EADS Mako

Outlook

- The Mako program has been shelved
- Mako technology may eventually be utilized in India's Light Combat Aircraft program

Orientation

Description. Family of single-engine, single- and twin-seat, supersonic advanced trainer/light combat aircraft.

Sponsor. The Mako was sponsored by EADS Military Air Systems.

Status. The Mako program has been shelved.

Total Produced. Not applicable.

Application. Advanced trainer, companion trainer, light combat aircraft.

Price Range. Published estimated price range was $15-$22 million.

Contractors

Prime

European Aeronautic Defence and Space Co (EADS) NV	http://www.eads.com, Mendelweg 30, Leiden, 2333 CS Netherlands, Tel: + 31 71 52 456 00, Fax: + 31 71 52 328 07, Prime

Subcontractor

GE - Aviation	http://www.geae.com, 1000 Western Ave, Lynn, MA 01905-2655 United States, Tel: + 1 (617) 594-0100, Fax: + 1 (617) 594-4729 (F414M Turbofan Engine)

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Technical Data

(Mako HEAT)

Design Features. Shoulder-mounted wing. Wing leading edge sweep was 45 degrees. The Mako's flight control surfaces included single-section flaperons, an all-moving tailplane, an inset rudder, and full-span wing leading-edge slats. The Mako was to be equipped with a reprogrammable quadruplex digital fly-by-wire flight control system. The aircraft featured retractable tricycle type landing gear, with a single wheel on each unit. As for avionics, a modular concept was used in order to permit easy upgrade or tailoring to customer specifications. A multimode radar was optional. Final selection of this radar never occurred; contenders had included the BAE Bluehawk, the Lockheed Martin APG-67, the SELEX Galileo Grifo, and the Thales RD-400.

Materials and components for the Mako were to be selected to meet predetermined cost figures. Fully developed equipment and subsystems were to be used in the aircraft in order to reduce development risk.

	Metric	U.S.
Dimensions		
Length	13.75 m	45.11 ft
Height	4.50 m	14.76 ft
Wingspan	8.25 m	27.07 ft
Weight		
Empty weight	5,800 kg	12,800 lb
Max TOW	8,300 kg	18,300 lb
Performance		
Max speed	Mach 1.3	Mach 1.3
Max altitude	15,240 m	50,000 ft
Max ferry range (with external tanks)	3,900 km	2,100 nm

Propulsion

Mako HEAT (1) General Electric F414MT turbofan engine derated to 75.0 kN (16,860 lbst).

Crew

One or two pilots, depending on version.

Armament

(Mako LCA) Depending on customer requirements, the LCA could be equipped with an internal 27mm gun and seven stores pylons. The latter included one at each wingtip (for air-to-air missiles only), two under each wing, and one under the fuselage. Stores that could be carried included air-to-air missiles, air-to-surface missiles, bombs, munitions dispensers, fuel tanks, and reconnaissance pods. The outboard pylons were stressed for 675 kilograms (1,488 lb) each, while the underfuselage and inboard wing pylons were stressed for 1,350 kilograms (2,976 lb) each.

Variants/Upgrades

Three versions of the Mako were envisioned: an advanced trainer variant called the Mako High Energy Advanced Trainer (HEAT), a single-seat light combat aircraft (LCA) version, and a two-seat LCA version.

Program Review

Background. In April 1989, Dornier and Aermacchi launched a joint program to develop an advanced trainer called the AT-2000. Later that year, Dornier became part of Deutsche Aerospace (DASA). Aermacchi withdrew from the AT-2000 program in 1994, and DASA continued the program on its own. In 1998, the AT-2000 was renamed the Mako.

During the mid-1990s, DASA unsuccessfully proposed the AT-2000/Mako to meet a South Korean Air Force

requirement for an advanced trainer, as well as South African Air Force (SAAF) requirements for a light fighter and a lead-in fighter trainer. The Korea Aerospace Industries KTX-2 (now known as the T-50) was eventually selected for the South Korean Air Force requirement, while the SAAF requirements are being met by Saab Gripen light fighters and BAE Hawk lead-in fighter trainers.

A full-scale mockup of the Mako was displayed at the 1999 Paris Air Show. DASA was merged into the new EADS consortium in 2000.

Potential Suppliers. In February 2001, four companies signed Memoranda of Understanding (MoU) regarding potential participation in the Mako program. These companies were Computing Devices (for the mission computer, displays and controls, and stores control system), Eurojet/MTU (EJ200 engine), General Electric (F414 engine), and Honeywell (environmental control system, external lighting, life-support system, navigation, hydraulics, and secondary power system).

In June 2001, five more companies signed MoUs regarding the Mako program. These were APPH Precision Hydraulics (landing gear and hydraulics systems), BAE Systems Controls (flight control computers, flight control system actuation, and utility control system), BGT/Diehl (flight control computers, mission computers, and participation in weapons, self-defense systems, and training aids), FHL (flight control system actuation), and Snecma Group (M88 engine, landing gear, gearbox, APU/starting systems, brakes, wheels, wiring, filter systems, and other equipment).

Signing MoUs in November 2001 were Autoflug, Flight Visions, GAMCO, the Higher College of Technology, Rockwell Collins, and the UAE University at Al Ain.

A Mako cockpit demonstrator was displayed at the 2001 Paris Air Show. Potential Mako suppliers that provided equipment for the demonstrator included BAE Systems North America (throttles and sticks), Essex Industries (grips), Martin Baker (front ejection seat), and Goodrich (rear ejection seat).

F414M Selected

Engine Competition. Engine candidates for the Mako were the General Electric F414, the Eurojet EJ200, and the Snecma M88. In July 2002, the M88 was eliminated from the competition.

In December 2002, the General Electric F414M, a derivative of the F414-GE-400, was selected to power the Mako, defeating the EJ200.

EADS Military Air Systems and GE Aviation signed a teaming agreement for the definition phase of the Mako program. The two companies worked together to complete the technical definition of the Mako aircraft and its subsystems, the F414M engine installation, and the definition of the single-engine features for the F414M. Specifications and documentation were to be defined in preparation for the launch of the development phase of the program.

In late 2002, GE Aviation signed an MoU with Volvo Aero Corp regarding collaboration on the F414M engine for the Mako. The MoU covered cooperation on development activities, hardware production, final assembly, and testing, up to a total engine value of 30 percent. According to Volvo Aero, final assembly of the engine would likely have occurred at the company's facilities in Trollhattan, Sweden.

The F414M is rated in the 98.0-kN (22,000-lbst) class. A derivative called the F414MT was to be utilized for the advanced trainer version of the Mako. The F414MT was derated to 75.0 kN (16,860 lbst) to extend the aircraft's useful life and reduce maintenance costs. A full-rated F414M was to have been installed in the LCA derivative for export sales.

Participation of UAE AF & AD. In November 1999, DASA and the United Arab Emirates Air Force and Air Defense (UAE AF & AD) signed an MoU to define details regarding potential collaboration on the Mako program. A second agreement on the program between EADS Military Air Systems and the UAE AF & AD was signed in March 2001.

EADS Military Air Systems and the UAE AF & AD worked together on the definition phase of the Mako program. However, the UAE AF & AD never committed to participation in full-scale development of the Mako, and its interest in the project eventually dissipated.

Funding

The development cost of the Mako was estimated at EUR1.5 billion ($2.0 billion). EADS had invested approximately $101 million in the Mako program by March 2004.

EADS Mako

Timetable

Month	Year	Major Development
Apr	1989	AT-2000 program launched
	1994	Aermacchi withdraws from AT-2000 program
Jul	1997	Conceptual study completed
	1998	AT-2000 renamed the Mako

Forecast Rationale

Unable to secure a launch customer, EADS finally shelved the Mako project. The company once said that it would need around 60 orders to formally launch the program. However, not a single order was ever placed for the aircraft. In the meantime, the advanced jet trainer market had become increasingly crowded, and rival aircraft such as the Alenia Aermacchi M-346 and the KAI T-50 were entering production. By contrast, the Mako never became much more than a design concept.

Even the UAE Air Force, once a participant in the Mako program, eventually moved on. Ultimately, the UAE decided that it would only consider acquiring the Mako if EADS was able to secure a customer in the company's domestic market (i.e., Europe).

With no such customer materializing, the UAE Air Force finally turned to other options. The service selected the M-346 (over the T-50) as its new advanced trainer in early 2009. However, despite protracted negotiations, a deal had yet to be finalized by late 2010, and unconfirmed press reports indicated that the T-50 was back in the running.

The Mako had been a candidate for the multinational Advanced European Jet Pilot Training (AEJPT) program. Indeed, at one time, the EADS aircraft might even have been considered something of a frontrunner for the program. However, the AEJPT effort suffered considerable delay over the years, which was one of the factors that served to blunt any momentum that the Mako project may have once had.

In December 2009, EADS Defence and Security signed an MoU with Alenia Aermacchi regarding a joint effort to supply an integrated training system, based on the M-346, for the AEJPT program. The following March, the two firms submitted a joint proposal based on the M-346 to the European Defense Agency's AEJPT Request for Information (RFI). In essence, the EADS/Alenia Aermacchi collaboration on the M-346 and the AEJPT program underscores the demise of the Mako project.

The AEJPT program involves the acquisition of some 80-120 aircraft to train military pilots. The participating nations in the effort are Austria, Belgium, Finland, France, Greece, Italy, Portugal, Spain, and Sweden. Germany, the Netherlands, and Switzerland hold observer status in the program. Plans call for Initial Operational Capability to be achieved in 2017, followed by Full Operational Capability in 2020.

Meanwhile, EADS has held discussions with India's Aeronautical Development Agency (ADA) regarding the possibility of utilizing technology developed for the Mako in India's Light Combat Aircraft (LCA) program. The LCA is currently in production as a single-seat fighter, but a two-seat trainer variant is in development.

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