D.21s carried the typical light blue color used by most nations.

Danish red-and-white roundels were carried in the same fuselage and wing locations as on the 2 pattern aircraft. Instead of large side numbers, operational aircraft numbers were carried in fairly small black numbers located about halfway back on the vertical fin just above the horizontal stabilizer. As with the pattern aircraft, the operational models had the same color exhaust collector cowl nose ring.

Finnish D.21s

These aircraft, including the seven built for the Finns by Fokker Aircraft along with the Dutch and Danish production, will be covered in Volume II. The author felt it worthwhile to separate these aircraft since there are a large number of camouflage schemes, squadron markings, and personal markings - all very colorful aircraft despite the basic intent to camouflage them.

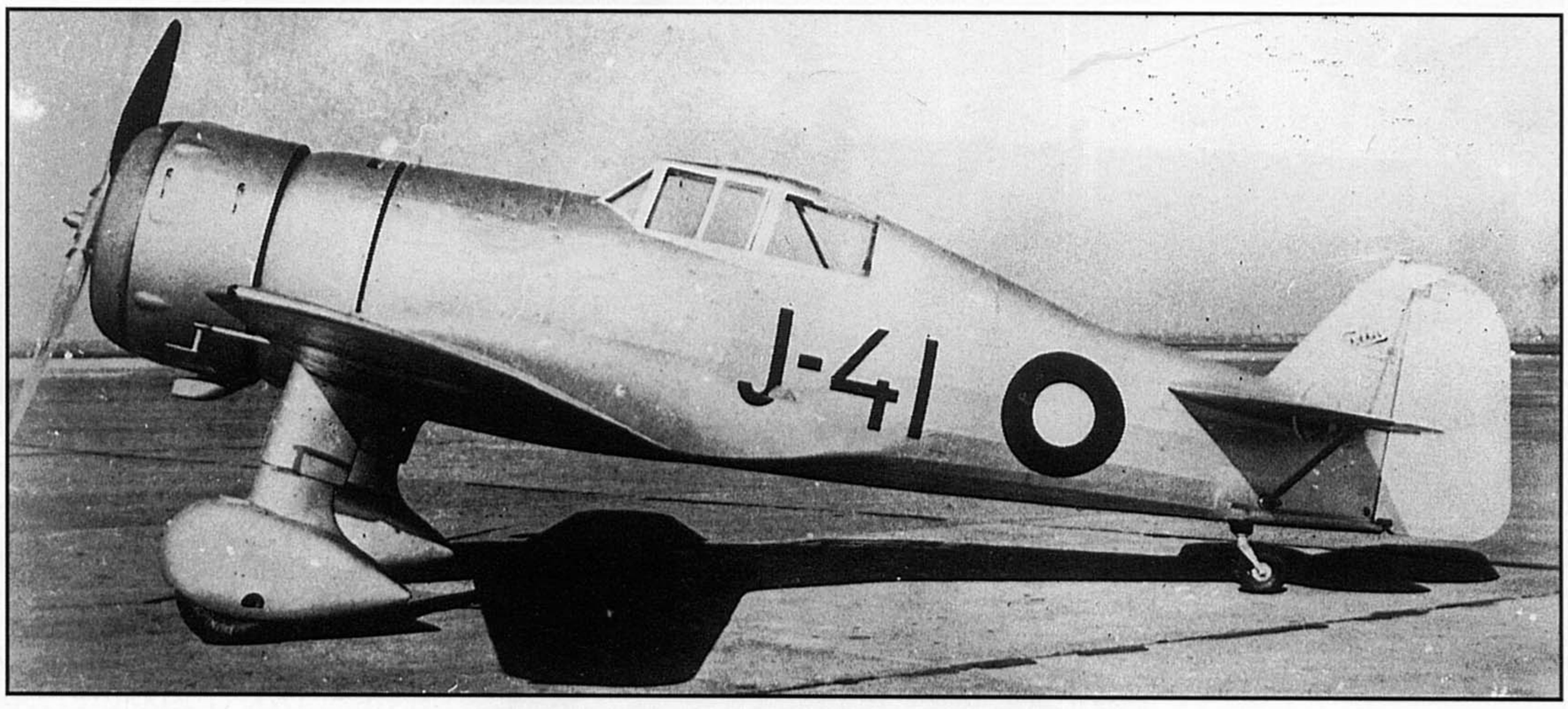
COCKPITS

Instrument Panels

From what can be ascertained from photos and the memories of those who flew the D.21, the segmented instrument panel was flat black. No indication of using a crinkled paint technique could be found.

Dutch Cockpit Interiors

The D.21 used a steel tube frame as the primary load carrying structure. As any aircraft manufacturer would do, it was corrosion protected with some type of paint, with zinc chromate almost universally accepted as the best. As you may well know, zinc chromate varies in shade from a light yellow to a dark green, even within the same air service, country, and manufacturer. Aluminum parts, such as the inside of the fuselage panels, canopy frames, seat, etc. were also protected in the same manner. It is surmised that the controls were also painted in a like manner as photos give that impression.

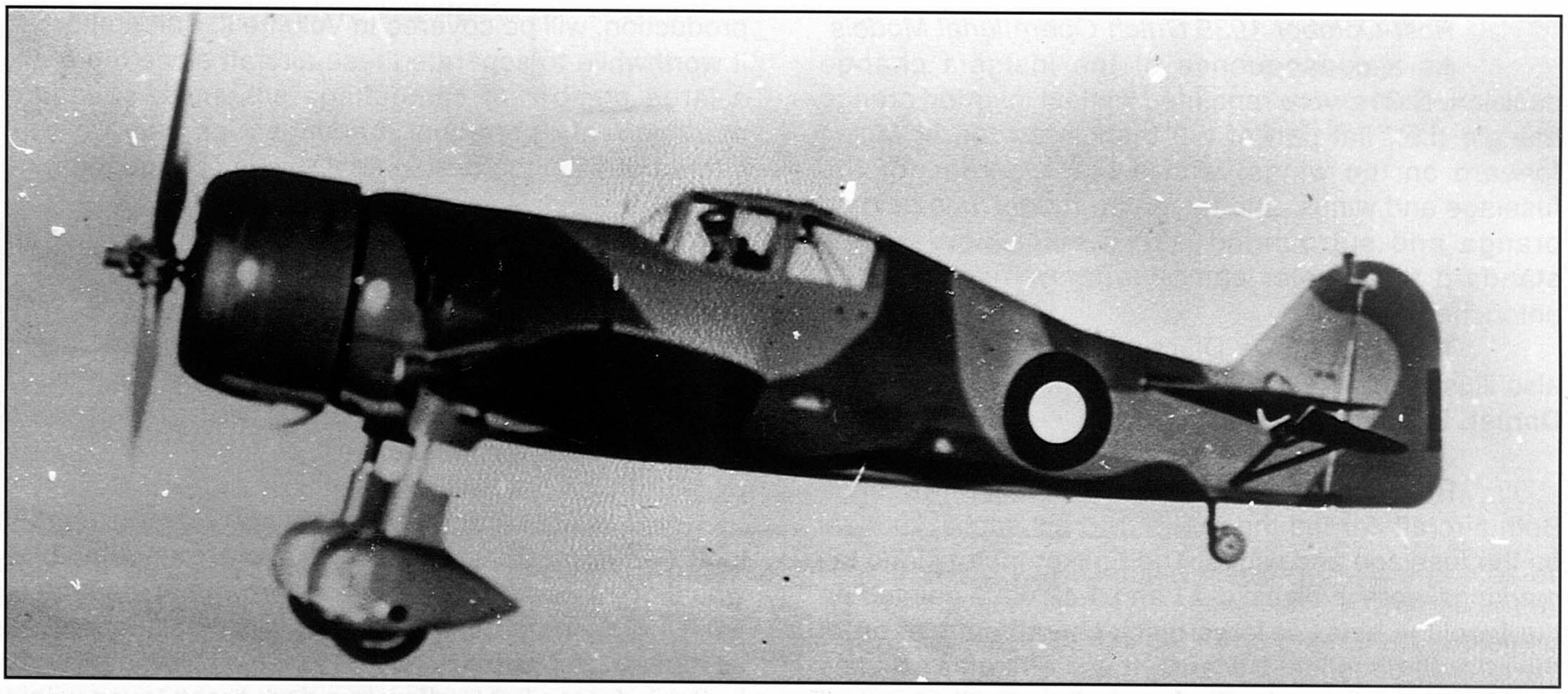


One of two Danish pattern aircraft powered by a Bristol VI-S. (Herluf Rasmussen)

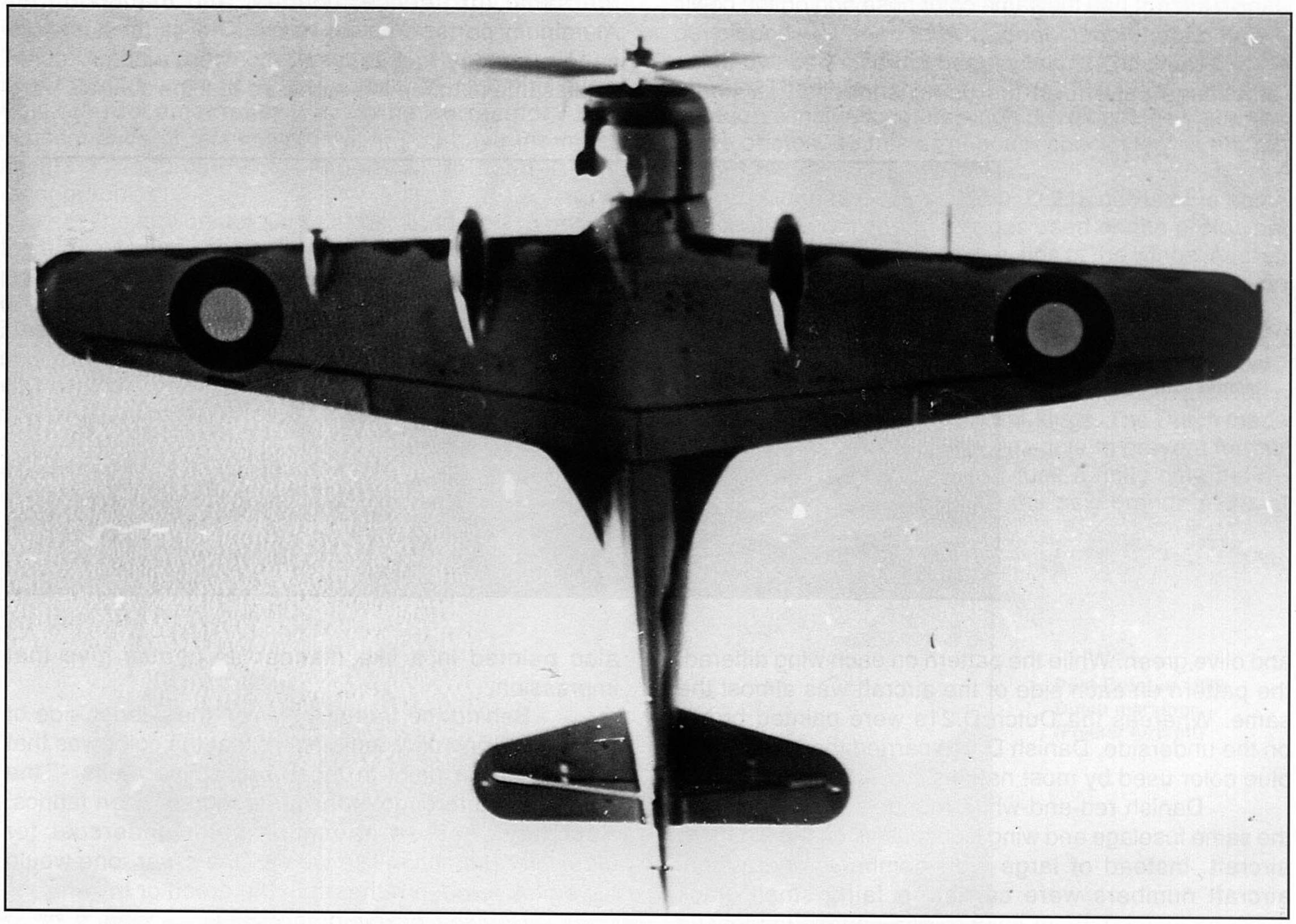
Behind the framework (i.e., the interior side of the fabric), one pilot remembers that the color was that of the exterior paint in those respective areas - the typical bleed-through in the old cotton or linen fabrics. Had they used an aluminum paint undercoat for ultraviolet protection like we did, the silver tone would have bled through rather than the green or brown.

Danish Cockpit Interiors

The Danes, on the other hand, apparently got a little more elaborate rather than just utilitarian. The one good photo series shows a lining placed over the steel frame to give a smooth interior “wall”. The photos are from one of the pattern aircraft, so it is surmised that



Early operational Danish production aircraft above and below. (Herluf Rasmussen)



the cockpit interior, seat, controls, etc. were also painted aluminum like the exterior. It was an obviously bright interior.

Not having any photos of the operational models, one can only surmise that they followed the standard Dutch production approach. Many times prototypes and pattern aircraft are "dressed up" as a promotional approach to "dazzle" committed or prospective customers who provide the funds for procurement.

CREDITS

The following aviation enthusiasts deserve a great deal of credit for their kind assistance in providing information, photos, factory details, commentaries, etc. which permitted creating the integrated details in this monograph. Their assistance made this new and closer look at the D.21 possible.
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INTERNATIONAL SQUADRON

INTERNATIONAL SQUADRON is the membership division of the HISTORICAL AIRCRAFT CORPORATION (HAC) - a developer of authentically scaled replica aircraft for the growing worldwide amateur-built sport aircraft market.

The purpose of these monographs is to accurately document as best possible with information available as a means to preserve the basic history, design, and color schemes of the great aircraft from all the major airpowers prior to and during WWII. Most people today are only familiar with the few restored originals that survived the scrap heap because that's all they can still see at aviation events or in static museums. However, prior to their development, as well as flying in parallel time-wise, were many great and colorful aircraft that either paved the way for these survivors or flew in combat with or against them. We felt that we should capture this history and design details for aviation enthusiasts, young and old alike, so all can become fully aware of the collective aviation heritage and what it took to bring aircraft design to its present state that we take for granted.

These monographs are therefore tailored to the serious aviation collector, the growing number of people who create piloted replicas of these great old aircraft, and the serious scale model builder. You can count on the technical accuracy because this is the type of information and details that HAC uses to create its own authentically scaled replicas for sport aircraft enthusiasts worldwide. Since we know that such research is never really completed, we welcome new or better information with which to update these monographs.

AUTHOR & ILLUSTRATOR

Warren A. Eberspacher, BAE, MBA

Warren is and always has been a serious aircraft enthusiast. He started building models at age eight and started doing his own research and scale drawings by age twelve because he was dissatisfied with the accuracy of available kits and scale drawings. Warren has had his private pilots license before he graduated from high school and it was only natural that he would study aeronautical engineering at the University of Minnesota in the Twin Cities where he grew up. With his BAE in hand, he started in preliminary design at Cessna Aircraft, but was called into active duty as Executive Officer of a Navy guided missile unit. Upon discharge, he continued working with the Navy as a civilian engineer in military aerospace and literally worked from the bottom of the ocean to outer space. Warren was a member of the Navy's Ready Reserve for 23 years and retired as a commander.

With Warren's love of old prop driven aircraft, jets weren't considered interesting. He got back into light aircraft design by helping form War Aircraft Replicas, Inc. (WAR) where he laid down the aerodynamics for WAR's first three successful half size replica fighters . . . FW-190, P-47, and F4U. Warren sold his minority interest to do a better job and formed the Historical Aircraft Corporation, a Colorado profit corporation devoted to authentic replication of old prop aircraft from all the major WWII airpowers. Besides his aircraft interests, Warren is also a successful management systems consultant who has helped other aircraft kit developers, school and health care delivery systems, earth sheltered housing and numerous computer system applications.

Warren's engineering and aircraft design backgrounds come to the surface in his discussions of aircraft as you can see in this monograph. He understands why and how designers do things and uses this experience to fill in research material gaps, as well as give his readers better insight into why or how a particular aircraft was designed, built, performed, etc. His goal is for people to have a better understanding and appreciation of our collective aviation heritage.

Warren has detailed scale drawings published in Finescale Modeler, Air Classics, Air Progress Warbirds, Historical Aviation Album, Journal of the American Aviation Historical Society, Cross & Cockade Journal, Aero Album, and on file in the archives of the National Air & Space Museum in Washington, D.C.

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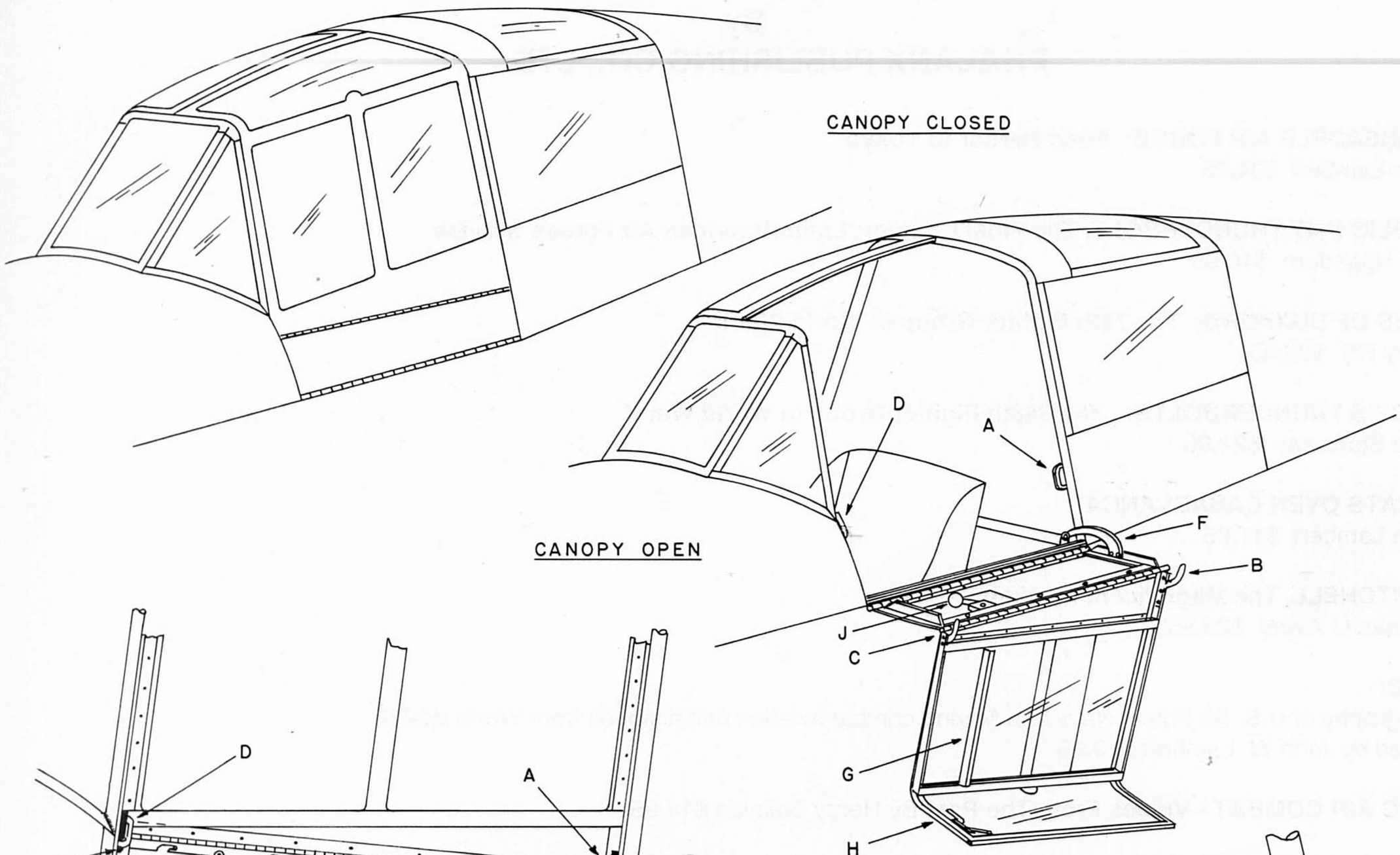

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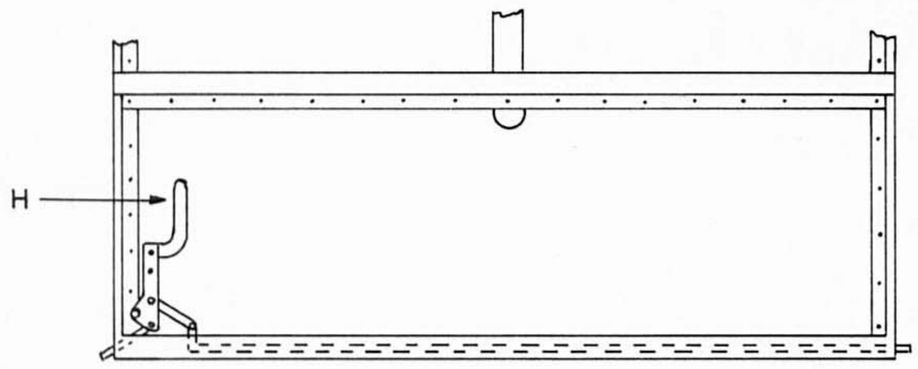

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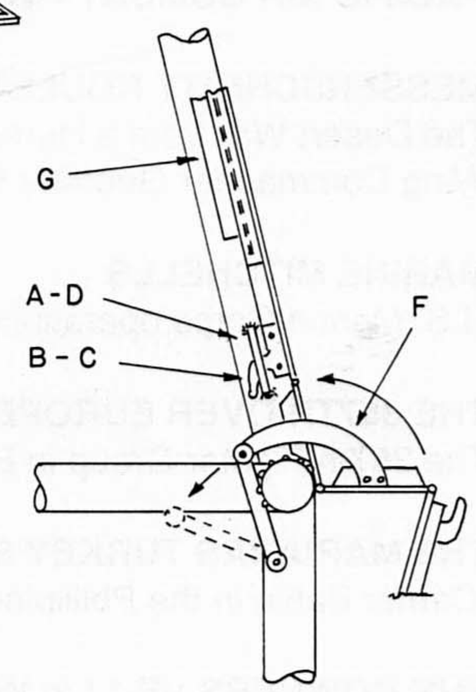

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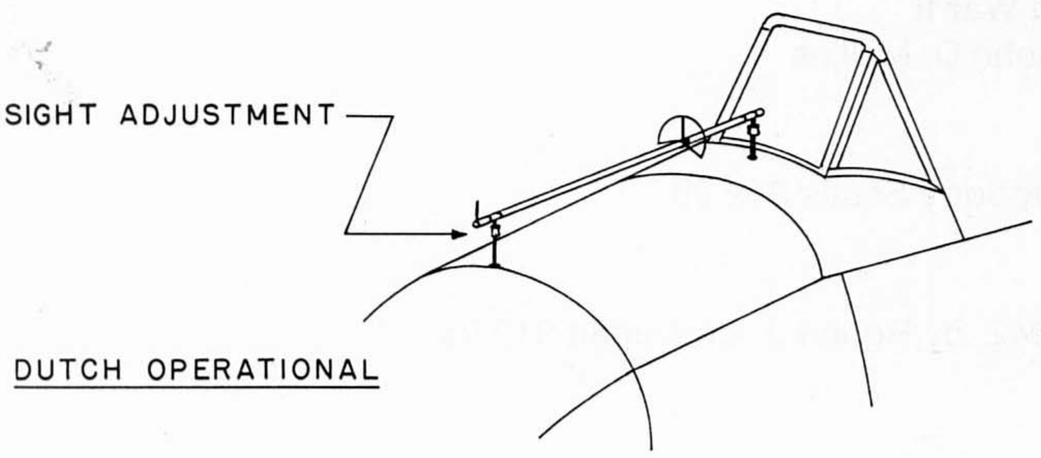

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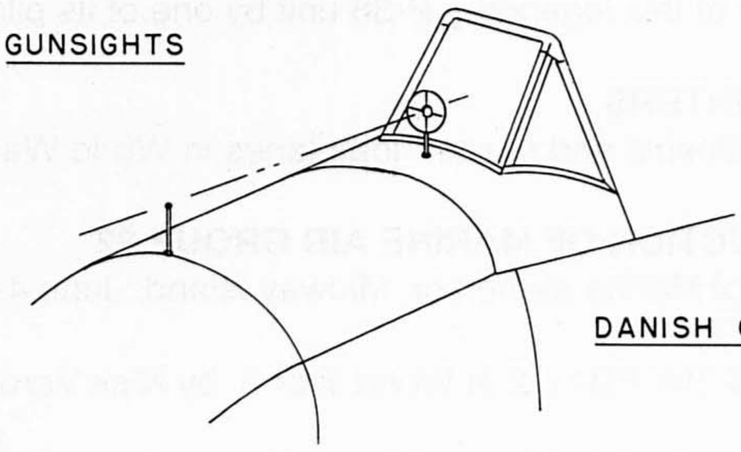

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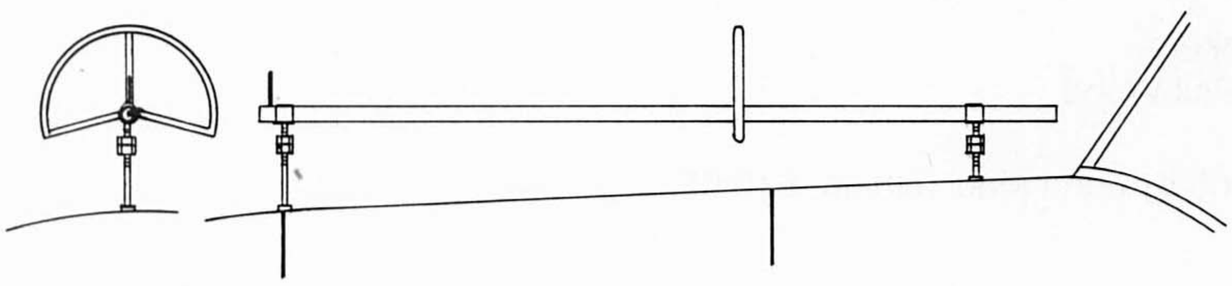

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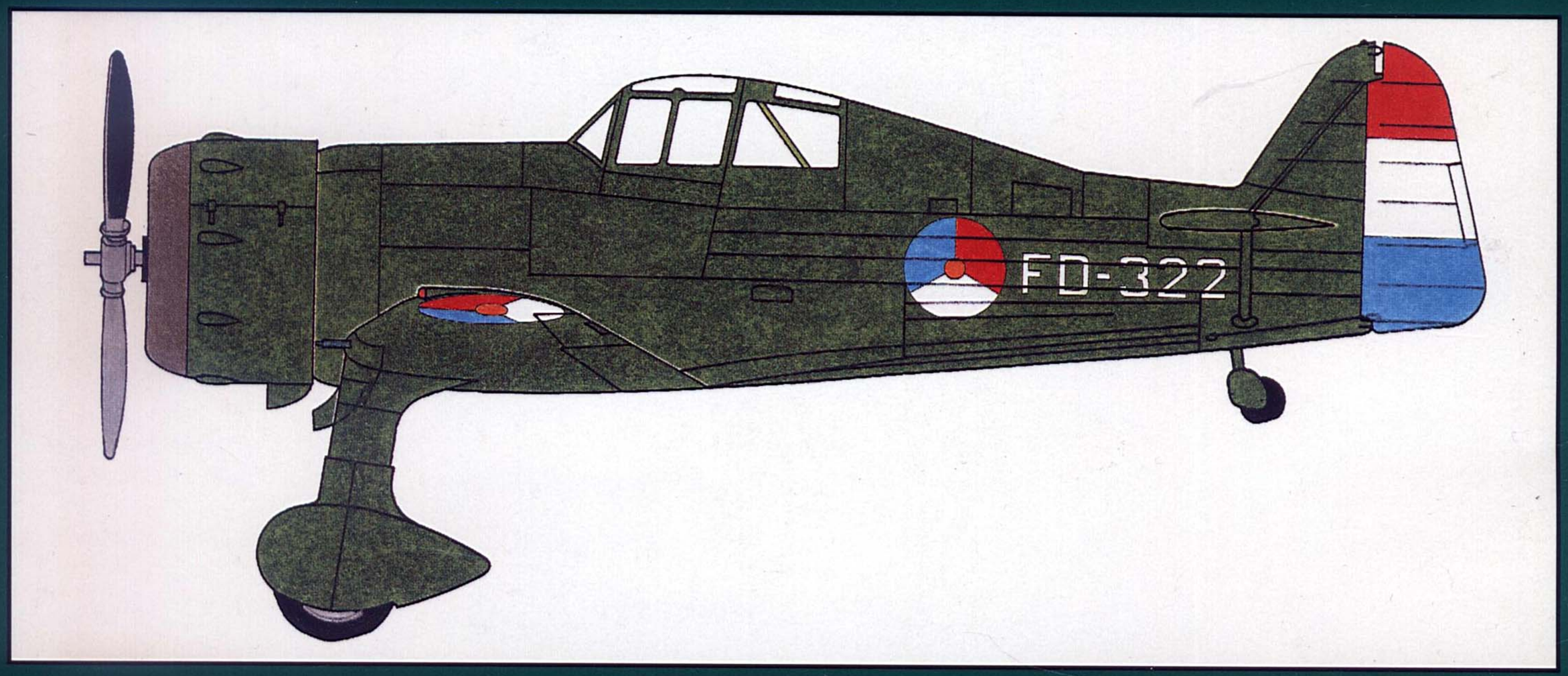

PHALANX
Publishing Co., Ltd.
1051 Marie Avenue
St. Paul, MN 55118 U.S.A.
612/454-0607

ISBN 1-883809-05-3
£7.95 Distributed by
AIR
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PUBLICATIONS
PO Box 223, Walton on Thames, Surrey, KT12 3YQ