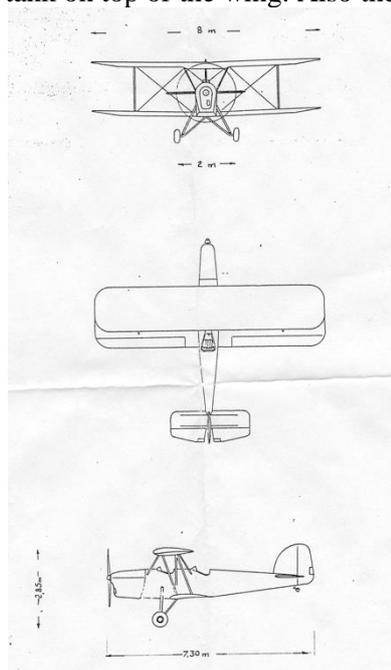


Koolhoven F.K.46S upgraded VAMI resin kit

Biplane aerobatic training

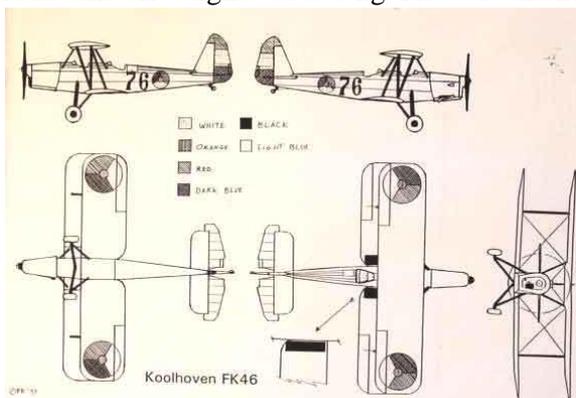
Scale 1:72

The Koolhoven F.K.46 was a biplane specifically designed as a trainer for beginners. A special version of it was designed as aerobatic trainer. Adaptations were ailerons in both upper and lower wing and a smaller fin with a straight leading edge, both meant to improve the manoeuvrability of the aircraft. It was also equipped with a large fuel tank in the upper mid wing section. The aerobatic aircraft has been produced in two versions, one with a fuel tank under the wing, the other with a tank on top of the wing. Also there were slight differences in the rudder shape. The engine of all aerobatic version was a De Havilland Gipsy Major I of 130 hp. Five aerobatic aircraft have been produced, of which the first two had the fuel tank under the wing, the other above the wing. The aircraft have flown in eight different painting schemes. For details is referred to the appendix.



The basic two-seat trainer had a span of 8.00 meter and was 7.30 meter long. It had a maximum speed of 175 km/hour and a ceiling of 4200 meters. Its empty weight was 570 kg and its take off weight was 870 kg. I have found no specific data and nor an original drawing for the aerobatic F.K.46, often designated as F.K.46S. However, on the Dutch IPMS website there is a (speculative) drawing of the first aerobatic aircraft originally produced for the Dutch Army Air Department (LVA) registered "76".

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The original VAMI kit is sold out for a long time already, and also only models the version with the fuel tank under the wing (so not the PH-APO) and contains only one rudder version. Also there were no decals included in the original kit. These all were reasons for the initiative to produce an upgrade of the kit.

The PH-APO has an attractive painting scheme, described by a former Koolhoven employee as: "Fuselage underside and sides blue-grey, fuselage piping dark blue, registration on the fuselage white and on the wings black, upper part of fuselage, fin, stabiliser and wings aluminium, dark blue band with white piping at both sides around the wings."¹ This information I have obtained from Harry van der Meer via Wout Moerman. This certainly applied for all aircraft in NLS (Nationale Luchtvaart School, National Flying School) livery. Examination of the pictures of the PH-APO by Rob de Bie suggested, however, that the fuselage of the PH-APO must have been orange, and not blue-grey. This was also the conclusion of Wout Moerman, who adopted some years earlier the same painting scheme. Later Jan Grisnich found confirmation in newsletters of the NLS of the new orange finish, which has been applied since April 1938. The top of the fuselage and the wings of all aircraft have an aluminium finish. For the finish and differences in configuration of the other aircraft is referred to the appendix.

The kit came originally in a thin carton box and contains 27 resin parts, which were rather deformed. I have corrected them by giving them a bath in hot water. The wings



show many very small air bubbles, which have been corrected with Mr. Surfacer 500 and Revell Plasto putty.

Next to the standard books on Koolhoven aircraft, I have obtained much specific information on the F.K.46 from Henri Kaper (formerly Stichting Koolhoven Vliegtuigen), the Aviodrome, a colleague modeller Wout Moerman, via Wout from Harry van der Meer, Jan Grisnich and Hans Berfelo.

	<i>Ref.</i>	<i>1:72</i>	<i>Original kit</i>	<i>Completed model</i>
<i>Span</i>	8.00 m	111.1 mm	107.2 mm	
<i>Length</i>	7.30 m	101.4 mm	99.3 mm	
<i>Height</i>	2.85 m	39.6 mm	36.0 mm	
<i>Engine</i>	De Havilland Gipsy Major I, 130 hp			
<i>Crew</i>	2			

Master production

Modifications and repairs

As shown in the table above the span of the original kit is 4 mm too small and the length 1 mm too short. The other major modification required is the fuel tank position, which is on top of the upper wing for all aircraft except the first one (so the '76', the PH-ARU and the PK-SAT), so an additional part has to be produced for this. This modification requires also larger V-struts between fuselage and the mid upper wing section. The elevator mechanism tubes under the fuselage included in the kit were of bad quality and their configuration is rather dubious, so a new one is required. Control sticks are missing in the kit. The N-struts are missing some pieces, hence need to be repaired. The fuselage deck over the cockpits is too wide and needs to be corrected.

For the lkit I have no considered the early versions of the aerobatic version (c.f. ref. 23), which were more like modified versions of the standard F.K.46 as used by the NLS.

Tail surfaces

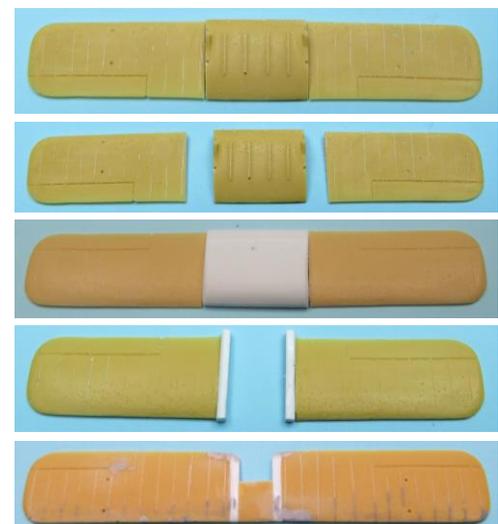
The photographs of the F.K.46S showed that there were at least three different shapes of the rudder. The original of the '76' had still a slightly curved trailing edge. Then there was the '1003' which had a more pointed rudder with a straight trailing edge, while the other aircraft had a rudder with a straight trailing edge, but less pointed. I have made a scan of the original resin vertical tail surface, have imported that in Corel Draw and have drawn two modified rudder shapes. I have printed these and have glued the prints on a styrene sheet of 1 mm thick. I have cut the shapes from the styrene and sanded them in shape.

The horizontal tail plane had the right shape but needed repair of the many small air bubbles and one major defect on a corner.

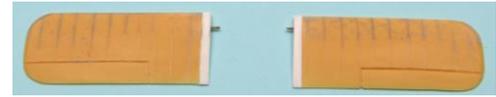
Wing

First I have separated the outer parts of the upper wing from the wing center section. The original center section with the tank was 4 mm thick, so I have glued some layers of styrene sheet on each other to the required thickness, assuming that the same thickness applied to the tank on top of the wing. I have sanded the new center section in profile and to the same width and chord and have fitted it with the outer wings. The result was satisfactory.

To correct the wing span I have glued a piece of 2 mm thick styrene sheet to each wing half and have sanded it to the correct profile. The lower wing has been treated the same way and the outer wing halves have been glued to the small center piece. I have repaired the large air bubbles in both wings with Revell Plasto putty and have treated them with Mr. Surfacer 500 to get rid of the small air bubbles.



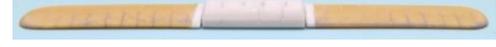
I have glued 0.75 mm brass pins in the upper wing halves and have drilled corresponding holes in the wing center piece to make assembly of the casted parts easier. Experience has shown that the casting of such small dimensions gives no problems.



As the wing ribs were not well engraved in the original parts and also disappeared a bit due to the treatment with Mr. Surfacer, I have retraced the ribs in alle wings with a panel scriber. I have dry fitted the upper wing with both



center sections as a last check. I have also drilled the holes in the wing mid-section where the wing-fuselage struts will go.



On pictures it also could be seen that the lower wing trailing edge was also skewed next to the fuselage.

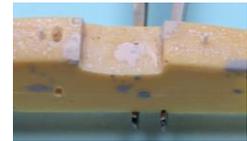


Fuselage

I have added 1 mm styrene to the rear end of the fuselage to get it to the correct scale length. Having done that I also had to move the location of the horizontal tail plane 1 mm backwards. Also quite some repair had to be done for large and small air bubbles, so also the fuselage was treated with Mr. Surfacer 500 and Revell Plasto putty. I have also adjusted the placement of the lower wing in the slot under the fuselage.



In order to fit the main undercarriage legs properly, I had to accommodate the top of the part deeper in the fuselage underside. This way it will also be easier to fit the elevator control rods over it.



Wing struts

The two N-struts were deformed and one of them missed a piece, as well as some insertion extensions of both. I produced the missing parts from styrene rod of different diameters.



The cabane struts were undamaged. But as I had produced a new mid wing section for the tank-on-top version, also new V-struts were required. The underwing tank was 2 mm thick, so the new struts needed to be 2 mm longer plus the length following from the angle under which they were running from fuselage to wing underside, being close to 45 degrees. So I made the V-struts some 3 millimeters longer and from 0.9 mm styrene rod. The insertion ends were again made from 0.5 mm rod, see 20 and 21 in the picture.



The forward cabane struts in the kit had some weird stretched S-shape; I could not figure out how they had to be mounted. As I had to produce anyhow a new one for the tank-on-wing version, I have made new, oversized straight struts, 22 and 23 in the picture, with an extension on one side. The builder will have to shorten it himself to the required length.

The inter-aileron struts for the '76', PH-ARU and the PK-SAT were rather bent. I have tried to correct that, but did not succeed. So I have produced new ones from left over streamline strut and some 0.5 mm rod.



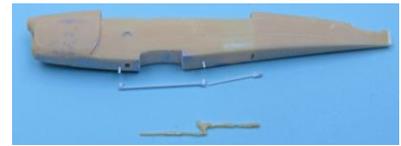
Elevator tubes and control sticks

In the documentation on the F.K.46S is written that the control rods for the elevator had to be moved from the cockpit floor to the underside of the fuselage to accommodate the seats with room for the crew's parachutes. Photographic evidence is limited to two pictures of the '76', shown at the right. The part in the original kit is very deformed and fragile, and not fit for reproduction. So I have constructed a new master for the



mechanism from 0.5 mm styrene rod and some slivers of strip. I have also inserted some pieces of rod in the fuselage underside at the location of the control sticks.

Looking at the pictures another time I decided to change the configuration a bit to resemble the original better. On the picture at the right also the piece contained in the kit is shown. I have no idea how that should have fitted under the fuselage, leaving the undercarriage struts free.



There were no control sticks in the kit. I have produced them from pieces of 0.5 and 0.65 mm styrene rod. I have also made an exhaust from 1.2 mm styrene rod.



Decals

Starting point for the decals was the decal sheet I had drawn for the original VAMI kit I had built previously, the PH-APO. The collection of photographs gave sufficient information to construct the decals for the other seven variants of the F.K.46S.



The registrations on the fuselage for the PH-APN and the PH-ATR I have drawn in black with a white edge around the letters, although later information suggested that they were (dark) blue with a light gray edge.



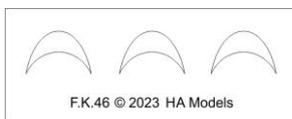
The PK-SAT was a special case. It had the scripted letters JEF, initials of J.E.F. de Kok, the person who gave the aircraft to the South Sumatra Aero Club Talang Betoetoe in Palembang, written on the rudder. I have imported a copy of the picture in Corel Draw and have manipulated it with the contour extraction function to reproduce the letters.



The Dutch roundels and orange triangles are variations of other decal sheets I have drawn for other models, as are the fonts for the registrations '76' and '1003'. The decal for the orange rudder of the '1003' I have drawn in Corel draw using a scan of the rudder I had produced. The final decal sheet is shown at the right. The decal sheet has been printed by Mika Jernfors of Arctic Decals. A larger picture of the decal sheet is contained in the appendix.

Windscreens

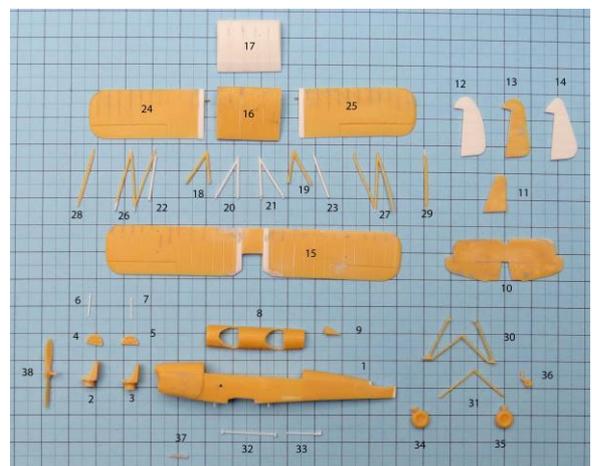
I have drawn the windscreen outline in Corel Draw, taking the measures of the fuselage cockpit deck and resizing them for the slope of the windows. After several iterations with models cut from paper I have arrived at a satisfactory result. They have been laser printed on transparent sheet material, a process that worked well.



Parts

The picture below shows all 38 parts in the kit serving as masters. Most of them are self-explaining. Parts 28 and 29 are the struts between the ailerons in upper and lower wing, only applicable for the '76', PH-ARU and PK-SAT. They have been replaced by scratch build masters.

The first sets of parts looked quite good except the parts 13 and 30. The former one had too thin a trailing edge, which was missing in some castings, the latter one was deformed (as was the original) and sometimes had air bubbles on strategic places. I have received from a



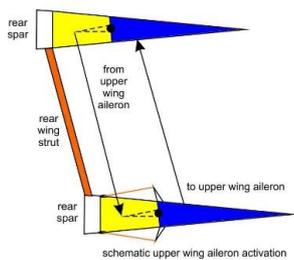
fellow modeler an original VAMI kit in better condition and have used the parts 13 and 30 from that kit after some rework as masters for a second mold.

I have also made some sketches for the upper wing aileron activation mechanism to derive the correct placement of the control cables. See the rigging and control cables list in the appendix.

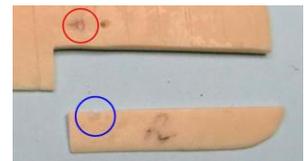
Prototype build

Wings and tail

I had decided to build one of the variants with the fuel tank on top of the wing, mainly to test whether the modified parts required for that were working correctly. I have started to glue the upper wing halves 24 and 25 to the mid wing section 16, aligning the leading edge along a steel ruler and keeping the lower wing surface flat. When the glue had dried I have sanded the joints and scribed the rib patterns again.



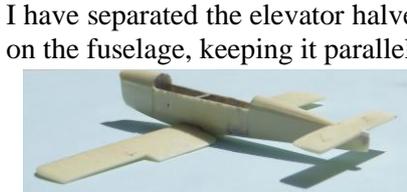
As I was going to build the model with deflected control surfaces, I have marked on the lower wing the position of the aileron control horns and the control cables leading to these on the wings according to the table at the end of this building report. I have drilled slanted 0.3 mm holes, indicated with a red circle, for the latter and superficial 1.0 mm holes for the former, indicated with a blue circle. I have separated the ailerons from upper and lower wing.



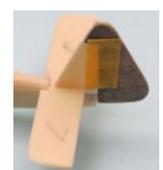
I have dry fitted the cockpit cover on the fuselage and have adjusted the width of the cockpit with a piece of styrene strip. I have glued the lower wing under the fuselage, taking care it was well aligned with the fuselage.



When dry fitting the horizontal tailplane to the fuselage it appeared not to be horizontal when seen from the side. I have removed some material from the interface with a scalpel until the tail plane was well horizontal. I have glued a piece of 0.5 mm thick styrene on the fuselage to compensate for the material removed. I was building the '1003', the one with the pointed vertical tail plane. I have attached the fin 11 to the rudder 14 with a piece of tape and have checked whether the leading edge of the tailplane was straight. This appeared not to be the case, so I have straightened it with a knife and sanding. The ruder-fin assembly also served to check whether the stabilizer was located at the correct height.



I have separated the elevator halves from the horizontal stabilizer 10 and have glued the stabilizer on the fuselage, keeping it parallel to the lower wing. I have filled the joints between fuselage and wing with putty. Finally I have marked the correct longitudinal position of the fin by measuring it by means of the fin-rudder assembly and have glued the fin to the horizontal stabilizer, keeping it well perpendicular to it.



Cockpit

I have painted the inner walls and the floor of the cockpit light grey, as well as the inner side of the cockpit cover. The seats, the instrument panels and the lower part of the control sticks have been painted dark grey, the tip of the sticks black. I have dry brushed the instrument panels very sparingly white to bring out the casted instruments a bit.



I have glued the instrument panels under the cockpit cover, the one marked V on the back in the forward cockpit, the one marked A in the rear one. The seats have been provided with photoetch seat belts and have been glued in the fuselage, taking into account the cockpit openings. I had to shorten the seat supports to 1.5 mm in order to fit them under the cockpit top cover. After gluing the control sticks in the pre-casted holes in the fuselage floor I have closed the cockpit.



I have filled the joints with putty and sanded them.

Rigging wire locations

I have drilled the thirty plus 0.4 mm holes for the rigging lines in the wings, tail surfaces and fuselage according to the table shown in the appendix. I have clarified some of the indications given that table in the building instructions.

Painting the model and applying the decals

For the assembly and rigging wire application I had selected, the fuselage, tail surfaces, upper side of the lower wing and underside of the upper wing have to be painted now. When applying primer to the upper wing, the port wing broke away from the center section. Apparently the connection by means of the casted resin pins was not strong enough. I have modified the building instructions advising that 0.5 mm brass pins should be used and the material required for that will be included in the kit.

I have repaired the wing and have carefully continued the painting job. The fuselage, upper side of the lower wing, lower side of the upper wing, the ailerons and the tailplane have been painted aluminum, the rudder black until the vertical line through the rudder hinge. I have given the fuselage a coat of gloss varnish and have applied the decals. I have given the fuselage a coat of flat varnish to seal the decals. To equalize the appearance of wings and tailplane I have given these also a coat of varnish.



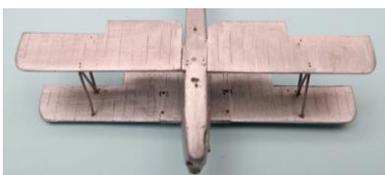
I have painted the cockpit edges leather. I have cut the windscreens from the print on the piece of transparent plastic and have removed the rest of the black print on the cut outs by carefully rubbing the piece. I have curved them first over the handle of a paint brush, then over a wooden toothpick. It was very



difficult to give the windscreen the desired curvature. Also, the shape was not correct; the points came too far down when fitting them to the fuselage. So I have decided to resort for the kit to my old technique and to include a piece plastic report cover into the kit. I have glued the windscreens to the fuselage with Microscale Kristal Klear.

Wing struts and upper wing assembly

I have cleaned the holes for the wing struts in the lower and upper wing with a 0.7 mm drill and have dry fitted the N-struts in them with the strut ends, which were closest to each other, in the lower wing. The middle strut should be vertical and to achieve this I have cut a sliver of the lower end of the N-struts. It shall be noted that a 0.1 mm slice at the bottom leads to approximately a 0.3 mm forward or backward displacement of the struts at the top.



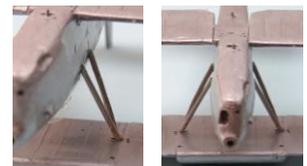
When the middle struts were well vertical I have glued them to the lower wing. Assembling the upper wing is easiest done with the model upside down, resting on the upper wing and the fin. After guiding the N-struts into the holes in the upper wing and checking that both wings were well parallel I have fixed the upper wing with some drop of thin cyanoacrylate glue, carefully avoiding to drop the glue on the holes for the rigging wires.



I have made the V-struts between fuselage and upper wing to the correct length trial and error and have slanted the lower edge to fit the fuselage better. Assembly was again being done easiest with the model upside down. I have glued the top connection first and, fixing the struts to the fuselage by applying a drop of thin cyanoacrylate glue and checking whether the wing configuration was well symmetrical. I have given the forward upper wing-fuselage connection strut the same treatment: determining the correct length trial and error and sanding a slanted edge for the fuselage connection. This completed the wing assembly.



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Wing bracing

I have started to apply the double rigging wires between the top of the fuselage and the underside of the wing center section by inserting the



black lacquered fishing line through the slanted holes in the top wing and then into the two holes behind the first cockpit. After applying some drops of glue on the joint between wires and fuselage I have tensioned the fishing line with pieces of tape. This operation took me about half an hour. I have not yet applied glue to the holes in the upper wing to prevent blocking the holes for the double landing wires.

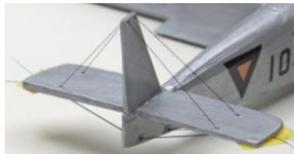
These were the next ones to be applied. Getting the fishing line through the holes went rather easy, as well as tensioning them both under the lower wing and on top of the upper wing. Finally I have applied the double landing wires and filled the holes in the wings with glue.



After letting the glue dry I have removed the excess fishing line. That caused a minor disaster: two of the landing wires were not glued well to the upper wing and came loose. The line was glued well in the holes in the lower wing, so I had to remove them by drilling the holes anew. I have also cleaned up the holes in the upper wing and have applied new wires.



This worked quite well. Next I have cut two small pieces of 0.25 metallic wire to form the rigging wire stabilization rods and have glued them on the place where the landing and lift wires cross. I have also applied the forward aileron activation cables between lower and upper wing.



The last wires to be applied were the fin bracing wires. I have done that by leading 12 centimeters of fishing line through the holes in horizontal tail plane, fin and underside of the fuselage and gluing it at the fuselage. When dry I have cut off the excess line with a small, but sharp knife.

I have lightly sanded the upper surface of the upper wing and the bottom surface of the lower wing and have given it a fresh coat of grey primer. After some sanding with very fine sandpaper they have got a coat of aluminum. I noticed the upper wing surface next to the tank was not completely free from glue residue, so I have cut and sanded that away and corrected the paint.

I have painted the ailerons, opened the holes for the aileron activation cables again and fixed them in deflected position to the wings with some drops of thick cyanoacrylate glue. It seemed to me the best order to install the aileron activation cables with minimum risk on damage. After guiding the fishing line through the holes I have tensioned them and applied some drops of glue to fix them.



After removing the excess fishing line and glue from the ailerons I have given them a fresh layer of aluminum



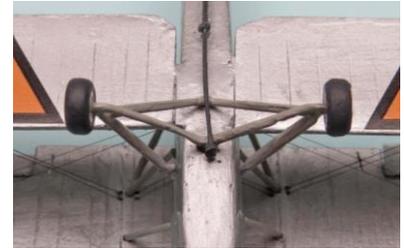
paint and a coat of gloss varnish. I have placed the orange triangles exactly midway of the wing halves, as prescribed in the regulation of October 1939. When the decals had set and dried, I have cut the triangles on the aileron-wing separation and the hinge line and reapplied decal softener on that place. When dry I have sealed the wing surface with flat varnish. Apparently I had handled the model to rough, because the rear tailplane bracing line broke.



Undercarriage and elevator actuation rods



I have mounted the main undercarriage legs and the supporting V-strut. This last one had unequal legs, so I had to shorten one of them. With the undercarriage legs mounted, I could glue the two pieces of the elevator actuation mechanism in place, which had to be mounted under the fuselage as on the real aircraft the seat had been modified to accommodate the obligatory army style parachutes, so there was no room any more for the mechanism under the seats.

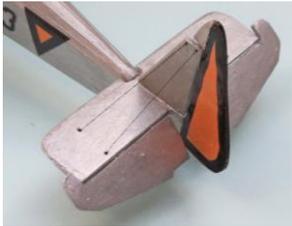
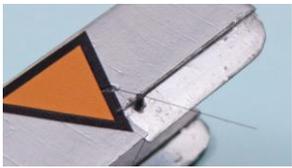


I have dry fitted the main wheels on the stub axles; I had to increase the hole in the wheels to 1.2 mm. I drilled a 1 mm hole at the rear end of the fuselage underside to accommodate the tail wheel and after repairing the rear tail bracing wire have glued it in place.



Ailerons, elevator and rudder

I have opened up the slanted holes in the lower wing for the aileron control cables with a 0.4 mm drill. As some holes were under the orange triangles, this has to be done carefully to not damage the decals. I have cut from the piece of 0.5 mm styrene included in the kit four control horns of approximately 0.5 mm wide and 2.5 mm high and have glued them in the superficial holes in the lower wing ailerons, slightly angle forward. I have inserted a small piece of fishing line in the slanted hole and fixed it with a drop of glue. The line has been led over the control horn and glued there. I have fished the job by cutting the excess line off.



Using thick cyanoacrylate glue I have fixed the rudder in place, deflected in the same direction as the tail wheel. The elevator halves have been mounted deflected downwards, reflecting the normal position with the stick pushed.



Propeller and exhaust

I have painted the exhaust rust and dry brushed it with gun metal and have glued it under the nose. The propeller has been painted first natural wood then a very thin layer of diluted burnt sienna old paint. The leading edge of the blades had been painted black, as well as the spinner. Gluing the propeller on the nose completes the model.



Summary

In summary the model is relatively easy to build. Some parts are rather fragile and need to be handled carefully. However, once the model is assembled and the rigging is in place, it is rather sturdy. There is one part in the kit that is defective: one leg of the V-strut supporting the undercarriage rearwards is shorter than the other. This can be solved in two ways: cut the longer leg down to the same length (what I have done) or replace the short leg with the longest leg of one of the extra center wing V-struts (the better solution). A note with this advice is included in the kit.

Below are some pictures of the finished model.











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Appendix F.K.46 documentation

Paint table for the '1003'

HE = Humbrol enamel (old numbering), R = Revell Aqua, V = Vallejo, O = Van Gogh oil paint

Code	Colour	Where
HE21	Black	Control stick handle, propeller edges, rudder, propeller spinner
HE62	Leather	Cockpit opening edges
HE110	Natural wood	Propeller
HE113	Rust	Exhaust
HE125	Dark grey	Seats, control sticks, instrument panels, control horns

Code	Colour	Where
HE129	Light grey	Cockpit wall and floor, struts, undercarriage
O411	Burnt	Propeller (light, thin coat)
R36178	Tank grey	Tyres
V71.072	Gun metal	Exhaust (dry brushed)
V71.062	Aluminium	Fuselage outside, wings, tail surfaces

Configuration, decals and painting scheme of the Koolhoven F.K.46S aerobatic version

Five acrobatic versions of the Koolhoven F.K.46 general trainer have been built in eight different liveries in total.

The five aircraft all showed small differences in configuration, mainly the fuel tank location (under or on top of the upper wing), the rudder, the upper wing aileron activation and the streamlined body behind the cockpit. A decal sheet has been developed for seven of these, based on photographs and other documentation. Paint schemes are based on written documentation, photographic evidence and on educated guesses.

c/n 46.08

'76'

Fuel tank under the upper wing, strut between ailerons in lower and upper wing. Balanced rudder with a slightly curved trailing edge. Streamlined body behind first cockpit. Served with the Air Department of the Dutch army.

Black registration 76 (1) directly behind the second cockpit on fuselage, followed by the small roundel (2). Red-white-blue rudder (3), including the aerodynamic balance surface. Roundels on upper and lower wing (4). Painting scheme LVA blue all over.



Became PH-ARU at Koolhoven.

PH-ARU

Configuration as '76'.

White registration PH-ARU (5) on aluminium upper and lower wing. White registration PH-ARU (7) directly behind second cockpit on fuselage. White band (6) from rear side cowling until end of fuselage, interrupted by small white registration (7). White text "KOOLHOVEN" on

left side of cowling (8). White Koolhoven logo and text on both sides of fin (9). Fuselage blue finish (FS 15102, RGB 59 105 143).



Became PK-SAT in Indonesia (Dutch East Indies).

PK-SAT

Configuration as '76'.

White registration PK-SAT (10) directly behind second cockpit on fuselage. White registration (11) on aluminium upper and lower wing. White band from rear side cowling until end of fuselage (12), interrupted by small registration (13). White text "KOOLHOVEN" on left side of cowling (8). White script text on rudder (14). Fuselage blue finish. (FS 15102, RGB 59 105 143). The streamlined body either behind the first cockpit or the second.



**c/n 46.10****PH-APN**

Fuel tank under the upper wing. Ailerons in upper and lower wing connected by a double cable. Balanced rudder with a straight trailing edge and an moderately rounded top. Owned by the Nationale Luchtvaart School, later used to train military pilots. No streamlined body behind the cockpit.

Black registration with white lining PH-APN (15) directly behind second cockpit on fuselage. Black registration on aluminium upper and lower wing (16). Dark blue circular decal (17) around the propeller spinner location (18). Dark blue and white band from the propeller axle until end of fuselage (19). White text "KOOLHOVEN" on both sides of the cowling (20). Fuselage sides and bottom dark orange, fuselage top aluminium. After 3 October 1939 also the underside of the lower wing was painted orange.

**c/n 46.11****PH-APO**

Fuel tank on top of the upper wing, rest as c/n 46.10. No streamlined body behind the cockpit. Operated by the Nationale Luchtvaart School.

Small white registration PH-APO (21) on the fuselage. Blue band from the propeller to the end of the fuselage (22). White Koolhoven logo and text (20) on both sides of the cowling. Black registration on aluminium upper and lower wing (23). Blue band with white lining on both wings (24), skewed blue band with white lining (25) from the lower wing trailing edge to the top of the fuselage. Blue band on stabilizer and elevator halves (26). Upper part of the rudder until the hinge axis red, white and blue (27). Lower half and bottom of fuselage orange, upper part of fuselage aluminium. After 3 October 1939 also the underside of the lower wing was painted orange.

**c/n 46.12****PH-ATR**

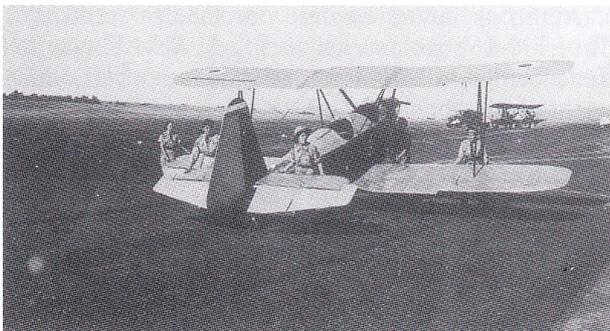
Configuration as c/n 46.11. No streamlined body behind the cockpit. Ordered by the Nationale Luchtvaart School, but not delivered. Shipped to South-Africa for demonstrations and requisitioned by the South-African Air Force.

Black registration with white lining PH-ATR (28) directly behind second cockpit on fuselage. Black registration on aluminium upper and lower wing (29). Dark blue and white band from the propeller axle until end of fuselage (30). Fuselage sides and bottom dark blue (?), fuselage top aluminium. Red, white and blue top of rudder (31)

until lower edge of aerodynamic balance surface. The fin has the same color as the lower part of the fuselage.



The painting scheme of the requisitioned aircraft is not known, but possibly the same as the PH-ATR. Only one photograph exists and shows the red, white and blue top of the rudder has been maintained. It carried British rounds and the registration 1598 and later as educational airframe IS108, which are not included in the decal sheet.



c/n 46.13

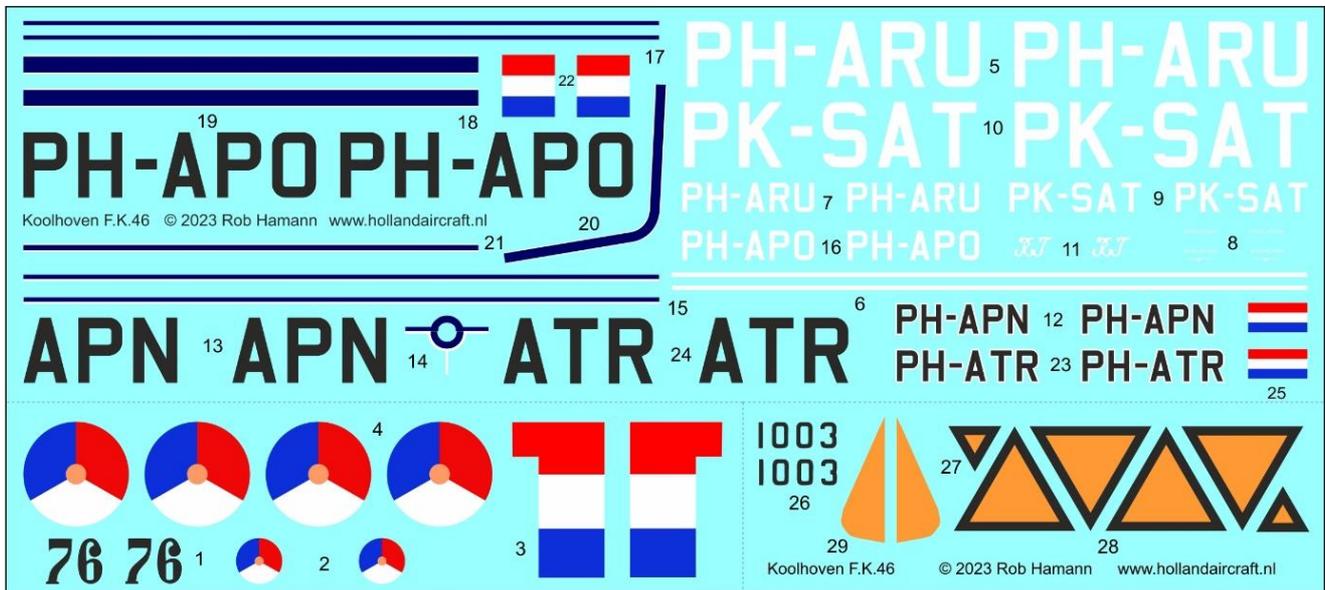
'1003'

Configuration as c/n 46.11, but with sharper rounded top of the rudder. No streamlined body behind the cockpit. Ordered by the Nationale Luchtvaart School, but not delivered. Original registration was PH-ATS, but no pictures are known of the aircraft with this registration. Requisitioned by the Air Department of the Dutch Army.

Black registration 1003 (26) directly behind the second cockpit. Small orange black bordered triangle (27) mid between wing trailing edge and fin. Large orange black bordered triangles halfway upper and lower wing halves (28). Black bordered orange rudder until rudder hinge. Decal (29) on rudder, black painted until hinge line.



Decal sheet



Rigging and control cables list

The rigging wires and control cables routing has been derived from photographs and is shown below. L means left or port, R right or starboard. S stands for a single rigging wire, D for a double one.

Aileron control horns are located at 23 mm from the wing tips, 0.5 mm behind the aileron hinge line.

Forward stabilizer spar is located 2.5 mm from the leading edge, rear spar 1 mm from the hinge line.

	Name	L/R	S/D	From	To	Remarks
1	Lift wire	L	D	Lower wing root forward spar	Upper wing rear spar wing strut	Wide separation

	Name	L/R	S/D	From	To	Remarks
2	Landing wire	L	D	Upper wing rear spar cabane strut	Lower wing forward spar wing strut	Narrow separation
3	Lift wire	R	D	Lower wing root forward spar	Upper wing rear spar wing strut	Wide separation
4	Landing wire	R	D	Upper wing rear spar cabane strut	Lower wing forward spar wing strut	Narrow separation
5	Forward stabilizer bracing	L	S	Lower edge rear fuselage	At stabilizer forward spar 6 mm from tip	
6	Rear stabilizer bracing	L	S	Lower edge rear fuselage	At stabilizer rear spar 6 mm from tip	
7	Forward fin bracing	L	S	At stabilizer forward spar 6 mm from tip	Leading edge tip fin	
8	Rear fin bracing	L	S	At stabilizer rear spar 6 mm from tip	Rear spar tip fin	
9	Forward stabilizer bracing	R	S	Lower edge rear fuselage	At stabilizer forward spar 6 mm from tip	
10	Rear stabilizer bracing	R	S	Lower edge rear fuselage	At stabilizer rear spar 6 mm from tip	
11	Forward fin bracing	R	S	At stabilizer forward spar 6 mm from tip	Leading edge tip fin	
12	Rear fin bracing	R	S	At stabilizer rear spar 6 mm from tip	Rear spar tip fin	
13	Cabane bracing	L	D	Top fuselage behind first cockpit	Top rear cabane strut	Narrow separation
14	Cabane bracing	R	D	Top fuselage behind first cockpit	Top rear cabane strut	Narrow separation
15	Aileron control cable top	L	S	Rear spar lower wing top; skewed hole	Control horn lower aileron top	
16	Aileron control cable bottom	L	S	Rear spar lower wing bottom; skewed hole	Control horn lower aileron bottom	
17	Aileron control cable top	R	S	Rear spar lower wing top; skewed hole	Control horn lower aileron top	
18	Aileron control cable bottom	R	S	Rear spar lower wing bottom; skewed hole	Control horn lower aileron bottom	
19	Forward aileron activation cable	L	S	1.5 mm aft 15, 0.5 mm outboard from 15	22.5 mm from wing tip, 1.5 mm behind rear wing spar	Not on '76', PH-ARU and PK-SAT
20	Rear aileron activation cable	L	S	2 mm aft control horn, 0.5 mm outboard from 15	22.5 mm from wing tip, 2.5 mm from hinge line	Not on '76', PH-ARU and PK-SAT
21	Forward aileron activation cable	R	S	1.5 mm aft 17, 0.5 mm outboard from 17	22.5 mm from wing tip, 1.5 mm behind rear wing spar	Not on '76', PH-ARU and PK-SAT
22	Rear aileron activation cable	R	S	2 mm aft control horn, 0.5 mm outboard from 17	22.5 mm from wing tip, 2.5 mm from hinge line	Not on '76', PH-ARU and PK-SAT
	Upper wing aileron activation					<p>'76', PH-ARU, PK-SAT:</p>

¹ This was according to Harry van der Meer the standard painting scheme of the NLS aircraft.