

VFW-Fokker VAK-191B Anigrand Craftwork¹ resin kit

Monoplane fighter demonstrator

Scale 1:72

In 1962, the West German government launched the requirement for a new ground attack fighter to replace the Fiat G.91. In the meantime NATO had launched a program for VTOL combat aircrafts. In answer to that requirement the VAK 191B experimental VTOL nuclear strike fighter was designed and built by the Vereinigte Flugtechnische Werke (VFW²). Initially, Fiat of Italy was also involved but dropped out in 1967, though it remained as a major sub-contractor. When NATO requirements changed, it became a technology demonstrator.

Propulsion of the VAK 191B was provided by a Rolls-Royce/MAN Turbo RB.193-12 vectored thrust engine for both lift and cruise, which was augmented by two vertical lift engines. Three aircraft were flown in the flight test program between 1970-1975 making 91 flights. The first hovering flight was made in Bremen on 20 September 1971 and the first transition from vertical flight to horizontal and vice versa was achieved on 26 October 1972 in Munich. The prototypes were used to test some of the concepts in what was to become the Panavia Tornado program, including 'fly-by-wire' technology.

The VAK 191B was similar in concept to the British Harrier, but was designed for a supersonic dash capability (Mach 1.2-1.4) at medium to high altitudes. The two lift engines were dead weight in cruise, and the relatively small cruise engine gave a poor thrust to weight ratio. It also had very small highly loaded wings.

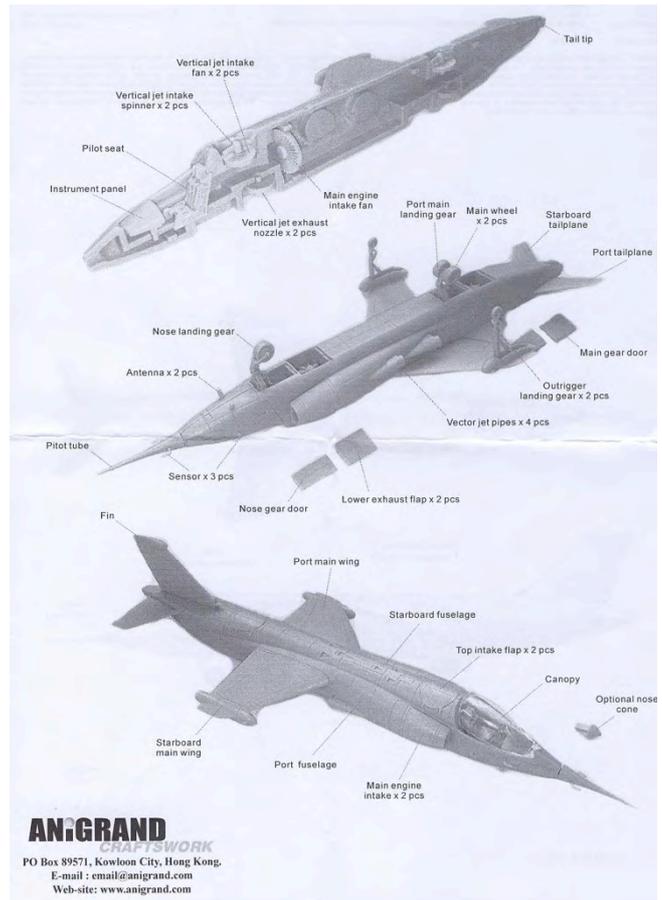
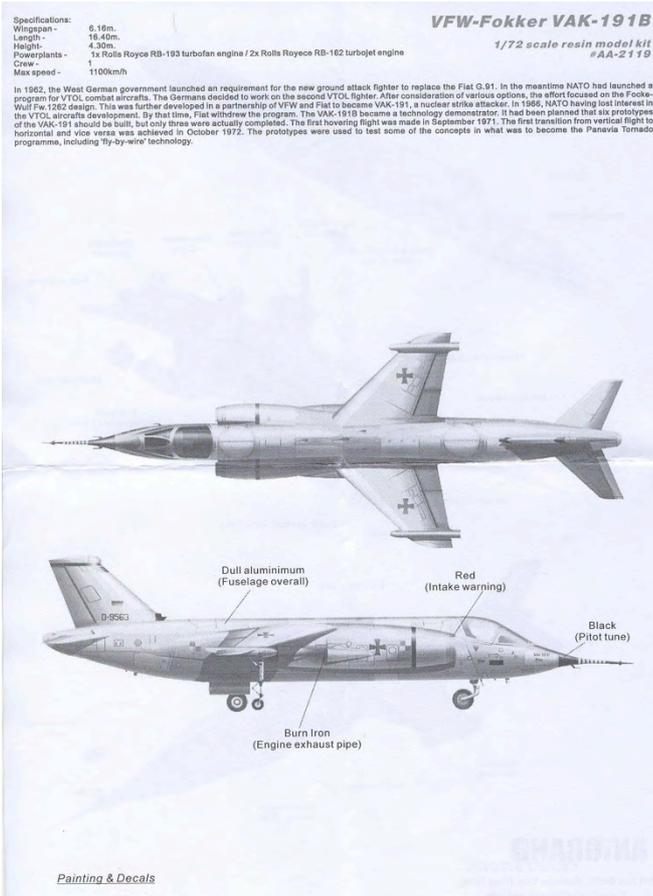
An example of the VAK 191B can be seen at the Deutsches Museum Flugwerft Schleißheim at Oberschleißheim near Munich and a second aircraft is part of the Wehrtechnische Studiensammlung (Military technical collection) at Koblenz, Germany. The third VAK 191B was reported as being put into storage in 1976. Its current location is at Airbus in Bremen.

The kit comes in a sturdy carton box and contains the resin parts, a clear plastic canopy, a decal sheet and an instruction sheet.

The resin parts are packed in a separate plastic blisters, are very neatly finished and supplied as individual pieces³.



The instruction sheet is very basic. It contains a two-view drawing giving summary painting instructions and some drawings indicating the approximate place of the model components. No painting instructions for the cockpit interior are present. Most of the information for building and detailing of the model must come from photographs and drawings present on the Internet, which have been collected in the annex. One of the drawings is worked open to show the location of some internal parts.



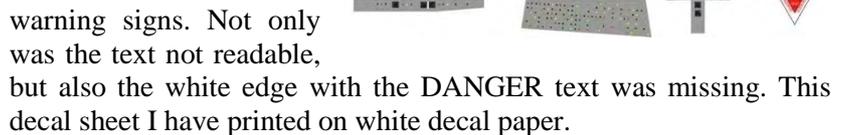
	Ref.	1:72	model
Span	6.16 m	86.6 mm	85.3 mm (98%)
Length	14.72-16.40 ⁴ m	204.4-227.8 mm	231.5 mm (102%)
Height	4.30 m	59.7 mm	63.5 mm (106%)
Engine	Rolls Royce/MTU RB 193-12, 45.2 kN; Rolls Royce RB 162-81 F 08, 2 x 26.5 kN		
Crew	1		

With exception of the height the model has quite correct dimensions.

In inspecting the parts it appeared that the left rear exhaust was missing. I have mailed Anigrand twice with a request for a spare part. The response was a deadly silence, a shame for the producer of such an expensive kit. Fortunately the Aviation Megastore (LHS) obliged as an intermediary, supplying me with a spare part.

Decals

The decal sheet is very limited and for the instrument panels nothing is provided at all. I have measured the instrument panel and the side panels and drawn some decals in CorelDraw, borrowing dials from the Internet and using the *Flight* drawings for inspiration. Note that the side panel decal measures only 19 mm. I have also redrawn the election seat warning signs. Not only was the text not readable, but also the white edge with the DANGER text was missing. This decal sheet I have printed on white decal paper.



Examination of the photographs of the VAK 191B showed that quite some detailed marking were missing or incorrectly reproduced on the kit's decal sheet. The yellow arrows had no text in it (NOTFALL), some black panels with (unreadable) yellow text were missing and all black markings, indicating the position of movable engine components (main engine inlet, left engine inlet



doors and forward nozzle position), were missing at all, as well as the VFW Fokker logo on the tail fin. These I have drawn and printed on clear decal paper, printing two copies for those decals with light colours to be glued one over the other to obtain sufficient covering.

Another thing I noticed in examining the pictures is that the forward part of the wingtip landing gear housings was painted yellowish orange, as were the tips of the elevator. This information is missing in the instruction sheet.

Cockpit



The cockpit is very little detailed; only an (well detailed) ejection sheet and an instrument panel are furnished, the side panels are moulded with the fuselage body and have no details. I could not find photographs of the VAK-191B cockpit interior; the most detailed information was contained in a cut-away drawing in *Flight* 1972.



The canopy did not fit well; it was slightly too short. I have corrected this by gluing a piece of 1 mm plastic on the rear cockpit wall.

I have engraved an additional panel line below the movable part of the canopy; on pictures it is very clear that the upper part of the cockpit sidewall is part of this movable part.

No indications at all are given in the instructions for a painting scheme for the ejection seat. I have taken some inspiration from the Internet and have painted the frame dark grey, the cushions khaki, the belts light grey and the buckles silver.



I have cut out the cockpit decals, ensuring no white decal paper was visible any more. The decal for the instrument panel fitted well, and shows sufficient detail. The decals for the vertical walls of the side consoles needed a small correction; the decals for the top were a bit difficult to attach. They curled up and in the end I had to fix them with diluted Kristal Klear. Dry fitting the seat and the instrument panel showed an acceptable imitation of reality.



I have made the throttle levers from 0.2 mm brass wire, the knob with a drop of thick cyanoacrylate glue and, after painting them, have mounted them on a small piece of 0.25 mm plastic, which I have glued on the left side console. The control stick has been made from 0.5 mm brass wire, has been painted and glued in a small hole in the cockpit floor.



Fuselage

I have cleaned the fuselage halves well, but even then gluing them together needed a bit of force. The wings fitted quite well to the fuselage, although some repeated measurements were needed to achieve symmetry. The only imperfection was (on both wings) an air bubble just at the leading edge, which was not easy to repair, as it was just located in one of the panel lines.



In first instance I had forgotten to insert the engine fan, but luckily the fuselage halves let themselves separate quite easily again. I have painted the fan steel with a wash of black to accentuate the fan blades.

The underside of the fuselage needed quite some putty; the joint was not very regular and the moulding was not perfect, especially in the cavities for lift engines and undercarriage. The top surface does hardly need any correction, except for the cavities where the lift engines must be accommodated and the cockpit. I needed the help of my Praxxon drill to get them in an acceptable shape.



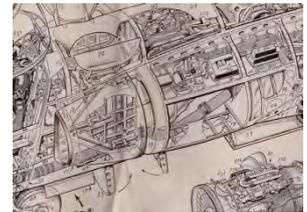
I have assembled the tail surfaces, which again showed a very good fitting, certainly for a resin kit. I have given the model two coats of light grey. However, the right tail plane was missing the tip, apparently broken just on the panel line. I have repaired that with a piece of 1 mm plastic sanded in profile.

I have drilled 0.6 mm holes at all places where the bleed air attitude control jets were located and in the vent openings and have painted them black.

Engines, inlets and exhausts

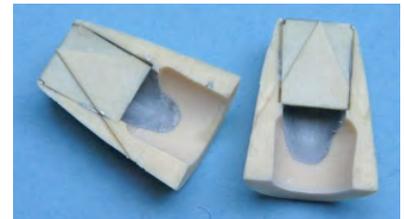


I wanted to model the VAK 191B in a hovering configuration, in which flight phase the forward part of the inlet moves to the front, as shown in the photograph and the *Flight* drawing. This required



some modifications to the kit, which assumes the inlets to be in the configuration for horizontal flight, when hardly anything of the "intestins" are visible.

I have hollowed the part of the inlet in front of the fan and have painted that black. Also the forward part of the inlet has been hollowed and painted with Vallejo steel. This part also had to be modified slightly to fit smoothly over the forward part of the fuselage under the cockpit. When assembled this gives the correct appearance to the model.



I have painted the horizontal surface of the compartments where the lift engine fan and exhaust will be located dark grey to suggest more depth. I have painted the fan and exhaust steel with a black wash and the other details on those parts light grey. After gluing these parts in place, I noticed that the engines are not inclined in the kit as they are in the original. Top and bottom compartments openings are on the correct position, but the fan and exhaust



are horizontal, hence shifted relative to each other along the longitudinal axis of the aircraft.



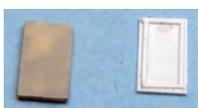
I have solved this by gluing a wedge of 1 mm plastic under inlet and exhaust, thus creating the correct impression of a skewed engine.



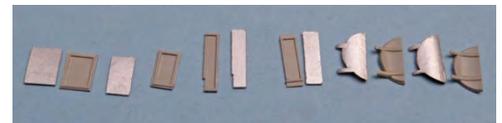
I have painted all fans steel and the exhausts brass with a drop of aluminium to simulate the colour of slightly overheated metal. The inside of the nozzles has been painted gun metal and black.



Undercarriage



The parts for the landing gear doors are very thick (0.8 to 1.0 mm) and show no detail. I have made new ones with a skin of 0.25 mm plastic, reinforced with 0.2 x 0.5 mm plastic strip. I have



painted the inside of all doors light grey, the outside aluminium.

While painting the undercarriage parts the nose wheel gear lost part of its struts, probably due to an air bubble. In an attempt to repair it I lost the piece, so I produced a new part from plastic strip. I have painted the landing gear light grey and aluminium, the tires Revell tank grey.



When dry-fitting the main and nose landing gear they were too large for the wheel bays, so I had to sand the sides off.



Final assembly

Prior to assembling the undercarriage and the engine exhausts I have painted the control jet exhausts and some scoops black according to the photographs and have given the model an overall aluminium coat. Tentatively some panels have been given a wash with very much thinned black and yellow oil paint⁵.

Next I have painted the nose section and some areas on the fin black. I have also painted the nose section



of the wing tip undercarriage fairing and the tip of the elevator halves yellow (Humbrol 69). This shade seems to fit the colour as seen on the photographs quite well. The boom on the nose appears to be painted black and yellow. I have painted that part yellow and have made a decal for the black stripes. This required some calculation, translating the more or less conical shape of the boom into circle sections with increasing diameter. After some trial and error with prints on paper I have obtained a reasonable fit. The decal will be printed both in a yellow-black and a "white"-black version on clear decal paper.

Black/yellow rings VAK 191B

lines	8
length	13 mm
d1(max)	1.14 mm
d2(max)	2.78 mm
C1(max)	1.58 mm
C2(max)	8.73 mm
proj. angle	0.0630 rad
strip width	1.881 mm
beta(rad)	0.396
beta(deg)	22.66

Computation				check			
delta length	delta C	x	diameter	y	x/y	beta(rad)	beta(deg)
1.857143 mm	0.736 mm	9.054644	18.10909	10.91538	1.860834	0.395538	22.66265
1.58 mm	4.32 mm	10.91538	21.83076	12.7921	1.860834	0.395538	
C1(max)	5.05 mm	black	12.77021	25.5242	14.63705	1.860834	0.395538
C2	5.79 mm	yellow	14.63705	29.27426	16.49768	1.860834	0.395538
C3	6.53 mm	black	16.49768	32.9576	18.35871	1.860834	0.395538
C4	7.26 mm	yellow	18.35871	36.71743	20.21955	1.860834	0.395538
C5	8.00 mm	black	20.21955	40.43909	22.08038	1.860834	0.395538
C6	8.73 mm	yellow	22.08038	44.14076		0.395538	

I have mounted the nose and main undercarriage legs in place. When mounting the wing tip legs they appeared too long; the main wheels did not touch the ground at all and the mismatch was far too much to correct by "flattening" the tires. I have shortened the wing tip legs in two stages for a total of close to 2,5 mm. The remaining "unbalance" I have corrected by flattening the tires of the main wheels.

I have given the whole model a coat of undiluted gloss varnish and have applied the decals after the varnish had dried well. The ejection seat decal has been cut out just inside the black boundary. I have used the black and "white" clear decal for the boom; the black covered well on the yellow. The opening angle of the circle section was however too large and had to be made smaller; apparently the five degrees extra are not needed.

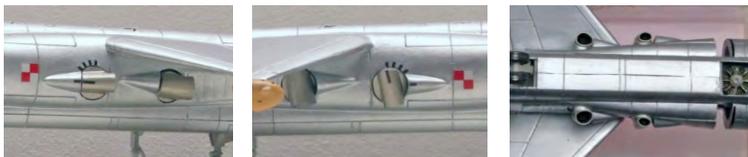


I have applied the type number and the German flag on the fin; the flag decal had to be doubled to achieve enough coverage of the yellow part. The only original decals of the kit that I have used are the red and white movie registration marks on the sides.

I have placed the type registration on the nose, the red danger line on the main engine intake, the black mechanism position indicator lines on the rear of the movable part of the intake and its counterpart on the fuselage above it and the VFW-Fokker logo on the tail, the last one double to get sufficient coverage of the light colours. The exhaust mechanism position indicator lines have been placed on the fuselage; the overlap has been cut when the decal had dried well. I have applied the small yellow arrows and the black and yellow panels on the forward fuselage under the canopy.



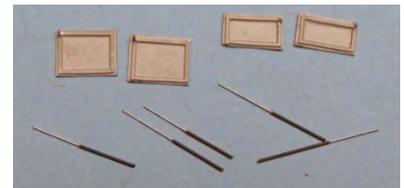
I have applied the position indicator lines on the lift engine intake doors. The actuators for these doors are completely hidden inside the aircraft structure.



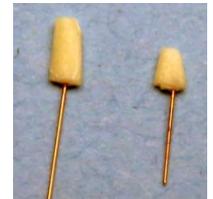
The last decals were the ones on the cruise/lift engine exhausts indicating the position of these components. I have dry-fitted the nozzles in the fuselage in their cruise flight position and have placed the decals. Next I have

rotated them in their final VTOL position; I had to glue the rear and front nozzles with Kristal Klear, as they fell out in the down position.

The doors of the lift engine exhaust compartments are actuated by hydraulic jacks, but according to the *Flight* drawing⁶ only one is visible in the compartment, the other three are accommodated in the fuselage. I have glued small brackets for the jack attachment to the four doors and have made the jacks from 0.1 x 0.3 and 0.3 x 0.5 mm brass tube, four for lift engine exhaust doors⁷ and four for the undercarriage doors.



Two small antennae are located on the lower surface of the fuselage. To make a better connection with the fuselage I have provided them with a piece of 0.2 mm wire. I have painted the antennae aluminium. Although the instruction sheet gives a vague indication that both antennae should be positioned under the nose, I could not find any documented evidence for this; on the contrary, on pictures the large antenna sits off-axis under the nose and the small antenna most likely under the tail section, so I have glued them in those positions.



I have glued the landing gear doors in place, opened slightly more than 90 degrees. The doors of the compartment of the lift engines hinge normal to the flight direction



and according to the photographs and drawings they are hanging slightly rearward, the front door less than the rear one. This is contrary to the description in the instruction sheet, which positions the doors purely vertical.



I have glued the jacks in the wheel wells and exhaust compartments and have finished the model by gluing the lift engine inlet doors in an open position. To enhance the contrast of the parts inlet fans and exhaust turbines of the lift engines have been given a wash of Citadel Athonian camoshade. I have painted the navigation light on top of the fin and on the wing tip fairings for the undercarriage.



I have glued the canopy in place with white glue, filling well the gaps between canopy and fuselage and retouching the black anti-glare panel in front of the windshield.

The last thing to do was to glue the lift engine inlet doors in place.

In summary: The Anigrand Craftwork VFWFokker VAK-191B is a nice kit to build of a little known German contemporary of the British Harrier. Unfortunately the kit I received was missing one of the exhausts, and I never received an answer from the kit's producer on my request for a replacement. I owe thanks to the Aviation Megastore, which provided me with the missing part. The kit itself has some errors, which can be corrected with minor effort. For a kit of this price class it is a bit of a shame that the decal sheet is very limited and that the kit does not include an option to mount the main engine inlets in the takeoff position. Also, the panel line engravings are very deep; on the original airplane they are, as usual, hardly visible. Nevertheless the VAK-191B model is a unique addition to my collection.

Below some pictures of the completed model are shown.









References

1. http://en.wikipedia.org/wiki/VFW_VAK_191B
2. <http://www.deutsches-museum.de/flugwerft/sammlungen/senkrechtstarter/vak-191/>
3. <http://www.airfighters.com/photossearch.php?cra=4628>
4. <http://www.aviastar.org/air/inter/vak-191.php>
5. <http://jpcolliat.free.fr/vak191/vak191.htm>
6. <http://www.airwar.ru/enc/xplane/vak191.html>
7. Flight International, pp 502-506 plus fold out, April 1972
8. Flight international, p. 798, December 1972
9. <http://www.klassiker-der-luftfahrt.de/geschichte/flugzeuge/vfw-fokker-vak-191-b/699502?skip=13#13-699538>

Annex Photographs and other documentation

A short, but interesting video showing the VFW-Fokker VAK 191B at takeoff and landing can be found at <http://www.military.com/video/aircraft/attack-and-fighter-aircraft/must-see-the-german-harrier/885389212001/> and a longer version at https://www.youtube.com/watch?v=q613kD_lrjo.

Pictures have been taken from the Internet, mainly from the sites included as references.

Modifications & corrections

M = modification, C = correction

Change	Location/part	Modification or correction
M01	Cockpit	Throttle levers and control stick
M02	Engine	Inlets in Hoover configuration
C01	Engine	Tilted inlets and exhausts lift engines
C02	Fuselage	1 mm strip to accommodate canopy
M03	Fuselage	Landing gear and lift engine exhaust doors
M04	Fuselage	Air vents opened up
C03	Fuselage	Extended position of lift engine compartment doors
C04	Fuselage	Location of small antenna
C05	Tail	Repair of tip
C06	Undercarriage	Width of nose and main landing gear reduced.
M05	Undercarriage	Doors extraction hydraulic jacks

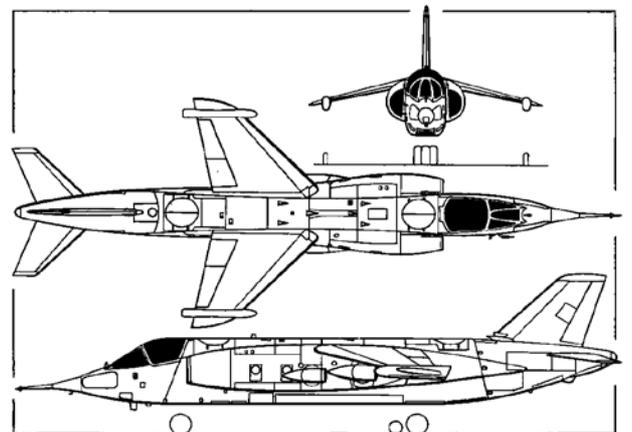
Paint table

C = Citadel, H = Humbrol, R = Revell, V = Vallejo

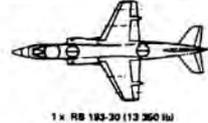
Code	Colour	Where
C	Athonian camoshade	Lift engine fan and turbine
H2	Emerald	Bottle on seat
H26	Khaki	Seat cushions
H69	Yellow	Nose section of wing tip undercarriage fairings, elevator tips.
H123	US dark grey	Seat, bottom of lift engine compartments, seat frame
H130	Black	Nose cone and anti-glare panel, tip of fin; inlet at fin base and below canopy
H166	Light aircraft grey	Cabin and cockpit walls, wheel bays and doors, walls and doors of lift engine compartments, undercarriage legs, wheels, seat belts
R36178	Tank grey	Wheels
V71.062	Aluminium	Overall airframe, seat belt buckles
V71.065	Steel	Engine fan and inlet components

Code	Colour	Where
V71.062/ V	Aluminium/ brass 25/75	Main engine exhausts
V	Gun metal	Inside of exhausts
V	Black	Inside of exhausts

Photographs & drawings



Силовая установка и система управления СВВП
VAK-191B Mk.1

<p>MK.1</p>  <p>1 x RB 183-12 (110 200 lb) 2 x RB 162-90 (11 740 lb)</p>	<p>MK.3</p>  <p>1 x RB 183-30 (113 360 lb) 2 x XJ-99 (14 400 lb)</p>
<p>MK.2</p>  <p>1 x RB 183-30 (113 360 lb) 2 x RB 162-91 (112 300 lb)</p>	<p>MK.4</p>  <p>1 x RB 183-30P (118 300 lb) 2 x XJ-99 (14 400 lb)</p>

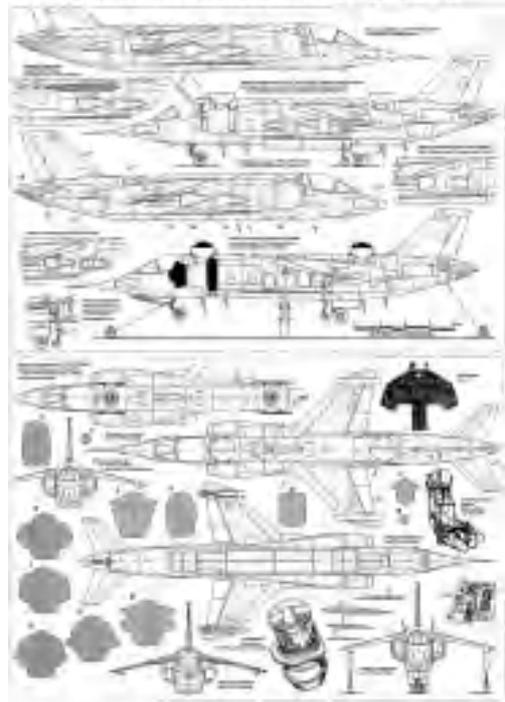
VAK-191B MK.2



VFW VAK 191B



VFW VAK 191-B German Vstol Aircraft





[Source: Braas]



[Source: Paul Nann]







WORLD NEWS

VAK 191B cancelled . . .

The West German Ministry of Defence announced last week that it will discontinue its support for the VFW-Fokker VAK 191B experimental V/Stol fighter programme at the end of this year. In a statement issued on November 30 the Defence Ministry noted that the beginning of this German V/Stol development, which went back to 1958, had been based on a Nato doctrine which had now been abandoned. These military demands (the statement continued) did not justify the continuance of national programmes which, in total, have now amounted to DM1.5 billion (£192 million).

Development of the airframe has cost DM280 million (£36 million), while the powerplant has cost a further DM230 million (£29.4 million). About 300 people at VFW-Fokker's plant at Bremen and the flight-test unit at the German Air Force Centre at Manching will be affected. Some of these will probably have to be laid off, but others will be found work on the Airbus, MRCA and Alpha Jet programmes. The VAK 191B programme manager, Prof Rolf Riccius, was due to meet officials of the German Ministry of Defence last Tuesday in an attempt to see whether parts of the programme could be salvaged. One hope is that the Ministry of Research and Development may be persuaded to carry on the programme at least to the end of the transition flying; many German engineers feel bitter that cancellation will come at a critical period of the flight-test programme.

The VAK 191B arose from the NMBR5 (Nato Military Basic Requirement No 3) document issued in August 1961 calling for a Fiat G.91 replacement. In July 1965 Germany and Italy

signed a Memorandum of Understanding to proceed jointly with development of this vertical-take-off fighter and six aircraft were ordered. Differences of opinion regarding the operation of the fighter, and escalating costs, caused Italy to withdraw from the project in August 1967, though Fiat stayed on as a subcontractor, and the number of prototypes was reduced from six to three.

In 1968 the German Government reclassified the VAK 191B as a research programme and greatly reduced its priority. Roll-out in April 1969 was followed by first flight in September 1971. All three aircraft are flying, and news of the cancellation comes, ironically, only a month after the first transition from vertical to horizontal flight (October 26).

Another possibility of salvaging the project, though now a remote one, is through the US Navy's Sea Control Ship fighter competition, in which North American has a contract to build an augmentor-wing fighter; VFW-Fokker was teamed with Grumman to tender for this project.

Germany's ambition to develop her V/Stol technology is represented by the VJ101 fighter (now in a Munich museum); support of Britain's three-country Kestrel evaluation in 1965; the Dornier Do31 experimental transport (in collaboration with Hawker Siddeley), the programme for which was completed in about 1970; the ambitious Advanced Vertical Strike fighter of 1966, which gave way to a less advanced MRCA predecessor; another VFW project, the tilt-wing VC 400, cancelled a couple of years ago; the Dornier 231 commercial/military transport, dormant winner of a competition in 1970; and the

VAK 191B, originally a nuclear bomber. With the demise of the last-mentioned, Germany now has no V/Stol aircraft flying or planned.

There was a scheme to use one of the 191s as a test-bed for MRCA on the basis of its similar fly-by-wire light-control system, but these plans have never been formalised and both British and German observers told *Flight* earlier this week that the 191's absence would not affect the MRCA flight-test schedule already planned.

. . . and Super Etendard

The French Government has decided not to finance further studies of the so-called Super Etendard for the French Navy, an aircraft which emerged from navy doubts about the Jaguar's ability to use its aircraft carriers. Based on the Etendard IV, the Super Etendard was to have been powered by a single unheated Snecma 9K50, designated the 8K50, which had completed about 50hr of bench running by last week.

With the Super Etendard *hors de combat*, two types, the Jaguar and the Skyhawk, remain in contention to equip the French aircraft carriers *Clemenceau* and *Foch* from about 1977 onwards. Having already had their lives extended once, it is not clear for how long these ships will remain in service after that date.

With earlier part-throttle reheat problems with the Adour now solved, the Jaguar has one main advantage over the Skyhawk: two engines. The Skyhawk, on the other hand, is both lighter (concern has been expressed about compatibility between the 32,000lb Jaguar and the carriers' catapults) and cheaper. The A-4's cost advantage might well be eroded if the French Government had to reimburse British R&D expenditure on the naval version of Jaguar (see *Sensor*); also there are the inevitable considerations of dollar expenditure.

Space Conference date set

December 20 has been confirmed as the date for the next meeting of the European Space Conference in Brussels. The meeting is to enable

The VAK 191B during its first transition flight, on October 26. Its cancellation by the German Ministry of Defence is recorded on this page. The three aircraft have made over 200 flights totalling more than 15hr. A joint US Services/Nasa team was at Bremen and Manching as recently as last August to examine the possibility of a joint test programme. The VAK 191B is powered by two Rolls-Royce RB.162 lift engines and a vectored-thrust RB.193 powerplant, specially designed for this application by MAN and Rolls-Royce



[Source: Flight, November 1972]

