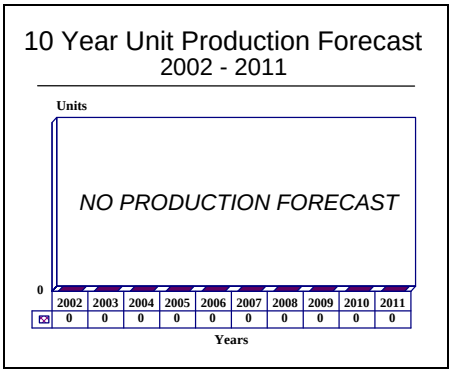
# Kormoran (AS.34) - Archived 3/2003

## Outlook

- No longer in production
- Germany will arm its surface combatants with the RBS15 Mk 3
- Polypheme could also be acquired to arm German ships and helicopters
- No successors to the Kormoran 1 and 2 have been procured
- A decision on a follow-on missile could be made before the end of the decade




## Orientation

Description. Air-launch anti-ship missile.

Sponsor. The Federal Republic of Germany's Ministry of Defense with funding through the Defense Technology & Procurement Agency, Bonn, Federal Republic of Germany. The Deutsche Marine (formerly Bundesmarine) fleet air arm is in charge of procurement.

Contractors. DaimlerChrysler Aerospace (formerly Deutsche Aerospace AG, Defense & Civil Systems Group, Dynamic Systems Division), Munich, Federal Republic of Germany; and Aerospatiale, Paris, France. Originally, jointly developed by Messerschmitt-Bolkow-Blohm GmbH, Defense Systems Group, Dynamics Division, Munich, Federal Republic of Germany, and Aerospatiale, Paris, France. The program was run by and the missile produced at Messerschmitt-Bolkow-Blohm GmbH. MBB was the prime contractor for the Kormoran program, with responsibility for the design, development and production of the missile and warhead. MBB was completely absorbed by Deutsche Aerospace (itself later absorbed by DaimlerChrysler); its former defense activities were divided among its various groups and divisions.

Major Subcontractors. Aerospatiale, Bayern Chemie, Bodenseewerk Gerätetechnik GmbH, Diehl Group, Junghans, Litef, Litton Systems, Mannesman Technologie, Societe Nationale des Poudres et Explosifs, Telecommunications Radioelectriques et Telephoniques, Teldix GmbH, and Thomson-CSF (now Thales).

Licensee. The Boeing Company holds a license for the production of the Kormoran.

Status. Serial production of both the Kormoran 1 and Kormoran 2 may have ceased. Fabrication of the Kormoran 1 concluded in 1987, followed by the Kormoran 2 in 1998. Kormoran 2 entered service with the Deutsche Marine (formerly Bundesmarine) during 1995-1996. Germany is said to have a requirement for some 175 improved missiles, although other sources put the total as high as 262.

Total Produced. The Kormoran has been in the Federal German Navy's inventory since 1977. As of the end of 1991, 583 Kormoran 1 missiles (including RDT&E units) had been produced. Some 225 Kormoran 2s were produced by the end of 1998. The German Naval Air Arm received its last Kormoran 1 missiles in 1983. By 1988-1989, approximately 400 Kormoran 1 missiles had been built, of which 350 were delivered (from 1977 to 1983) to the German Marineflieger for 56 installations, and 40 were delivered to the Italian Air Force.

Application. An all-weather anti-ship missile, Kormoran equips German F-104G and Tornado aircraft used in anti-ship roles.

Price Range. Kormoran 1 costs approximately $348,000 per missile in Fiscal 1987 dollars. Kormoran 2 costs about $476,500 in Fiscal 1998 dollars.

# Technical Data

Design Features. The Kormoran 1 is very similar to the Kormoran 2. The major differences are weight – 600 kilograms for the Kormoran 1 compared to 630 kilograms for the Kormoran 2 – and the lighter 160-kilogram warhead carried by the Kormoran 1.

| | **Metric** Kormoran 1 | **Metric** Kormoran 2 | **US** Kormoran 1 | **US** Kormoran 2 |
|---|---|---|---|---|
| **Dimensions** | | | | |
| Length Overall | 440 cm | 440 cm | 14.43 ft | 14.43 ft |
| Diameter of Body | 34.4 cm | 34.4 cm | 13.54 in | 13.54 in |
| Wingspan | 100 cm | 100 cm | 39.37 in | 39.37 in |
| Weight at Launch | 600 kg | 630 kg | 1,320 lb | 1,386 lb |
| **Performance** | | | | |
| Speed | Mach 0.95 | Mach 0.95 | Mach 0.95 | Mach 0.95 |
| Cruise Altitude | 20 m | 20 m | 65.61 ft | 65.61 ft |
| Range (max) | 30+ km | 30+ km | 16.20+ nm | 16.20+ nm |

Propulsion. Two solid-fuel booster motors, designated Prade and rated at 27 kN (6,000 lbst) each, are used to accelerate the missile to cruise speed, after which a solid-fuel sustainer engine designated Eole IV with 2.8 kN (622 lbst) maintains cruise speed at about Mach 0.9. Kormoran 2 features a new four-nozzle, ring-shaped booster motor which will allow the missile to be launched from slower aircraft. All engines are manufactured by Societe Nationale des Poudres et Explosifs, Paris, France.

Control & Guidance. When used on the F-104, the target is initially acquired by the aircraft's NASARR F15N-A radar. The F-104G launch aircraft is equipped with Litton Systems LN-3 Inertial Navigation System, which provides the aircraft's orientation in pitch, roll and yaw, as well as its position in space and its speed. The NUG-B Navigation Support Unit processes the LN-3 input and feeds it into the aircraft's Kormoran computer. The PHI-4A19 Position and Homing Indicator serves as a navigational aid to the pilot, facilitating the target approach. The Vector Addition Device is used to approach the target in various ways as it provides a continuous display of range and bearing information on the position and homing indicator.

The Kormoran missile itself is equipped with an inertial navigation system produced by Bodenseewerk Gerätetechnik and a radar altimeter provided by Telecommunications Radioelectriques et Telephoniques, which provide information to the missile's course and position indicator for corrections to the flight path. The radar homing head is based on the Thomson-CSF R.E. 576 unit, and is capable of active search lock-on and tracking, as well as passive anti-radar or anti-jamming modes. If the radar is not operational or the pilot does not wish to employ it, the missile can also be guided in an optical mode, using the aircraft sight, with information transmitted from the aircraft to the target. Operation with the Panavia Tornado aircraft is similar. Kormoran incorporates a comprehensive electronic counter-countermeasures subsystem in its nose. Details are classified. While the original Kormoran has analog electronics, Kormoran 2 features digital electronics, allowing the size and weight of guidance system components to be reduced. Kormoran is roll-stabilized and steered by electro-mechanically actuated control surfaces at the rear of the missile.

Launcher Mode. The missile is carried externally aboard wing or fuselage pylons on F-104G or Tornado aircraft. Prelaunch information is provided to the missile via the aircraft's systems.

Warhead. Kormoran 1 has a high-explosive warhead weighing 160 kilograms (352 lb) produced by Messerschmitt-Bolkow-Blohm's Schrobenhausen facility. The warhead has a delay impact fuze and is composed of two rows of elliptical-shaped charges (16 total), which act as projectiles upon explosion in order to penetrate 7-9 centimeters (2.75-3.54 in) of grade 37 steel. The high explosive content is 56 kilograms (1,231 lb) and surrounds the 16 projectile charges. Kormoran 2 features a much larger warhead, weighing 220 kilograms (484 lb), of the same design but with a new fuze mechanism.

Kormoran 2

Source: EADS

# Variants/Upgrades

The two primary versions of Kormoran are the Kormoran 1 and 2. For additional information on these missiles, please see the pertinent entries in the **Program Review** section.

# Program Review

Background. Based on a Bolkow study of air-to-surface missiles in 1962 and Franco-German projects of the early 1960s, the Kormoran program was launched in 1964. The Kormoran, also known by its French designation, AS.34, is a roll-stabilized, air-to-surface anti-ship missile. Initially, the prime contractors were Bolkow (now MBB) and Nord Aviation (now Aerospatiale). The design and concept studies of a seeker head were performed in conjunction with the French Compagnie Generale de Telegraphe sans Fils. However, by 1967, the two nations had divergent paths with regard to missile development, and the leadership of the Kormoran program was assumed by the Germans. Although several French subcontractors have continued to collaborate with Messerschmitt-Bolkow-Blohm on the radar seeker and propulsion, the primary French efforts have since been directed toward its own Exocet program (see separate report). In October 1967, the Kormoran development program was integrated with the Lockheed F-104G Starfighter aircraft program of the German naval air arm (Marineflieger). Development continued until 1974, when a contract worth DM469 million was signed for the production of 350 missiles and 56 aircraft installations. Following a series of problems, the program slipped and the final contract was signed in November 1976. Of the total cost, DM432 million was for missiles and DM37 million for the aircraft installations. In September 1977, four missiles were successfully fired, meeting the Ministry of Defense requirement that at least four out of seven firings be successful. The first production rounds were delivered in December 1977 and were successfully tested by Marineflieger.

The German Navy had to consider alternatives to two of its Kormoran contractors. Teldix will integrate the missile with the Tornado, as MBB could not carry out the work within the financial limits of the contract. In addition, improvements to the seeker head increased the program cost from DM45 million to nearly DM100 million, with the result that Motorola was asked to take over the work from Thomson-CSF. To meet the contract terms, Teldix had to demonstrate a working model of the system by fall 1980, with a flight standard model produced by early 1981 and production of six units per month starting a year later.

Testing & Evaluation. A full-scale development contract was awarded to Messerschmitt-Bolkow-Blohm by the German Defense Technology & Procurement Agency in October 1968, resulting in early trials of an X3 missile the following year. This was followed by demonstration of a sea-skimmer variant in 1970 and tests with radar seeker units in 1971, as well as the first launch from an F-104G. From 1972-74, the German Navy conducted firing evaluations of the missile, qualifying it for operational use. Also developed during this time were the improved seeker with electronic counter-countermeasures (ECCM) capability and the automatic check-out system for the missile.

Approximately $22 million was authorized in procurement funding in 1975 to get the program under way. However, the actual procurement contract was not signed until November 1976. This contract, for DM469 million, called for the production of 350 Kormoran missiles and 56 F-104G aircraft launcher systems at a reported cost of DM1,234,000 ($536,000) per missile, and DM660,714 ($287,267) per launch set. Deliveries commenced in late 1977 and have continued since, with the unit price falling as serial production increased.

Kormoran equips some 25 German F-104Gs, and is being fitted to 113 Panavia Tornados which are replacing the Starfighters in the German Navy. Each F-104G carries two Kormorans underwing, while the Tornado carries two under the wings plus two under the fuselage. It should be noted that Italy is receiving 100 Tornados to replace its F-104Gs. While it is not known at this time if any of Italy's Tornados will be employed in a marine role, it is known that Italy has purchased an undisclosed number of Kormoran missiles, plus spares, documentation and training.

New Missile for Navy. The German Navy is considering replacing its US-built RGM-84 Harpoon missiles with a navalized version of the TAURUS. The TAURUS is a family of missile systems being developed initially for use on updated German Panavia Tornado fighters.

This TAURUS version, the KEPD 350, is intended for use by Germany's frigate fleet and possibly other surface combatants. Berlin would like to start development of this version by 2003 so that it can enter service with the Navy starting in 2009. However, budget shortfalls could force a delay in, or by some estimates a termination of, this program.

Whether a system like this would affect the operational status of the Kormorans is unclear. Nevertheless, the successful deployment of a shipborne TAURUS missile could prompt the German government to at least investigate the feasibility of developing an air-to-surface version.

Missile Models. Germany has developed two versions of the Kormoran anti-ship missile. No further versions are expected to be developed.

Kormoran 1. The Kormoran 1 is equipped with a radar altimeter, and an inertial navigation system produced by Bodenseewerk Gerätetechnik. Upon launch, the missile descends to its programmed flight level (as low as 20 m - 65.61 ft), under inertial guidance. When Kormoran is within line-of-sight of the target, the radar receiver is switched to search to scan for signals emitted by the target. If signals are picked up, the homing head locks on and the missile operates in a passive homing mode. Should no signals be received, Kormoran's radar transmitter is activated and a target search, lock-on and tracking sequence follows. At a short distance from the target, the missile descends to its final sea-skimming flight level to hit the target just above the water line.

Kormoran 2. In March 1983, Messerschmitt-Bolkow-Blohm announced that development would soon begin on the Kormoran 2 under an initial contract worth $49.5 million. This announcement came somewhat as a surprise, given the fact that Messerschmitt-Bolkow-Blohm was already involved with Aerospatiale on the development of the Anti-Navires Supersonique (ANS) missile project, which would have supersonic performance. Aerospatiale, among the subcontractors listed for Kormoran 2, is responsible for the cruise engine.

The Kormoran 2 missile retains the dimensions, center of gravity position and external shape of the Kormoran 1; however, the Kormoran 2 has a much larger warhead, longer range, more launch modes and greater electronic countermeasures resistance. Kormoran 2 has essentially the same performance envelope as the original missile, but with enhancements that enable it to perform its mission much more effectively.

In 1983 it was announced that Thomson-CSF would develop an all-new digitized, solid-state, micro-processor-controlled, active radar seeker for

Kormoran 2. The new seeker improves discrimination-facilitating target selection and acquisition, and offers greater electronic countermeasures resistance. This is achieved with only 60 percent of the volume and half the weight of the previous Kormoran 1 seeker. The use of digital technology that allowed the downsizing of the seeker, processing electronics and strapdown inertial navigation system also enabled the Kormoran 2 to have a 40 percent larger warhead, with a new fuze and greater explosive power. The warhead makes up 35 percent of the missile's launch weight.

A new Bayern Chemie four-nozzle ring booster motor with 63,000 Newton-second impulse is also being added. This new motor enables the missile to be deployed by maritime patrol aircraft, like the Atlantic, and other relatively slow aircraft. The higher impulse also allows the electronic ignition of the SNPE Eole IV solid-propellant sustainer motor to be delayed until the missile falls to its cruising speed of Mach 0.9. The high-speed glide contributes to the system's 30+ kilometer range.

An MBB MODUS microprocessor, the brains of the missile, is fed the aircraft and target position before launch. During flight, the microprocessor receives input from the inertial navigation system and the TRT AHV-14 radar altimeter to control the missile's flight path from the sea-skimming height up to the terminal attack phase. The MODUS can detect ECM emissions and initiate counters, and can also be reprogrammed to meet new threats. The missile remains passive until 15 to 20 seconds prior to impact in order to evade detection and limit reaction time.

There are four firing modes with the Kormoran 2: Silent firing, where the target is acquired outside the maximum missile range and the missile is launched without additional radar transmission; Radar firing, where the target position is fed in or updated by the aircraft radar at the launch point; Visual firing, a short-range alternative for ad hoc targets or in case of avionics failure; and Offset firing, where the target data are fed through the datalink to the launch aircraft from another source, such as a maritime patrol aircraft.

Captive flight trials were carried out in 1985 to check the new seeker, with the main development activity being the integration of this system. The first guided launch was performed in 1986. MBB completed the second major firing of the Kormoran 2 early in 1988. Thomson-CSF said that this launch was aimed at demonstrating the overall operation of the system under realistic conditions.

Production contracts were believed to have been awarded in 1988, with service entry scheduled for 1990. However, service entry has been delayed, with no specific reason given. The German Navy may receive upwards of 262 Kormoran 2 missiles worth DM400 million ($242 million). Deliveries commenced in the mid-1990s.

## Funding

The Italian defense budget for 1981 included $68 million for procurement of approximately 40 Kormorans for Italian Air Force Tornados. In 1982, Germany provided funding of $69.4 million for 88 Kormoran 2 missiles. Total German Kormoran 2 procurement could amount to DM400 million ($242 million).

## Recent Contracts

No information is available.

## Timetable

| Month | Year | Major Development |
|---|---|---|
| | 1962 | Research initiated in France and the Federal Republic of Germany |
| | 1967 | Engineering development contracts awarded |
| Oct | 1968 | Full-scale engineering development begins |
| | 1969-70 | Contractor testing starts |
| | 1974 | Contractor testing completed: 50 test firings |
| | 1975 | Pilot production for operational testing begins |
| | 1975-76 | Operational testing conducted |
| Nov | 1976 | Production contract awarded |
| | 1977 | Operational qualification |

| Month | Year | Major Development |
|---|---|---|
| Feb | 1978 | Initial deliveries to German Navy |
| | 1978 | Initial Operational Capability with F-104G aircraft |
| | 1980 | 100th Kormoran missile delivered |
| Sep | 1980 | Sale of Kormoran to Italy |
| Mar | 1983 | Development of Kormoran 2 announced |
| Jun | 1983 | Last Kormoran 1 delivered to Federal Republic of Germany |
| | 1986 | Kormoran 2 flight tests to begin |
| | 1987[(a)] | Production of Kormoran 1 conclude |
| | 1995[(a)] | First production deliveries of Kormoran 2 |
| | 2000 | Germany looking for new anti-ship missile |
| | 2001 | Berlin selects RBS15 Mk 3 for K-130 corvettes |

[(a)] Estimate

# Worldwide Distribution

The primary customers for the Kormoran 2 are expected to be the Federal German Navy, the Italian Air Force, and possibly Italy's Navy. The missile is expected to equip F-104 and Tornado fighter aircraft. Other possible customers for the Kormoran include users of the Tornado, such as Saudi Arabia.

User Country(s). Operators of the Kormoran 1 include the **German Navy** and the **Italian Air Force**. The Kormoran 2 is deployed by **Germany** only.

# Forecast Rationale

The Kormoran is no longer in production, but remains in service with the German military. The German Navy is currently involved in a modernization program that includes the introduction of new surface combatants and anti-ship missiles.

In a major victory for Saab and BGT, the German Navy selected the RBS15 Mk 3 to arm its new K-130 corvettes. Saab and BGT had teamed to market this missile to the German Navy. The RBS15 defeated opponents from the United States and France. The companies expect the RBS15 to become the standard anti-ship missile for the German Navy. Still, Berlin has not announced if the RBS15 will be procured for use from fighter aircraft, thereby replacing the Kormoran.

Germany is said to be considering the purchase of a separate missile to meet airborne anti-shipping needs. One option mentioned was the acquisition of the Norwegian NSM, while another centered on the French Anti-Navires Futur (ANF) program. A final decision has yet to be made.

# Ten-Year Outlook

**ESTIMATED CALENDAR YEAR PRODUCTION**

| | | | High Confidence Level | | | | Good Confidence Level | | | Speculative | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Missile | (Engine) | thru 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | Total 02-11 |
| DAIMLERCHRYSLER AEROSPACE | | | | | | | | | | | | | |
| AS.34 | EOLE IV | 583 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AS.34/2 | EOLE IV | 225 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Production | | 808 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |