
HELICOPTERS FOR COLLABORATIVE PRODUCTION

By

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In the forty years since World War II, the helicopter has become an indispensable military tool. Initially mainly used for liaison and transport duties, it has evolved into a most complex weapon system on the battlefield, at sea and in the air. It is also an excellent candidate for international industrial collaboration but, as . . . Erhard Heckmann shows in this comprehensive survey of manufacturers and types, there are many obstacles.

Helicopters are employed to destroy tanks and to support tank units during assault operations thus taking over the role of the close air support fixed wing aircraft. They are also used in counter-insurgency operations with guns and rockets, in ECM roles, to take over target identification in the army and naval role for OTH missile firings, and onboard ships in the ASW role. They have observation, liaison and transport roles.

The following report will present manufacturers of helicopters -- there are only eight of them in the Western world -- and describe the tedious way that a bilateral programme might lead to the common basic design of combat helicopters between two nations, i.e., the Federal Republic of Germany and France.

STONE AGE BARTER

There are eight helicopter manufacturers in the Western World. Four of them, Bell, Boeing-Vertol, Hughes and Sikorsky are located in the United States; the other four are in Europe: Aerospatiale in France, Agusta in Italy, MBB in Germany, and Westland in the U.K. It is characteristic of the aerospace industry that demand and employment are undergoing changes. With advances of technology reducing production costs and increasing maintainability and certain market saturations, it is recognised by all helicopter manufacturers that there is an over capacity in production. It is part of human nature that recognition of a fact is one side and the drawing of conclusions the other side of the coin. The helicopter industry is not acting differently from others. President Robert F. Daniell of Sikorsky for instance proposed last year that his company would be open to any kind of cooperation with other manufacturers based on the S-60 range of variants.

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That this offer -- or threat -- did not find a positive reaction is obvious. The simplest form of cooperation is the licensing agreement; such an agreement can help to penetrate markets which otherwise would not be accessible and might even include a permission for the licensee to sell abroad. In recent years sales of military equipment have been conducted in the way of stone-age barter trade. Modern words for it are "offset" and "compensation." This archaic method of trading has its justification nowadays in the necessity of the buyer not only to purchase a product but also having a certain technical know-how which permits him to maintain the purchased item and also to apply this technology in other areas.

BELL HELICOPTER TEXTRON CORPORATION

This US manufacturer is active in development and production of light to medium size helicopters and has produced 20,000 helicopters up to now. The company employs 7,000 people. At the present time Bell Helicopters has very few military production contracts, only improvement and development programmes. In production are COBRAs for foreign countries sold through FMS, and 62 TH-57 primary trainers for the US Navy (a military version of the JetRanger III). The company is now expecting an order of 44 AN-1T plus twin-engined SEACOBRA's for the US Marine Corps. These helicopters will be armed with TOW, HELLFIRE and SIDEWINDER for delivery by 1986. Bell is evaluating the dynamic components to be used in the aircraft being developed for the US Army Helicopter Improvement Programme (AHIP). Under a \$150 million contract announced in September 1981, Bell will design, modify and test five prototype helicopters. A successful development programme could lead to modification of 578 OH-58A to the Model 406 (OH-58D) configuration.

In the LHX, the Light Helicopter Experimental Programme, Bell's design studies concentrate on tilt rotor configurations to carry out three missions: armed reconnaissance, anti-armour and utility. The programme is only in the design concept phase; Army requirements and specifications do not yet exist. The company's future rests on the JVX programme, the joint tilt rotor vehicle programme from which the Army has recently dropped out. Here Bell forms a team with Boeing.

Bell helicopters are produced in many countries of the world. In 1982 Bell and Mitsui signed a contract to co-produce AN-1S modernized COBRAs for the Japanese Army. Twelve units are approved for production with first deliveries late in 1984. Fuji Heavy Industries has been nominated as prime contractor for the COBRA and will assemble the aircraft under a sublicense from Mitsui. Nurtanio of Indonesia will assemble two Bell 212s for offshore work. Agusta is producing nearly all Bell types under licence with the exception of the 214ST.

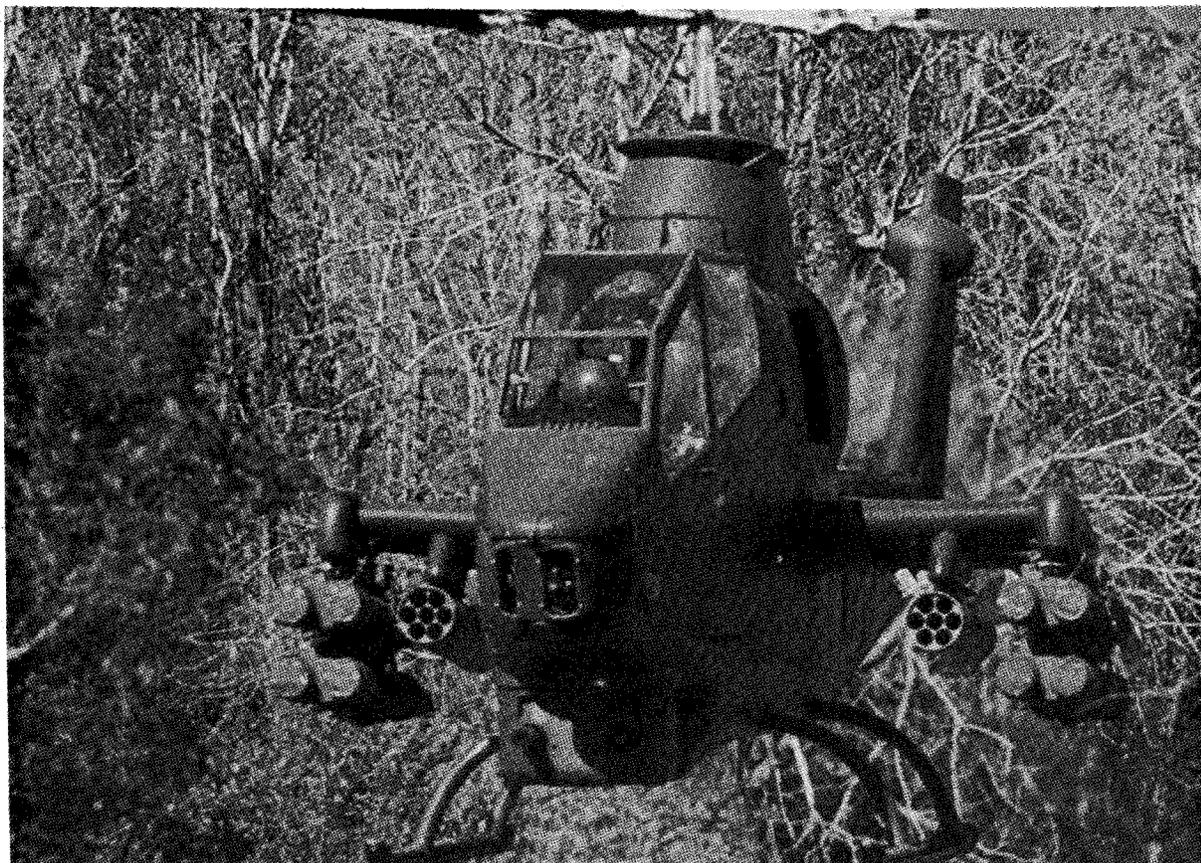
BOEING VERTOL

This company, located near Philadelphia, Pennsylvania, has produced over 2,500 helicopters since 1943. Originating from Frank Piasecki's P-V Engineering Forum in the early 40s, the company changed its name to Piasecki Helicopter Corporation in 1964 and developed the world's first tandem-rotor helicopter, the XHRP-1. In the following year, more than 1,000 piston engined tandem-rotor helicopters including the UH-25, the H-21, the YH-16, Vertol 42, 43 and 44, were built. With the advent of the jet age, a new

generation of tandem helicopters was designed, and in 1956 the company became the Vertol Aircraft Corporation which was acquired by the Boeing Company in 1960.

The first helicopter type of the new generation was the Model 107 from which a military version, the CH-46 SEAKNIGHT, was ordered by the US Marine Corps for its assault and transport mission. Production of the 107-II continues with Kawasaki Heavy Industries in Japan under licence.

In the late 1950s Vertol received a contract from the US Army to design and develop a medium transport helicopter which became the CH-47A CHINOOK of which almost 1,000 were sold to the US Army and to thirteen foreign nations. A total of 354 A models, 108 B and 270 C models were purchased by the US Army of which 436 are now being modernized to the D version. Thirty were ordered in the livery of the Royal Air Force which has ordered eight additional aircraft to replace losses when the ATLANTIC CONVEYOR was sunk off the Falkland Islands. Agusta has a licence agreement with Boeing Vertol to manufacture the CHINOOK in Italy and to sell to various other countries.



The most powerful combat helicopter of the Western world is the Hughes AH-64A Apache. Roll-out of the first production AH-64A is scheduled for September [1984].

HUGHES HELICOPTERS

This subsidiary of the Hughes Corporation employs about 4,500 people. In 1985, when APACHE production will reach its peak, 1,800 people in Mesa, Arizona, and 1,400 people in Culver City will be employed on this project alone. As the company is a private enterprise, no annual report is published. The first production model of the AH-64 APACHE . . . [was to] be rolled out on 30 September and handed over to the US Army in February 1984. In the middle of the 80s the monthly production will reach ten helicopters per month.

A German company is also participating in the project: AEG-Telefunken is the second source for the de-icing system. The fly-away price of the APACHE is given as \$7.2 million; this price should go down to \$6.4 million by the end of 1986 when production reaches its peak. At the Paris Air Show Hughes showed the No. 1 prototype of the APACHE which will be used to train pilots of the US Army.

According to present plans the US Army will procure 515 APACHES by the end of fiscal year 1987. Hughes' 500 model series is derived from the US Army OH-6A CAYUSE which flew for the first time March 1963. A considerable noise reduction of the Model 500D was achieved by changing the twin-bladed tail rotor to a four-bladed rotor which turns at only 2,200 rpm instead of 2,900. Technology programmes with Hughes are the no-tail rotor (NOTAR) helicopter, the higher harmonic control system and the flexbeam tail rotors of composite material.

SIKORSKY

Sikorsky Aircraft of United Technologies is the largest helicopter manufacturer in the world with a work force of 11,500. The company has built more than 6,000 helicopters in the medium to heavy category.

Founded in 1923 as the Sikorsky Aero Engineering Corporation producing flying boats and amphibious aircraft in the 20s and 30s, Sikorsky has concentrated its efforts on vectored lift, chiefly the helicopter in the early 40s. The present development and production spectrum consists of several major government programmes: the UH-60A for the US Army, which has a requirement for 1107 aircraft, the SH-60B SEAHAWK for the US Navy, a programme for more than 200 helicopters in the ASW and SAR role, the HH-60D NIGHT HAWK combat SAR helicopter for the US Air Force with an expected buy of 243 units, the CH-53E SUPER STALLION, a triple turbine heavy lift helicopter for US Army and US Marine Corps with a potential of over 100 helicopters, and the MH-53E mine-countermeasure helicopter for the US Navy of which about 50 are required.

Based on the commercial S-76 helicopter of the five-ton class mainly employed for corporate use and offshore work, Sikorsky has developed a multi-mission helicopter, the H-76 for export. It has an optional weapons armament support pylon which is mounted across the cabin floor. To date the H-76 has been qualified for light and heavy machine guns and rocket systems. A qualification programme to fire the TOW anti-tank missile is in progress. The helicopter features sliding doors on either side of the cabin and can be equipped with a mast or roof mounted TOW sight.

AGUSTA

The Agusta Group underwent a reorganisation in January 1981 into three operational divisions: Helicopters, Airplanes, and Diversified Activities and Systems Division.

The Helicopter Division consists of Costruzioni Aeronautiche G. Agusta, E.M. Elicotteri Meridionale S.p.A. and E.H. Industries Ltd. Agusta employs 4,500 of the 6,000 people in the division.

Elicotteri Meridionale was started in 1963 by Agusta to follow the Italian Government's programme for the industrialisation of Southern Italy. Operations began in 1967 with the overhaul of helicopters for the Italian Forces and paramilitary units. Afterwards it was enlarged to include construction of components of different aircraft.

In 1952 Agusta arrived at a licensing agreement with Bell to produce AB-47 helicopters. Own projects were the A-102 as the first helicopter of Italian design to receive the CoA in 1958. A year later the A-104 and A-115 were developed and in 1961 the Agusta Bell AB-204B went into mass production. In 1964 the A-101G, powered by three turbo engines (38 passengers), started flight trials together with the A-105B. 1965 saw the beginning of the production of the turbine-powered Agusta Bell 205 followed by the AB-206 JetRanger and by the ASW Agusta/Sikorsky SH-3D for the Italian Navy. Agusta is the only manufacturer of the 212 ASW.

E.H. Industries was formed on an equal basis by Agusta and Westland for the joint development of the EH-101 helicopter, destined to replace the SH-3D/SEAKING in service with the Italian and Royal Navies. A commercial company with head offices in London was formed in 1980 within the framework of an agreement between the governments of the respective countries. E.H. Industries is the prime contractor for the EH-11 programme and issues sub-contracts to Agusta, Westland and other suppliers. The helicopter in the 13,000 kg class will satisfy the requirements of both the Italian Navy and Royal Navy up to the end of the 90s to fulfill a specific role in anti-submarine and anti-ship warfare.



The EH-101, a joint venture by Westland and Agusta, is a development funded by the British and Italian governments for a successor to the Seaking.

The EH-101 will be flying in 1985 with production starting in the second half of the 80s. Both companies hope to produce 750 helicopters of this type.

AEROSPATIALE HELICOPTERS

With 8,300 employees the Helicopter Division of Aerospatiale is the second largest helicopter manufacturer after Sikorsky. Up to the end of February 1983 the company has sold 7,586 helicopters with 6,441 delivered. Licence production of this French company is continuing in Brasil, India, Indonesia, Romania and Yugoslavia (military version of GAZELLE 342 without armament). China has obtained a licence for production of the commercial SA-365 DAUPHIN and is planning and building 300 helicopters.

In Egypt the Arab Organization of Industrialisation is building a military version of the GAZELLE under licence. The company is very much export-oriented. Of the 1982 turnover of 4260 million FF, 3450 million FF were made in export. It is company policy to produce a new model every other year. On every work-day two helicopters leave the final assembly. Ninety-three percent of the turnover is spent for R&D.

Military helicopters of Aerospatiale are subdivided into tactical transport such as SUPER PUMA and DAUPHIN, and the combat helicopters such as ECUREIL, GAZELLE, DAUPHIN and SUPER PUMA. The ECUREIL is a relatively cheap helicopter armed with a 20mm cannon and rockets. The GAZELLE, developed together with Westland, can be armed with a 20mm cannon, rocket launchers and machine guns.



Proposal of Aerospatiale and MBB for a joint anti-tank helicopter.

An advance in technology in particular in regard to the rotorhead design is worth mentioning. Whilst the rotorhead of the ALOUETTE consists of 377 parts, has 30 bearings and weighs 108 kg at a price index of 100%, the rotorhead of the GAZELLE had only 202 parts and 21 bearings with a weight of 103 kg (price index 95%). A technical break-through was reached with the STARFLEX rotorhead of ECUREIL and DAUPHIN which had only 70 parts, 3 bearings and weighed 59 kilos at a price index of 35%. In the experimental stage is the triflex rotor having only 50 parts; it weighs 50 kilos though the price basic of 35% cannot be adhered to.

MBB

Two years ago the Helicopter Division of MBB was merged with the Surface Transport Division with its main factory at Donauworth where the BO-105 and BK-117 helicopters are being produced. About 2,000 people are employed in helicopter design, production and service.

MBB's order book shows 1,004 orders for helicopters including 212 anti-tank helicopters (PAH-1) and 100 liaison and observation helicopters (VBH) for the German Army, as well as 60 for FAMED, the Spanish Army Aviation, in three different versions: unarmed (14), armed with HOT (28), and armed with a 20mm Rheinmetall cannon (18). Thirty BO-105s were ordered by the Army of the Netherlands, 24 by the Nigerian Air Force for SAR work, six by the Mexican Navy, three unarmed by the Peruvian Navy (with a final requirement of 10 units) and two by the Canadian Coast Guard.

While CASA of Spain is assembling the BO-105 helicopters for the Spanish forces and police, a farther reaching agreement was signed with Nurtanio of Indonesia, calling for licence production with increasing portion of own manufacture for 102 helicopters, about 40 of which are destined for military employment by the Indonesian Army and Navy with the Air Force holding an option. Nurtanio is also planning to produce 100 of the larger BK-117 beginning April 1985.

WESTLAND

The Westland Group employs 12,500 people of whom 7,500 are working for Westland Helicopters. In production are LYNX in the ARMY LYNX and SEA LYNX version, WH.30 (commercial) with increasing production rate. In this year nine helicopters of this type will be produced with the monthly rate increasing to four. This is a helicopter in the six-ton class and able to carry 22 troops. SEA KING and COMMANDO production rate is 1.5. Westland is also delivering components and parts for the PUMA/SUPER PUMA and GAZELLE.

Westland entered the helicopter industry by acquiring the license of the Sikorsky S-51S which was produced under the name DRAGONFLY. In 1959 Westland Aircraft acquired Saunders-Roe and one year later the Helicopter Division of Bristol Aircraft and Fairey Aviation, thus merging all helicopter production . . . [in] the U.K. . . . [into] one company. In 1966 the helicopter activities of Westland Aircraft were consolidated in the Westland Helicopters Ltd.

At the Paris Air Show Westland showed a mockup of the LYNX 3 anti-tank helicopter. Armed with HOT, TOW or HELLFIRE and equipped with TADS/PNVS, chaff dispenser, radar warning receiver, IFF receivers, IR jamming and self-protection by STINGER, the helicopter belongs to the 5.5 ton class. The reason for the rather heavy weight of this foreign anti-tank helicopter is the British Army requirement to carry an anti-tank squad in the fuselage.

It is no exaggeration to state that the first real successful collaborative agreement in the military helicopter field was the British/French agreement of 1967 which was endorsed by both governments in April 1968. This agreement led to the development of the SA-341/42 GAZELLE, the WG.13 LYNX, and the SA-330 PUMA. An important point in these agreements was the assignment of prime responsibility to one of the companies; thus Westland was responsible for the design of the LYNX and Aerospatiale for GAZELLE and PUMA.

PAH-2/HAC

A more recent programme for the joint development and production of a combat helicopter is the joint French/German attempt which after five years of studies, negotiations, and interruptions finally appears to be the right track.

It was back in the early 1970s that the Chief of ALAT, the French Army Aviation, and the General in charge of German Army Aviation, met and discovered that their requirements for an anti-tank helicopter with not only night flying but night fighting capabilities were almost concurrent. It was during that time when the German Army, in order to fill the anti-tank helicopter with full night fighting capability would require some more time and therefore started producing the PAH-1 as an anti-tank helicopter based on the Boelkow 105.

In 1978 the French and German Governments signed the MoU offering the concept phase of an anti-tank helicopter with night fighting capability which brought Aerospatiale and MBB closer together. This collaboration was assisted by these two governments which also sponsored R/D programmes for their national commercial companies that might become applicable in such a helicopter. Examples of such programmes are the fibre elastomere rotor, the tail rotor design in composite materials, fly-by-wire and night vision. This concept phase was followed by a definition phase which -- endorsed by a bilateral MoU of the governments -- covered the period from 1979 to 1981.

The result, in 1981, of these studies was a design which met all military requirements, had a take-off weight of 4.5 to 4.7 tons, a fibre elastomere rotor of 12.6 m[eter] diameter and a tandem cockpit. The question of night vision was not solved because the French Government planned to develop a "European" (French) system, while the Germans, having access to US common module technology based on a Government MoU, were reluctant to "reinvent the wheel." The two companies also offered two economy versions. Reduction Version I called for a weight reduction to 4.2 tons by reducing general equipment and armour. Reduction Version II could only meet the minimum requirements of the military in regard to performance, with six anti-tank missiles and had significantly reduced capabilities with eight missiles. The rotor diameter was 12 m[eter] and the weight 3.8 tons.

All these proposals were not accepted by the governments -- particularly the Germans -- because the solutions offered were either too far off the basic requirements or too expensive.

Industry was asked to submit new proposals by the middle of 1981 aiming primarily at a price reduction, achieved by using existing components, and also by asking industry to participate in financing the project. Both companies proposed side-by-side seats, a modified DAUPHIN transmission, a Fenestron shrouded tail rotor and a fibre elastomere rotor of 12.3 m[eter] in diameter. Also proposed was the European night vision and sight system PORTHOS/PISA.

At the end of 1981 this proposal was rejected by the German Government; the French Government, however, accepted, and followed along those lines on a national programme with Aerospatiale.

The German Government on the other hand asked MBB to investigate and evaluate proposals made by other helicopter manufacturers. This request caused MBB Ottobrunn some surprise as German-French collaboration had been assumed to be the official policy, and MBB had its own strong interest in collaboration with France because of the ties developed in the anti-tank missile field with an agreement for the third generation of anti-tank missiles under negotiation.

During the following months the following projects were studied: Bell 249, Hughes AH-64 APACHE, Westland LYNX III, Sikorsky UH-60A BLACK HAWK, Agusta A-129 MONGOOSE and a national MBB proposal.

In France, owing to financial constraints, the French Army Aviation had altered the requirements. It was decided to introduce first a combat helicopter armed with a gun with night flying but not night fighting capability. This was then supposed to be supplemented by a night fighting anti-tank helicopter in the middle of the 90s. At that time, the second half of 1982 to early 1983, the requirements of both countries were farther apart than ever before.

It was a political decision which finally led to an agreement. Dr. Manfred Worner, the new German Minister of Defence, pressed for a solution. In the first phase the French-German military requirements were laid down, then the Chiefs of the Army were asked which requirements were essential and which were not. This led, finally, to a fair compromise calling for a helicopter with a



Mock-up of the Italian anti-tank helicopter Agusta A-129 Mongoose.

take-off weight of 4.7 tons able to carry eight anti-tank missiles plus (a specific German requirement) four air-to-air missiles such as STINGER; twin engines -- which means development of a new engine on the basis of the MTU Turbomeca MTM385; a tandem cockpit; and night vision system from European sources should it be competitive with TADS/PNVS in price and performance.

The development of this helicopter should be complete by 1990 leading to its introduction into the German Forces in 1992/93 with the improved anti-tank missile HOT-B. At the same time France will introduce this helicopter as HAP (Helicoptere d'Appui et de Protection) with air-to-air missiles and an articulated gun, vally an anti-combat helicopter.

Only after 1995 will the French Army Aviation receive their Helicoptere Anti Char (HAC) armed with eight third generation anti-tank missiles (HOT successor) under development in French/British/German collaboration.

The formal MoU between the French and the German Governments is supposed to be signed in late summer 1983. It should be noted however, that this agreement leaves the door open for the U.K. which will require 200 to 250 light attack helicopters in the second half of the 90s.

Three conclusions can be drawn from this story:

1. Prerequisites for a joint programme starting from the R&D phase are: similar military requirements and a similar time frame.
2. Industry is doing what it is being told to do by the governments (the customer).
3. If a multinational programme does not proceed for various reasons which might be national industrial interests, diverging military requirements or financial constraints, then the political leaders are called into action.



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