

ARCHIVED REPORT

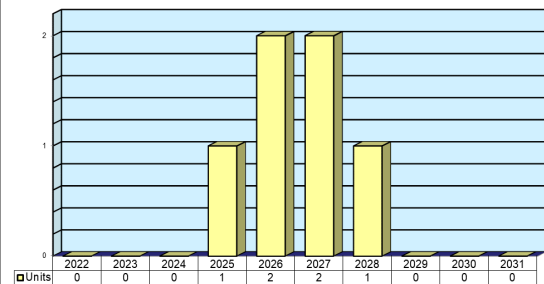
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MEADS Program

Outlook

- Lockheed Martin and MBDA Deutschland are partners in a MEADS-based bid for Germany's TLVS requirement; a revised bid was submitted in August 2020
- Germany has said it would procure a MEADS-derived IAMD solution, but no acquisition funding is expected in 2021, and plans have been repeatedly delayed
- Introduction of the GhostEye radar upgrade for the Patriot missile defense system could hinder the MEADS radar's chances for procurement

Unit Production Forecast
2022-2031



Orientation

Description. The Medium Extended Air Defense System (MEADS) is a multinational, limited-area defense system for maneuver forces. The system includes AESA radar systems, missiles, launchers, and control stations incorporated in a modular, open architecture. The radar has a 360° field of regard and incorporates gallium arsenide (GaAs) componentry.

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(Program management)

Status. Program equipment developed, but production not begun.

Application. The MEADS could replace current-generation air defense systems for deployed troops. It was conceived to replace existing Patriot systems in the U.S. and Germany, the retired Hawk system in Germany, and the Nike Hercules system in Italy.

Price Range. Unit cost to be determined. The various parts of the system – such as sensors, missiles, and C4I systems – have separate costs.

Based on the price of similar systems, the cost of a MEADS MFCR is estimated to range between \$26 million and \$32 million.

MEADS Program**Contractors****Prime**

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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data**MEADS MFCR**

	<u>Metric</u>	<u>U.S.</u>
Antenna	Pulse-Doppler Phased Array	
Antenna Type	AESA	
Component Features	GaAs	
Frequency Band	I-/J-band	X-band
Scan Coverage	360°	
Rotation Speed	0, 15, and 30 rpm	
IFF	Mode 5	
Interoperability	Link 16	

MEADS Surveillance Radar

	<u>Metric</u>	<u>U.S.</u>
Antenna	Pulse-Doppler Phased Array	
Antenna Type	AESA	
Component Features	GaAs	
Frequency Band	B-/C-band	UHF
Scan Coverage	360°	
Rotation Speed	0 and 7.5 rpm	
IFF	Mode 5	
Interoperability	Link 16	

MEADS Program

Design Features. The goal of the Medium Extended Air Defense System program was to create a highly mobile, lower-tier air defense system that could replace the Patriot air defense system in the U.S., the retired Hawk system and Patriots in Germany, and the Nike Hercules system in Italy. It was envisioned as a key element of theater missile defense in the U.S. Army's air and missile defense (AMD) architecture. The program's goal was further to provide area and point defense capabilities against threats from tactical missiles (tactical ballistic, air-to-surface, and anti-radiation) and air-breathing missiles and aircraft (fixed- and rotary-wing aircraft, cruise missiles, and unmanned aerial vehicles).

A critical void remains in maneuver force defense against the threat of short- and medium-range theater ballistic missiles, cruise missiles, and low- to medium-altitude advanced air-breathing threats. The program sought to integrate the Patriot Advanced Capability-3 (PAC 3) missile and develop the technologies required for maneuver force protection, including development and testing of a lightweight launcher, a reloader, 360° multifunction fire control and surveillance radars, and a netted and distributed battle management command, control, communications, computers, and intelligence (BMC4I) tactical operations center (TOC).

Sensor and battle management software technology from both U.S. and international programs is being examined in an effort to enhance organic equipment functions and reduce development costs, labor requirements, and program risk toward development of a capability to counter current and future threats.

The developmental approach emphasizes prototyping system-specific and surrogate hardware to satisfy mobility, strategic deployability, and interoperability

requirements. MEADS supports the Army's Transformation Campaign Plan.

The goal was for the program to be capable of autonomous operation as part of the Army AMD architecture and for MEADS to be compatible and interoperable with other Army air defense systems, as well as to be able to interface with joint and allied sensors and BMC4I networks.

A MEADS fire unit consists of two BMC4I TOCs, six near-vertical launchers capable of carrying and launching up to eight missiles, three launcher reloaders, a UHF surveillance radar providing 360° coverage, and two X-band multifunction fire control radars (MFCRs) providing 360° coverage.

Operational Characteristics. MEADS was to provide limited-area defense against tactical ballistic missile and air-breathing threats, including cruise missiles. The intent was to cover low to medium altitudes as part of integrated air defenses or in support of stand-alone operations. At one time, the intent was to develop MEADS to address the low-observable cruise missile threat anticipated in the 21st century.

Corps-level MEADS was envisioned to be networked with other air defense systems such as the division-level Forward Area Air Defense system. It was thought that FAAD would operate about 20 miles ahead of MEADS, with its sensors extending another 25 miles. This plan would extend the system's range by roughly 45 miles.

The military wanted MEADS to be transportable by C-130 and A400M aircraft and standard amphibious landing aircraft. Commanders wanted the system to be able to move rapidly and protect a maneuver force during offensive operations.

MEADS Program



The MEADS Fire Control Radar and Auxiliary Power Unit

Source: MEADS, Bernhard Huber

Variants/Upgrades

MEADS. The Medium Extended Air Defense System (MEADS) is a transportable air and missile defense system that incorporates a radar, a BMC4I center, and a missile launcher. It utilizes an open architecture that allows it to be more easily customized for user-specific configurations.

TLVS. The Taktisches Luftverteidigungssystem (TLVS) is Germany's next-generation air and missile defense system, incorporating short-, medium-, and long-range components. A proposal to satisfy the TLVS requirement would have a joint venture between Lockheed Martin and MBDA develop a solution based on MEADS technologies.

Program Review

In 1995, U.S. Deputy Secretary of Defense John M. Deutch signed a Statement of Intent with France, Germany, and Italy for the joint development and production of a medium air and missile defense system. At the signing, the participants recognized the SOI as an important step toward the future modernization of tactical air defense systems for the United States and other NATO participants.

The effort underscored a common desire to pursue cooperative programs that would produce affordable tactical weapons systems. The program was designed to encourage competition by industry to help ensure that

the participants developed the best value system possible.

Allied Cooperation Plan

The United States sought cooperation with allies on MEADS for political, military, and economic reasons. Such programs help strengthen the military and industrial relationships that unite the participants in the face of a common threat. When the U.S. and its allies operate as a coalition, using interoperable equipment is essential. Tight budgets have driven the need to pool resources and to achieve economies of scale. Programs

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that nations cannot afford individually may be affordable if undertaken as a joint activity.

In 1996, the U.S., Germany, and Italy signed a Memorandum of Understanding (MoU) for the program's project definition and validation phase. France, one of the signers of the original SOI, withdrew from the program at that point.

The design and development (D&D) phase was scheduled to begin in FY99. However, given competing priorities for U.S. defense resources, the DoD proposed a restructured MEADS program that would include a three-year risk reduction effort. This restructured program was based on the PAC 3 missile. Germany and Italy had accepted the PAC 3 as the initial interceptor for MEADS.

The Army modernization plan for MEADS would initially replace four Patriot battalions with six MEADS battalions, and eventually replace all Patriot battalions with MEADS battalions.

In 1999, the NATO MEADS Management Agency (NAMEADSMA) awarded a contract to MEADS International (Lockheed Martin, DaimlerChrysler Aerospace, and Alenia Marconi) to begin work on the next phase of the program. This effort supported the transition of MEADS into the risk reduction phase, which began in summer 2000.

The proposed program management structure included both U.S. and international arrangements. The Army's MEADS National Product Office would oversee the development of U.S. requirements and serve as the single point of contact for U.S. support to NAMEADSMA. The National Armaments Directors and a MEADS steering committee would provide international oversight. NAMEADSMA leadership positions have rotated among the nations.

Program Lurches Along

In 2003, the DoD combined the U.S. Army management of the MEADS and Patriot programs. The Defense Acquisition Board approved the continuation of work with the international partnership, and encouraged the Army to develop a more detailed and comprehensive plan for DAB approval in late 2003. This plan was to include Future Years Defense Program (FYDP) funding.

In August 2003, MEADS successfully demonstrated its ability to acquire, classify, track, and destroy simulated missile and aircraft targets in a system-level interface demonstration that took place at Lockheed Martin facilities in Syracuse, New York. In September 2003, MEADS completed a series of tests on the prototype missile launcher in Brescia, Italy. The tests

demonstrated the uploading and offloading of PAC 3 missile canisters using special manpower-reducing devices being developed for MEADS.

Design and Development

In September 2004, a six-month, \$3.4 billion contract was awarded to begin D&D; Italy and the U.S. formally signed the development agreement. Germany agreed in principle to the D&D plan, but its formal signing was delayed pending parliamentary approval, which was granted in January 2005. The delay was based on Parliament's schedule rather than any disagreement with the program. According to then-German Defense Minister Peter Struck, MEADS was included in the funding plan, despite criticism from the Peace Research Institute Frankfurt.

In April 2005, MEADS International announced that Germany had approved entry into the D&D phase. In February 2007, EADS (now Hensoldt) was awarded a \$155 million contract to develop and build transmit/receive (T/R) modules for the MEADS active electronically scanned array (AESA). In 2008, the program completed the Preliminary Design Review. The T/R modules, designed by EADS, passed acceptance tests the following month. EADS announced in January 2009 that it had delivered the first batch of 5,000 T/R modules and related electronics for the MEADS multifunction fire control radar.

German Missile

In February 2009, the German government requested that a European air defense missile be integrated into MEADS. Germany was looking to incorporate the IRIS-T SL (Surface Launched) as a secondary missile. MEADS would implement an intersystem plug-and-fight capability for the IRIS-T SL. The effort would include new software to integrate the missile and launcher plus incorporation of the second missile into existing MEADS simulations. A MEADS hardware redesign would not be required. Diehl BGT Defence GmbH manufactures the IRIS-T SL missile.

Italian IFF

Lockheed Martin announced in October 2009 that the MEADS program had received approval to use a European cryptographic device to implement identification friend or foe (IFF) technology. For U.S. MEADS units, a waiver from the U.S. National Security Agency would make MEADS the first U.S. system to incorporate a non-U.S. cryptographic device. The SELEX Sistemi Integrati IFF units would be packaged into both the UHF surveillance radar and the X-band multifunction fire control radar.

MEADS Program

U.S. Wants Out – Germany, Too

Several sources in the recent past indicated that the U.S. Army wanted to terminate MEADS. *The Washington Post* reported in March 2010 that MEADS was too expensive, its timeline too long, and the program too difficult to manage because any changes required both German and Italian approval.

Two U.S. options were immediate program termination or withdrawal from the MEADS program after the D&D phase. Termination, however, would result in funding being diverted to "contractor termination costs" instead of hardware development. *The Washington Post* reported that if the DoD were to cancel MEADS, it would be required to pay \$550 million to \$1 billion in cancellation penalties to the MEADS contractors.

In February 2011, the U.S. Office of the Secretary of Defense (OSD) stated that the U.S. would go forward as a participant in the MEADS proof of concept D&D phase by providing funding up to the agreed-upon MoU cost ceiling of \$4 billion (in 2004 dollars). The funding would be used to complete prototypes, demonstrate and document the capabilities of major system elements, and complete limited system integration. The proof of concept D&D program would end by 2014 and provide a meaningful capability for Germany and Italy, as well as a possible future option for the U.S. military.

In October 2011, Germany also voiced its desire to leave the MEADS program, announcing that it wanted to leave following completion of the proof of concept phase. The development would leave Italy alone in procurement if the program were ever to be completed.

By late 2012, the funding of MEADS had become a divisive issue in the United States. The argument pitted the president against Congress. After President Barack Obama said that any defunding of MEADS in 2013's National Defense Authorization Act (NDAA) would result in a veto, in December 2012, Congress still drafted a version banning the system's funding. However, in March 2013, a government funding measure passed in the House that included \$348 million for MEADS and \$53 million for the program's U.S. office.

The \$401 million authorization funded U.S. extraction from MEADS without the incursion of additional penalties. From the floor, House Appropriations Chairman Hal Rogers confirmed that the congressional authorization continued to follow the funding ban, and that "the prohibition in the NDAA is law, and nothing in this bill or report overrides or changes that fact." The measure still had to pass in the Senate before the issue was settled.

Recent Reviews and Tests Successful

In August 2009, all major components of the MEADS program successfully completed Critical Design Reviews. A year later, the MEADS program successfully completed the summary CDR, which cleared the way for production of the radars, launchers, and other hardware needed for system and initial flight tests. In December 2010, LFK (MBDA Deutschland) delivered the first MEADS launcher to MEADS International. That same month, the first MEADS Battle Manager was displayed at MBDA Italia facilities in Fusaro, Italy.

In January 2011, Lockheed Martin announced that the MFCR had completed final rotation tests at both 15 and 30 rpm.

The MEADS program took several major steps forward in 2012, despite intense budgetary pressure. In April 2012, the 360° MFCR began integration testing at Pratica di Mare Air Force Base near Rome. Shortly thereafter, in June 2012, the first power and communication unit completed acceptance testing in Germany; it was later sent to Italy for integration with the MFCR.

By August 2012, the MFCR had been integrated with the battle manager, the MEADS TOC, and the MEADS launcher at Pratica di Mare, successfully passing all tests. IFF integration was completed in October 2012, and the system was then airlifted to White Sands Missile Range in New Mexico. In New Mexico, in November 2012, MEADS successfully performed its first flight test, detecting, tracking, intercepting, and destroying an air-breathing target.

Then in the fourth quarter of 2013, the program began preparation for a test of the system's ballistic missile defeating capabilities, one of the final steps in D&D.

2013 – The United States Withdraws, and the System Endures

Based on timetables set out by the U.S. DoD, 2013 was to be the last year that the U.S. would fund MEADS development. The U.S. Army had decided to abandon the project, leaving MEADS to its other development partners, Germany and Italy. Despite that, 2013 was a big year for MEADS. Testing benchmarks achieved during the year included the following: the system's low-frequency sensor cued the fire control radar; the BMC4I TOC achieved interoperability with NATO's systems; MEADS IFF was approved by the U.S. Air Traffic Control office; the German MEADS launcher was integrated; and the MFCR tracked a ballistic missile for the first time. The most important developments, however, were the successful defeat of two opposed

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missiles and the signature of a tripartite letter of intent extending cooperation among the MEADS partners in any future use or development.

The LOI in particular is significant to the future of the MEADS program and the technologies developed for it. The agreement will allow the MEADS partners to pursue the use of MEADS components and software for integration into their own systems or potentially develop the system for full deployment. Additionally, the LOI allows MEADS International to market the missile defense systems to countries other than the program's development partners.

By the close of 2013, Poland had emerged as a potential purchaser of the MEADS missile defense system. The country identified MEADS as one of five candidates to fill an AMD capability requirement.

In 2013, development partner Germany began the process of potentially integrating MEADS technologies into its AMD systems. Raytheon and Germany discussed integrating mature elements of the MEADS program such as the MEADS launcher and Germany's IRIS-T SL missile with existing Patriot systems. This contingency could also include incorporation of elements such as the radars and the BMC4I TOC.

By December 2013, U.S. Army officials had vetted the MEADS technology, calling it "state-of-the-art" and rating the components' readiness levels between five and seven on a scale of one to eight. In the FY14 defense authorization bill, U.S. lawmakers incorporated provisions requiring the Pentagon to report on how best to utilize this multibillion-dollar investment. A proposal read that the U.S. DoD had a "substantial interest in making constructive use of any MEADS data and technology owned by the United States."

2014 – Repositioning for a Future without U.S. Procurement

By the close of 2014, the U.S. had exited all MEADS development contracts. During the year, the contractors

pursued and met several key milestones, including a decision on whether the integration of certain higher-echelon sensors not already part of the MEADS program would work as planned. Data archiving was also performed, culminating in a review of the program's entire development phase.

Following the U.S. withdrawal, Germany and Italy came forward with requests for further MEADS integration tests. These included a plug-and-fight demonstration of MEADS' open-source integration capabilities that was performed in Italy.

Lockheed Martin submitted plans for a MEADS follow-on program to both Germany and Italy. The proposal was accepted, with Germany selecting MEADS as the basis for its Taktisches Luftverteidigungssystem (TLVS) next-generation network-based tactical AMD system. Germany and Lockheed Martin made a joint announcement of the selection in June 2015.

TLVS – A New Joint Venture

In March 2018, Lockheed Martin and European missile systems company MBDA announced the formation of a new joint venture that would develop and shepherd MEADS technologies for Germany's TLVS requirement. Equity in the TLVS joint venture is split between Lockheed Martin and MBDA in a proportion of 40 percent and 60 percent, respectively.

MBDA itself is a joint venture between Airbus (37.5 percent), BAE Systems (37.5 percent), and Leonardo (25 percent), so while Lockheed Martin had formed a new partnership to market and develop the MEADS program, the new joint venture was in effect just another agreement between the original MEADS partners.

MEADS Program



The Complete MEADS Air Defense System, with the Radar Truck to the Left

Source: Lockheed Martin

Funding

U.S. FUNDING

The U.S. partially funded MEADS RDT&E through FY13. The U.S. government does not currently provide funding for the MEADS program.

Contracts/Orders & Options

In 1996, the MEADS Management Agency awarded \$80 million to MEADS International for the program's definition/validation phase. In 2001, the program executive approved U.S. entry into the three-year risk reduction effort. A \$45 million contract was awarded to Lockheed Martin for the 32.5-month effort. Lockheed Martin would be responsible for developing the design concept for the new surveillance radar. Plans were to use a common digital design for the digital receiver and signal/data processor, allowing for validation of ground-based X-band radars for missile defense worldwide.

In Sep 2004, MEADS International was awarded a contract valued at \$3.4 billion to begin a nine-year D&D effort. The initial six-month period of performance would cover the effort until Germany formally signed the Memorandum of Understanding. The agreement changed the participation shares to 58 percent for the U.S., 17 percent for Italy, and 25 percent for Germany.

In May 2005, MEADS International signed a definitized contract valued at \$2 billion, plus EUR1.4 billion (\$1.91 billion) for MEADS D&D.

MEADS Program**Worldwide Distribution/Inventories**

MEADS is a joint development program of **Germany, Italy, and the United States**. **Germany** has announced its intentions to procure a system based on MEADS, the Taktisches Luftverteidigungssystem (TLVS), which translates to Tactical Air Defense System.

Forecast Rationale

By early 2015, most major MEADS development funding had ceased, and all operational testing had been completed. MEADS was a mature, highly capable system that lacked one important element – a customer. That soon changed.

Germany and Italy, both partners in MEADS development, were expected to pursue follow-on programs – either jointly or separately – but no clear path to production had been identified. This changed in June 2015, when Lockheed Martin announced that Germany had selected MEADS as the basis for its Taktisches Luftverteidigungssystem (TLVS) IAMD program.

However, after previously delaying the MEADS award from the "end of 2016" to the spring of 2017, the German Ministry of Defense, in March 2017, said that the contract would not be completed during the current legislative session.

By late 2018, with a contract still to be announced, doubts as to whether MEADS would ever win the German contract had grown. In the interim, Raytheon, one of the main contenders in the U.S.'s Patriot radar replacement contest, had launched a competing TLVS bid. Nonetheless, in December 2018, a Lockheed Martin representative revealed that the company expected a contract for a MEADS-derived TLVS as early as Q2 2019. That date, like the others, passed with no contracts announced.

On June 24, 2019, though, MBDA and Lockheed Martin announced that they had submitted a formal bid for the embattled TLVS award. As of the end of 2019, a contract still had not been awarded, but hopes for a contract lingered. A Lockheed Martin representative was quoted as saying at the October 2019 Berlin Security Conference that a German contract was expected in 3Q 2020. Again, the time passed, and no contracts were awarded.

Hoping to reinvigorate the TLVS procurement effort, in August 2020, Lockheed Martin and MBDA submitted a revised bid to Germany. It was reported that the new bid would feature Hensoldt's TRML-4D in the surveillance radar role, with the MEADS' MFCR thought to remain in its original capacity. However,

even with the proposal revised once more, in December 2020, MBDA revealed it no longer expected a contract to be awarded in 2021. Indeed, instead of an award, it was announced that German Defense Minister Annegret Kramp-Karrenbauer would be reviewing the country's air defense requirement in its entirety.

However, some hope for the embattled TLVS program emerged following the beginning of Russia's "special military operation" in Ukraine. With military activity near its doorstep and international outrage increasing, in February 2022 German Chancellor Olaf Scholz said that the country would sharply increase its defense spending. It was revealed that the defense budget for 2022 would be raised to EUR100 billion from 2021's EUR47 billion. This could bode well for a decision on TLVS, whether for procurement of MEADS or an alternative, or even the program's outright cancellation.

As complicated as the German TLVS procurement is, the status of MEADS in Italy is even less clear. As of press time, Italy had yet to publicly announce whether it would continue with the MEADS program, although after many years, it is now unlikely to resume its involvement. Eventually the MEADS partner could follow Germany's lead and incorporate the system into its defense structure, but with every passing year, this appears less likely. Both countries face the tough decision of procuring MEADS by itself or incorporating its technologies into more evolved or modular setups. The selection of pure MEADS components would mean increasingly higher life-cycle costs in inverse relationship to the number of countries buying the system – a situation that has resulted in a wait-and-see approach.

The third MEADS partner, the U.S., is now pursuing an alternative GaN component-equipped, next-generation AESA radar replacement for the Patriot, dubbed the GhostEye (formerly known as the LTAMDS). This further complicates the situation for the MEADS development team. With the arrival of the more advanced GhostEye, Raytheon, the radar's developer, is hoping that it can sway Germany to, like the U.S., specify the alternative and assign the MEADS program to the dustbin of history. Due to the considerable delays

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in MEADS procurement, this could easily happen, and developments should be watched closely.

However, even with the advent of the GhostEye, MEADS could attract the attention of buyers outside of the original three-country partnership. The technology is viable, proven, and fully NATO-interoperable, a potentially appealing combination that might be less expensive than alternatives. Still, an order outside of the German acquisition is unlikely without the commitment of a major military power.

Since much of the future of the MEADS program is in flux, it is difficult to forecast potential unit acquisitions or peg a defined RDT&E funding figure. Even if it is not procured as a total system, however, MEADS may have a future in the continued life of its individual components. Consequently, a small number of systems have been forecast, albeit tentatively and more speculatively than Forecast International would typically project.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
MEADS International Inc												
MEADS Radar <> Worldwide <> Armed Services												
Note: Speculative; Includes TLVS												
	2	0	0	0	1	2	2	1	0	0	0	6
Total	2	0	0	0	1	2	2	1	0	0	0	6