

ABOVE: Three views of the EWR-Süd VJ-101C-X1, powered by six Rolls-Royce RB.145s. For vertical flight the front part of each pod moves forward leaving a gap (LEFT) to admit air for the engines, but this is closed in level flight (TOP), air then entering through the nose intakes

The Hanover Show

Projects in profusion: V/STOL a highlight

VARIED IF SOMEWHAT uneven fare greeted the visitor to this year's Hanover Air Show, held at Langenhagen Airport from 24th April to 3rd May. There were aircraft in plenty—over 240 of them including visitors—but these were mostly light aircraft of well-known types, and it fell to the V/STOL VJ-101, the HFB 320 Hansa, two Transalls and an assortment of helicopters to provide the main flying interest.

Inside the exhibition halls it was a different story. Most manufacturers were not averse to giving a foretaste of the future with models of their projects and chatting about possible developments. After a rash of over-enthusiasm apparent at the Paris Show last year, the German firms seem to have settled down to the pursuit of fewer but more realistic lines of research—although for the most part they have not so far attracted much in

the way of government backing. Future "Hanovers" will no doubt bring to light the "surviving fittest".

American firms attended in reasonable force, the main French companies banded together on a joint stand and had something to show outside, Holland's Fokker and Italy's Fiat were in evidence, but the British contribution was disappointing. Hawker Siddeley had quite a large stand but there was no sign of B.A.C.—and one had to go to Sud to see a model of the Concorde. Outside, too, while the lone Turbo-Skyvan was showing would-be imitators that it is the only aircraft of its type at present flying, there was precious little British "hardware", apart from the R.A.E.'s Hunter Mk. 12 and a batch of Beagles; and as Lufthansa's new Boeing 727, D-ABIB, was making more calls at Hanover than seemed normal in the course of ordinary passenger-conveying



An impression of the VJ-101D, with five RB.162 lift engines (all in the forward fuselage) and two deflected-thrust RB.153s

duty, a fitting contrast could surely have been provided by a Trident or a VC10.

British aero-engine manufacturers had no need to be downcast, however, particularly when V/STOL was mentioned, and it was some consolation that the star of the show was the Rolls-Royce-powered VJ-101, seen doing its transitions in public for the first time.

Designed and built by EWR-Süd—a consortium comprising Bölkow, Heinkel and Messerschmitt—the VJ-101C-X1 prototype is powered by six 2,750-lb. s.t. Rolls-Royce RB.145s (two wingtip pairs in swivelling pods and a pair for lift only in the forward fuselage) and is intended for research throughout the VTOL flight cycle and at speeds up to Mach 1. Due to fly shortly, the second prototype, VJ-101C-X2, is powered by six RB.145Rs, each giving 3,750-lb. s.t. with afterburning, and will enable investigations to be

The prototype Hamburger Flugzeugbau HFB 320 Hansa at Finkenwerder. It flew on 21st April and appeared during the latter half of the show

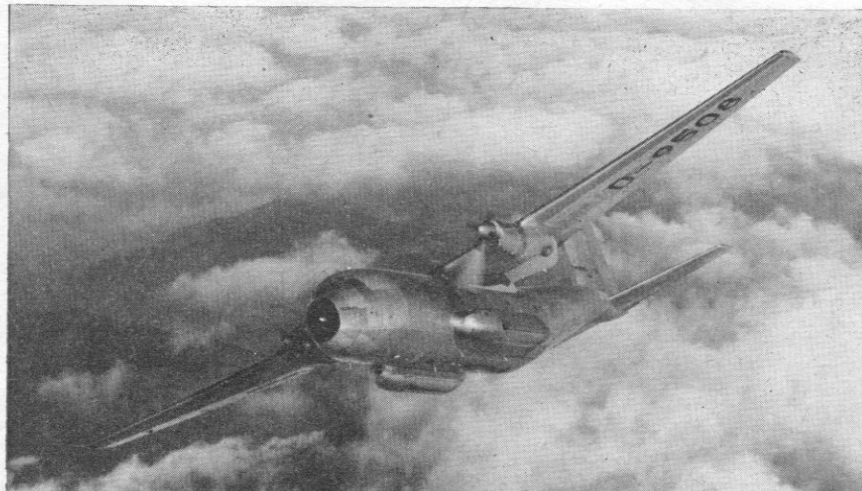


carried on above Mach 1. Although the VJ-101 programme was started some four years ago with the object of producing a Mach 2 V/STOL interceptor capable of ground-attack as well, this requirement has now been scrapped, and the machines are being used for research only. Results will however be applied to the VJ-101D, also a Mach 2 fighter but with the emphasis on the strike role and of totally different configuration, having all its engines (five RB.162s for lift and two thrust-deflection Rolls-Royce/M.A.N. RB.153s for propulsion and further lift) in the fuselage. At present the future of the VJ-101D seems doubtful, as the German Air Staff are showing increasing interest in the VAK 191 project, mentioned later.

VJ-101's display

At Hanover the VJ-101C-X1 put up a most impressive display, taking off from a concrete taxi-track and making a very smooth and steady transition from vertical to level flight. Forward speed built up as the tip-mounted podded pairs of RB.145s were swivelled almost imperceptibly through 90 deg. and the machine then did some fairly fast runs (it has already been tested up to Mach 0.8) over the field with a Luftwaffe Sabre VI acting as a "chase" plane. The transition back to a vertical landing was equally smooth.

Although a somewhat complicated solution, compared with the Hawker Siddeley P.1127 and P.1154, the VJ-101 has been shown to work and is the German aircraft industry's most notable post-war achievement so far. As the three pairs of engines are at the extremities of a triangle for lift, there is no need for "puffer pipes" to control stability while hovering; and in level flight only two of the six engines are not in use. However, if one engine fails during vertical flight, it is necessary to increase the thrust of the other engine of the pair to 100 per cent and cut the remaining four down to 50 per cent—equivalent to losing three out of six engines in all; the Dassault Balzac and Mirage IIIV, on the other hand, with all lift engines installed close together in the fuselage, can tolerate a degree of engine-thrust asymmetry, their



Two Transall C-160s were at Hanover, D-9508 (illustrated) and D-9509, the first German-built machine. A Luftwaffe order for 110 Transalls has been mentioned but has still to be confirmed

"puffer pipes" being powerful enough to overcome this.

Ideas on powerplant arrangements for V/STOL fighters are getting even more diverse. While Britain has backed the vectored-thrust concept and France has gone in for separate lift and propulsion engines, the German Vereinigte Flugtechnische Werke (VFW—a merger of Focke-Wulf and Weser) are trying to get the best of both worlds with their VAK 191 project (derived from the Fw 1262), which is being developed in conjunction with EWR-Süd and Fiat; the Italian company is, however, continuing work on its own G.95/4, a comparable design.

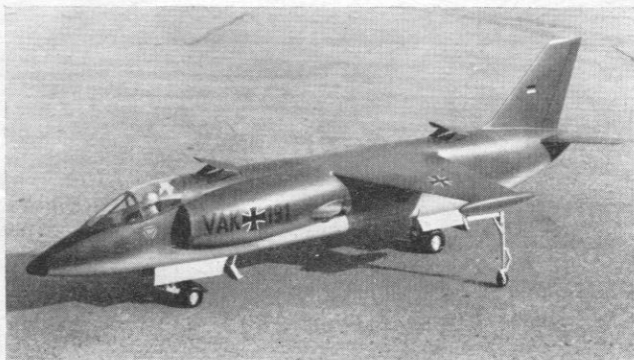
V/STOL G.91 replacement

Intended as a V/STOL replacement for the Fiat G.91 in both the German and Italian Air Forces, the VAK 191 is similar in layout to the Hawker Siddeley P.1127 but in addition to its main vectored- or deflected-thrust engine (type unspecified) has two lift engines in the fuselage, one forward and one aft of the wing. The lift engines will, it is calculated, give the machine the extra boost to get it off the ground with a sizeable payload; while in

flight the main engine will be well matched to efficient cruising conditions. Although this arrangement offers a better payload/range performance than is possible with a single vectored-thrust engine (as in the P.1127) it does add to the complexity and cost of the machine; control of the lift engines while the aircraft is hovering will have to be tied in with that of the main engine, the "puffer pipes" and (during transition) the control surfaces; and the lift engines may bring further problems in ground erosion and recirculation, points on which the P.1127 can score.

Vereinigte Flugtechnische Werke, who are at present involved in Transall and F-104G production, also had on view a model of their VFW 614 jet transport project. Powered by two 5,200-lb. s.t. Lycoming PLF1B-2s in over-wing pods, it is designed to carry a maximum payload of 9,930 lb. and cruise at 370 m.p.h., maximum range being 600 miles. Its swing-nose will be of particular value in the freight role, and the machine will be capable of operating from semi-prepared strips, taking off in 1,850 ft. and landing in 2,300 ft. VFW now have a licence from Malmö Flygindustri for the construc-

BELOW: The V/STOL VAK 191 is intended to replace the Fiat G.91 in the German and Italian Air Forces. RIGHT: A model of the VFW 614 transport project with swing-nose





Flown in January D-9514 is the first of three Bolkow Bo 46s being built to test the Derschmidt "lead-lag" rotor system, designed to keep tip speeds within efficient limits during fast forward flight

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tion of the MFI-10 Vipan and the two prototypes came over from Sweden for the show.

Projects from Siebelwerke A.T.G. include the SIAT 311A seventeen-passenger STOL jet transport, the SIAT 223 trainer-tourer and, in co-operation with Bolkow, the BS-210 "Skyvan-type" utility transport. Powered by two aft-mounted Lycoming PLF1B-2s, the SIAT 311A is notable in having full-span "blown" double-slotted flaps and, to aid low-speed control, nozzles at the wingtips; take-off distance over 35 ft. is estimated as 1,180 ft. Maximum payload is 4,400 lb. and performance estimates include 440 m.p.h. cruising speed and a range of 1,055-1,242 miles. Somewhat smaller than the Skyvan, the BS-210 is designed to take up to twelve passengers plus a crew of two, and in the freight role can carry Volkswagen-sized objects, maximum payload being 3,500 lb.; proposed powerplant is two 530-s.h.p. Turboméca Astazou IIs. A more immediate transport activity of SIAT's is their participation in the Dassault Mystère 30 programme, noted later.

Winner of a Government competition, the SIAT 223 (developed from the earlier 222) seats two side by side with dual control and is powered by a 165-h.p.

Continental IO-345; cruising speed is 140 m.p.h. The machine is of all-metal construction and is fully aerobatic; two prototypes are being built.

The most successful German firm since the war, Dornier have not only sold well over six hundred of their Do 27s and some fifty twin-engined Do 28s, but have formed a valuable link with Hawker Siddeley in the joint development of the Do 31 V/STOL tactical transport which is being pursued on behalf of both Governments. The first step is the construction of two "flying bedsteads" and the first of these (powered by four Rolls-Royce RB.108 lift engines) flew successfully just before the show opened. The second and larger bedstead will be fitted with two Bristol Siddeley Pegasus vectored-thrust engines and eight Rolls-Royce RB.162 lift engines; these will be the engines used in the two prototype aircraft, Do 31Es, the first of which is expected to fly next year. Powerplant composition of the production Do 31s, which will be larger and have a T-tail, will depend on results obtained from the experimental machines but it is expected to use two 8,800-lb. s.t. propulsion engines (with deflected-thrust capability) and ten 5,500-lb. s.t. lift engines; estimated cruising speed of the production Do 31 is 465 m.p.h. and maximum take-off weight 51,800 lb.

To follow their Do 32 single-seat, ultra-

light, collapsible helicopter—demonstrated at Paris last year—Dornier's are now building a two-seat version, the Do 32Z, powered by a 250-h.p. BMW 6022 turbo-compressor and with an elegant canopy to cheer up the occupants. The Do 32Z (*Zweisitzer*) can be folded for transport by trailer in much the same way as the *Einsitzer*.

Bolkow had some interesting helicopters to talk about too. Shown in model form, the rigid-rotor Bo 105 with glass-fibre blades is expected to fly next year; powered by two BMW 6022 turbines, it will have a top speed of 150 m.p.h. and will carry a pilot and four passengers.

High-speed helicopters

Although not itself at Hanover the Bo 46 is more advanced, the prototype having flown in January. Three Bo 46s are being built under Government contract to try out the Derschmidt "lead-lag" rotor system which has been designed to enable helicopters to fly at higher speeds than formerly, 300 m.p.h. or more. The blades of the Derschmidt rotor are mounted on pivots and can be swivelled 40 deg. forwards or backwards. As the rotor turns, the advancing blades are swivelled backwards while those on the other side are moved forwards, thus reducing tip speed—the limiting factor. With the Bo 46, powered by an 800-s.h.p. Turboméca Turmo IIIB, it is hoped to test the system at speeds above 250 m.p.h. If all goes well Bolkow may then go ahead with their P-310 project for a 23-seat helicopter with two Derschmidt rotors, powered by two 3,200/3,400-s.h.p. Lycoming T55s or General Electric T64s and capable of cruising at 310 m.p.h.

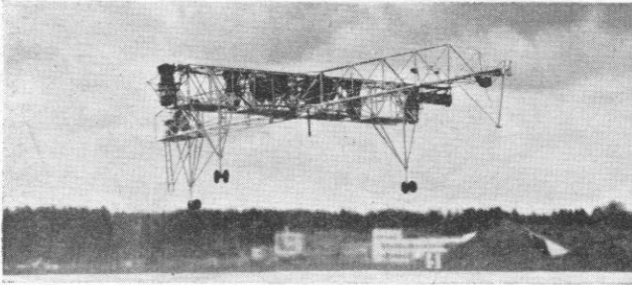
Taking part in the display were the well-known Bolkow Bo 207 and Junior and, as agents for the types, Bolkow also showed a Mooney Mk. 21 and an Austrian Simmering-Graz-Pauker SGP 222 Flamingo.

Messerschmitt's ideas on transports were illustrated by models of the Me P.160 and Me P.141 projects. The former is a short-haul airliner designed to carry up to fifty-four passengers at over 500 m.p.h. with a maximum range (with reserves) of 1,200 miles; originally the

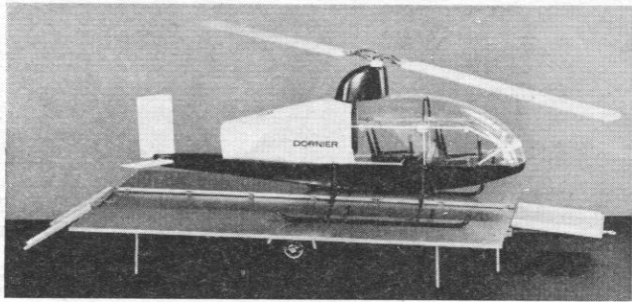
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LEFT: A model of the Fokker F.28 which, seating sixty passengers, is designed to fill the gap between the eighty-seaters (BAC One-Eleven, etc.) and forty-seaters. RIGHT: An impression of the forty-seat Dassault Mystère 30

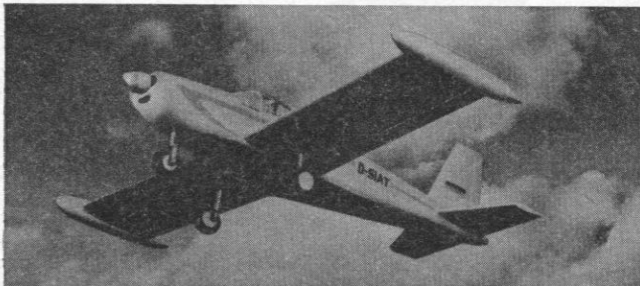




The first of two "flying bedsteads" built to help in the development of the Dornier Do 31 V/STOL transport



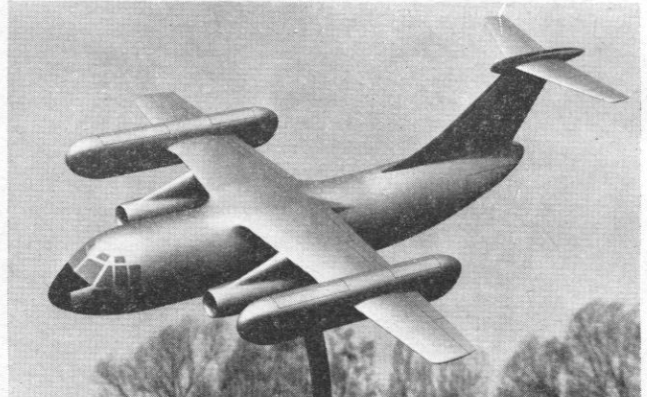
Model of the Dornier Do 32Z two-seat light helicopter



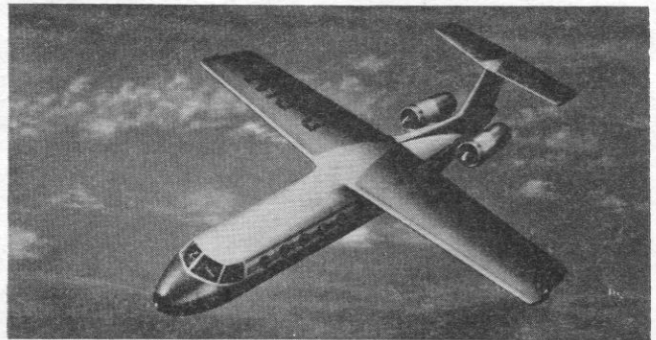
An impression of the SIAT 223 two-seat trainer-tourer



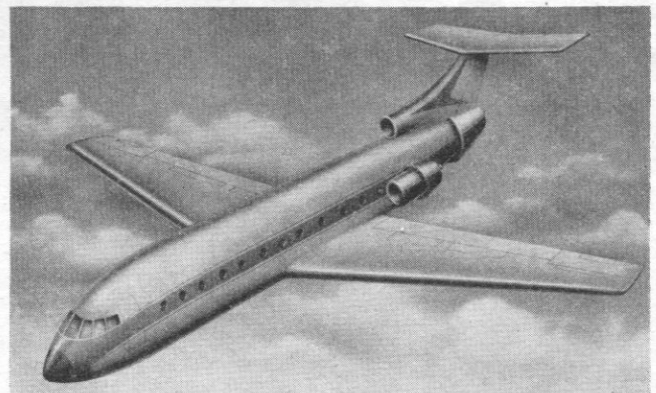
ABOVE: Bolkow-SIAT BS-210 is smaller than the Skyvan. BELOW: The Bolkow Bo 105 rigid-rotor helicopter



This is how the production-type Dornier Do 31 will look: T-tail and with lift pods moved in from wingtips

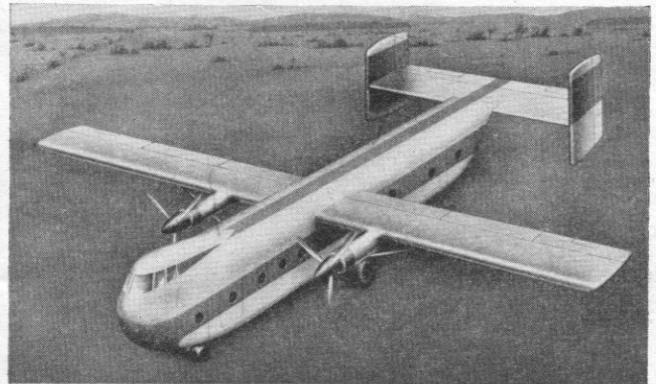


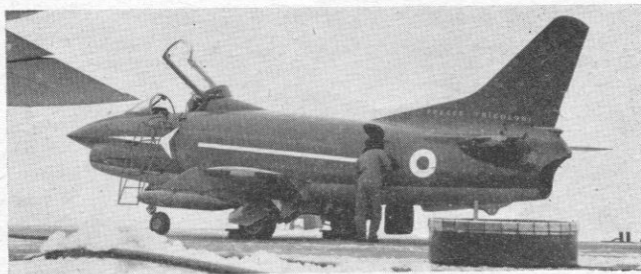
The SIAT 311A STOL transport project has "blown" flaps and wingtip nozzles to aid low-speed control



ABOVE: Original three-engined version of the Messerschmitt Me P.160 transport project; now offered with two RB.153s

BELOW: Me P.141 project is larger than the Skyvan





LEFT: One of the two Malmö Flygindustri MFI-10 Vipán at the show. VFW have obtained a manufacturing licence for the Vipán from the Swedish company. RIGHT: A Fiat G.91 P.A.N.—without armament and with special smoke containers—of the Italian Air Force's new aerobatic team, the Frece Tricolori ("Tricoloured Arrows")

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powerplant was to consist of three rear-mounted General Electric CF700-2B turbofans, but the P.160 is now offered with two civil versions of the Rolls-Royce/M.A.N. RB.153. Of similar conception to the Skyvan but larger, the P.141 is designed to carry loads of up to 7,250 lb. in its 1,550 cu. ft. hold and has large nose-loading as well as aft clamshell doors; two 1,000-s.h.p. turboprops—Turboméca Bastan VIs, General Electric T58s or Daimler-Benz DB PTL 6s—would give it a cruising speed of about 230 m.p.h.

Both these types are still at the project stage but Messerschmitt A.G. are building a full-scale mock-up and pressing development of their Me 308 Jet Taifun six-seat executive aircraft, powered by two 1,470-lb. s.t. Daimler-Benz DB 720 turbofans, which are now sited high up on the fuselage behind the cabin instead of low down in the wing roots as first intended; cruising speed should be around 480 m.p.h. and maximum range 2,000 miles.

After a surfeit of projects the appear-

ance on 28th April—seven days after its maiden flight—of Hamburger Flugzeugbau's HFB 320 Hansa brought a welcome touch of reality to the scene. Powered by two 2,850-lb. s.t. General Electric CJ610-1s, this eight-seat executive jet can cruise at 507 m.p.h. and has a range of 1,840 miles. Nine have already been sold and the machine is also offered as a light transport accommodating a crew of two and twelve passengers. Designed to operate from unprepared strips, the HFB 320 has excellent low-speed characteristics, due largely to its 15-deg.-forward-swept wing; forward sweep was first used on the W.W.II Junkers Ju 287 jet bomber whose wing was built to Blohm und Voss (now Hamburger) patents.

"Foreigners"

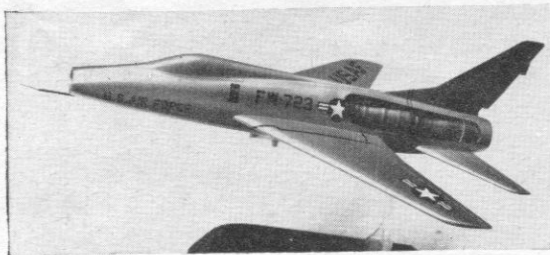
Of the visiting firms, Fokker's showed a model of their F.28 in its latest form with swept wing and longer cabin. Powered by two 8,650-lb. s.t. Rolls-Royce Spey Junior RB.183-1s, the 500-m.p.h. F.28 seats sixty passengers (sixty-five maximum) and Fokker's hope that it will

fill an important gap between the larger BAC One-Eleven and Douglas DC-9 and the many forty-seaters in view; the F.28 is, however, regarded as complementary to the F.27 Friendship, 274 of which have so far been sold and which is expected to continue in production until 1968 at least. Most of the F.28's development cost is being underwritten by the Dutch Government.

Shown in model form by SIAT, Dassault's partner in this particular programme, the Mystère 30 is a 500-m.p.h. jet transport resembling a scaled-up Mystère 20 and designed to carry forty passengers over stages of 125 to 930 miles. Powerplant will consist of two 5,000-lb. s.t. Rolls-Royce RB.172s, or possibly General Electric CF700s.

Fiat's G.222 V/STOL tactical transport project, shown at Paris last year, has undergone some changes and is now envisaged with eight instead of six lift engines, plus the two turboprops. In the flying display a Fiat G.91 P.A.N. of the Italian Air Force aerobatic team, *Frece Tricolore*, put up one of the prettiest performances.

On the North American stand was a model of an F-100 Super Sabre with a Rolls-Royce Spey, which would improve the machine's performance considerably. We also heard news that Hawker Siddeley have an exciting trainer project, the variable-sweep Gnat—possibly the forerunner of a whole new class of Mach 2 trainers which will soon be required by every major air force.



LEFT: Model of the F-100 Super Sabre with Rolls-Royce Spey, which would improve the machine's range, speed and climb. BELOW: A fitting tailpiece: the HFB 320 Hansa appeared at the show on 28th April, seven days after its first flight

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