Advanced Integrated Magnetic Anomaly Detection System (AIMS)

Overview

CAE is the world leader in the design, manufacture, and integration of magnetic anomaly detection (MAD) systems. The company has been designing MAD systems for over 40 years and has delivered over 2,000 MAD systems and equipment to military forces around the world. The current production CAE MAD system is called the advanced integrated MAD system (AIMS), which is also designated by the military nomenclature AN/ASQ-508. Most of these systems have been installed on anti-submarine warfare (ASW) aircraft, including both fixed- and rotary-wing aircraft, and used primarily for the detection of submarines. With the changing state of warfare, however, there are potentially new applications in the use of MAD technology.

How MAD works

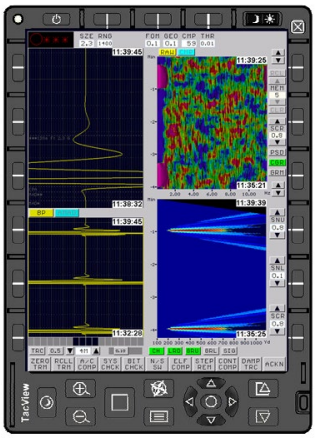
The MAD system consists of a highly sensitive magnetometer, which is designed to sense changes in the earth's magnetic field due to metallic objects in the vicinity. Typically, the MAD system is mounted in the tail area of an aircraft to minimize magnetic interference. The range of the MAD system varies, but will generally detect anomalies at approximately 1,200 metres.

When the MAD system detects a magnetic anomaly, an audio alert signals the crew and the display provides contact and range information.

CAE developed software allows for submarine location in the form of lateral and vertical separation (left/right indication) at the closest point of approach (CPA). This algorithm opens the route for a recommended tactical flight path to optimize target localization and detection. The inclusion of high bandwidth frequency to digital conversion provides better detection due to reduced background noise in higher frequencies as well as potential classification on the signature of the submarine.

MAD system components

CAE's AIMS is a fully integrated MAD system that includes sensor capsule assembly (which houses the detecting head and vector magnetometer) and an amplifier computer. The AIMS can also include a digital recording and display unit (DRDU) if the system is configured as a stand-alone unit instead of as a subsystem that is part of the aircraft's avionics suite.



- **Detecting head –** uses a sensor to monitor the earth's magnetic field and detect changes created by magnetic anomalies.
- **Vector magnetometer –** monitors the transverse, longitudinal, and vertical vectors of the earth's field relative to the aircraft's position and orientation for compensation of the aircraft maneuvers.
- **Capsule assembly –** serves as a protective housing for the detecting head and vector magnetometer as well as an electromagnetic interference (EMI) shield. In addition, it is designed to interface with the MAD boom of the different aircraft the AIMS is installed on. This assembly is the only item that is different from one aircraft installation to another.
- **Amplifier computer –** provides all interfacing and power for system operation. This unit performs information gathering, compensation and detection processing, and delivers digital outputs.

Program examples

CAE's MAD systems have been delivered to a range of military customers worldwide, including:

Customer/Users	Aircraft
U.K. Royal Navy	Sea King and Lynx
Japanese Ministry of Defense	P-3C and P-X
Canadian Forces	Sea King and CP-140
U.S. Navy	P-3, SH-60, SH-2
Australia	P-3, S-70B-2
Chilean Navy	C-295

In addition, CAE's MAD systems have been tested in a range of other aircraft platforms.

The latest customers who have selected CAE's MAD systems for their maritime patrol aircraft include:

- India for the Boeing P-8I Multi-Mission Maritime Aircraft (MMA);
- Kawasaki Heavy Industries and Mitsubishi Electric Corporation for Japan's new maritime patrol aircraft;
- Turkish Navy for the CN235 maritime patrol aircraft;
- Republic of Korea Navy for the P-3CK maritime patrol aircraft.

Potential MAD applications

Magnetic anomaly detection has traditionally been associated with submarine detection and overlooked as a possible solution for land-based surveillance and detection. Recent conflicts have demonstrated the need for enhanced detection capabilities. CAE has been evaluating the potential use of MAD technology for the detection of concealed metal objects on land. With a MAD system mounted on some type of ground vehicle or unmanned aerial vehicle (UAV), the system could detect a variety of targets, such as armored vehicles or artillery. The MAD system is capable of detecting metallic objects through walls, buried underground, or hidden in dense forest canopies. CAE is currently developing MAD-XR (Magnetic Anomaly Detection Extended Role) which is a MAD sensor with reduced size, weight, and power requirements allowing the potential uses of MAD to be extended to other applications. The CAE MAD-XR system is scheduled to complete qualification testing in 2018 and will be ready for production immediately thereafter.

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