

update

Aircraft Survivability Equipment



photo: RNLAf

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Terma is currently supplying the Royal Netherlands Air Force with a new concept for protection of the Apache AH-64D helicopter.

The F-16 Demonstrator program includes a number of new systems for operational testing. These new systems enhance aircraft survivability, improve situational awareness and decrease pilot workload.

The new generic Modular Reconnaissance Pod (MRP) developed for the Swedish Air Force' JAS 39 Gripen is an evolution of reconnaissance pods for fighter aircraft.

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TERMA[®]

Quick Reaction Contract for the Royal Netherlands Air Force

In February 2004, Terma signed a quick reaction contract with the Royal Netherlands Air Force (RNLAf) to supply self-protection equipment for Apache AH-64D helicopters. From the signing of the contract to development, production, and installation until deployment it took only four months. The aircraft have since June been deployed to the operational theater.

Apache with stub wing mounted pod of modular design.

Terma is prime systems integrator and the RNLAf is responsible for the installation, which is done at a RNLAf facility. The operational planning resulted in a very stringent timeframe to complete this challenging task. An Integrated Product Team (IPT) was quickly pulled together to ensure a common understanding and commitment to objectives and plans. Before starting the deliveries a complete System Integration Test was performed at Terma.

The AMASE (Apache Modular Aircraft Survivability Equipment) is an advanced Electronic Warfare self-protection solution against Infra-Red (IR) missile threats. Developed by Terma as a tailor-made system it is designed to provide optimum protection for helicopters.

With this new capability, the RNLAf operate their Apache helicopters at altitudes sufficiently high to avoid threats from small arms fire, yet protected against the most likely missile threats.

Stub Wing Pods

The AMASE system includes the Terma developed AN/ALQ-213(V) computer-based integrated Electronic Warfare Management System and missile warning systems and flare dispensers.

The tips of the Apache stub wings have hard points for the pods. The Stub Wing Pods contain the Missile Warning and Flare Dispensing systems. They are of a modular design and are located on each side of the helicopter structure. This position



photo: RNLAf



photo: RNLAf

The AMASE is an advanced Electronic Warfare self-protection solution against IR-missile threats.

of pods has two major advantages; it is an ideal location for missile warning sensors as there is very little shadowing from the aircraft structure and there is no operational restrictions on weapons deployment.

A new multifunction color display is installed to make the pilot aware of any possible threat. It is driven by a tactical data unit which at the same time serves as a recorder for post flight operational debriefing and analysis. A complete fault list and maintenance record is kept at a removable media for ease of technical maintenance.

A Tactical Data Cartridge is used for upload of new software and mission data files.

Aircraft Survivability Equipment

Terma has previously developed similar equipment (Aircraft Survivability Equipment – ASE) for the Dutch Cougar and Chinook transport helicopters. In addition, Terma has supplied electronic warfare equipment to a variety of fixed wing fighter and transport aircraft with more than 1,000 systems installed in US fighters.

The pods contain Missile Warning and Flare Dispensing systems.



Facts about EWMS

AN/ALQ-213(V) Electronic Warfare Management System

Terma's AN/AQL-213(V) Electronic Warfare Management System (EWMS) was originally developed for the F-16 in close cooperation with the Royal Danish Air Force for gathering, processing and presenting information in one coherent system. The equipment has successfully passed the comprehensive US Foreign Comparative Test (FCT) program.

It replaces individual control panels and indicators for Electronic Warfare (EW), such as the dispenser, jammer, radar warning and missile warning units. The display and management unit is placed in a central location within the pilots field of vision and reach. Terma placed significant emphasis on designing an optimal Pilot-Vehicle Interface (PVI).

The EWMS has been developed into a generic system which fulfills the requirements of a large number of aircraft types including fighters, helicopters and transport aircraft. As indicated above the management system integrates, manages, and controls a variety of EW subsystems.



photo: RNLAf

RNLAf AS-532 Cougar cockpit with Tactical Threat Display and Electronic Warfare Management System.

Terma introduces improvements in F-16 Self Protection and Pilot's Situational Awareness



Terma is committed to continuously seek, develop and apply new technologies, which support pilots in accomplishing their mission, and which sees them return safely.

As part of the F-16 Mid-Life Upgrade (MLU) program, the Royal Danish Air Force (RDAF) and Terma are working together to apply state-of-the-art technologies adding promising new capabilities which radically improve the protection of and working conditions for pilots. This has resulted in several innovations which now are integrated for operational trial in an

F-16 Demonstrator aircraft.

Enhanced Aircraft Survivability

A number of new systems have been installed in the RDAF F-16 Demonstrator aircraft for operational testing and evaluation purposes. These new systems enhance aircraft survivability, provide in-flight cost effective training, improve situational awareness, and decrease pilot workload.

The F-16 Demonstrator program constitutes a unique opportunity to evaluate these systems and to evaluate and improve the pilot-vehicle interface (PVI) under fierce operational

conditions. The systems will be thoroughly tested and evaluated and the prototype phases will benefit from these test trials.

The new systems are marketed to all F-16's world wide.



The Advanced Threat Display in semi-triangular version for the F-16.

All Threats on one Display

The advanced Tactical Threat Display replaces the existing Radar Warning Receiver Azimuth

Indicator. It gives the pilot all important Electronic Warfare information on one color display. This information includes primary threat warning (radar/missile threats and

jam indication) and secondary status indication (mode/health status, menus/selection and dispenser inventory).

In-flight Training

Synthetic Electronic Warfare Training is a self-contained function selectable at any time during flight and is based on pilot pre-programmed simulated threat characteristics. During flight, threats appear as real threats on the Tactical Threat Display, enabling the pilot to activate countermeasures and maneuver the aircraft like he would have done in a real situation. All Electronic Warfare training sessions are recorded in-flight for later evaluation. This system provides the pilot with a training aid that does not require expensive test ranges with multiple threat radars.

Missile Warning

The weapon pylons, which have been updated during the latest block cycle, are prepared for a field upgrade to install Missile Warning sensors. The pylon installed Missile Warning sensors provide nearly full coverage of the aircraft for incoming missiles and alerts the pilot via the Advanced Threat Display and 3D-Audio. The system can automatically initiate countermeasures (ex. flares) which the pilot then combines with coordinated maneuvers.

3D-Audio

The purpose of the 3D-Audio system is for the pilot to quicker become aware of an emerging threat than what is achievable using traditional display technology. The 3D-Audio system provides a natural sound using a standard headset. It allows the



listener to actually perceive the sound as coming from outside his head – and from a distinct direction. This is exactly what we are all used to, when not using headsets. It allows a pilot to quickly pinpoint the direction of a sound, horizontally and vertically, as well as keeping track of how the sound moves relative to the aircraft.

Active Noise Reduction

Combined with the above-mentioned capability or as a stand-alone feature, Terma has developed an Active Noise Reduction (ANR) system that has been installed in the F-16 Demonstrator. Sensors on the ear cups / helmet are positioned to pick up noise generated by the surrounding environment. This noise is displaced half a wavelength and impressed on the ordinary audio signal. The result is a remarkable noise reduction without loss of the actual intercom audio. Since the passive pilot helmet attenuation is poor at low frequencies (<2 kHz noise), the only

Test of Active Noise Reduction system in F-16 cockpit.

way to reduce low frequency noise is via Active Noise Reduction.

Modernized Triple Ejector Rack, TER

New Precision Guided Weapons require a lot of information to be passed between the aircraft and the weapon. To make this possible, a new wiring standard has been accomplished by the last block cycle on aircraft level, and by a wing weapon pylon upgrade program on pylon level. Terma has developed an upgrade for the TER Smart Triple Ejector Rack (STER) which allows carrying three Precision Guided Weapons on one pylon, hereby increasing the flexibility of the F-16 aircraft.

Modernized Triple Ejector Rack, TER, for the F-16.



New generic Modular Reconnaissance Pod

The new generic Modular Reconnaissance Pod (MRP), which currently is developed for the Swedish JAS 39 Gripen, is an evolution of reconnaissance pods for fighter aircraft.

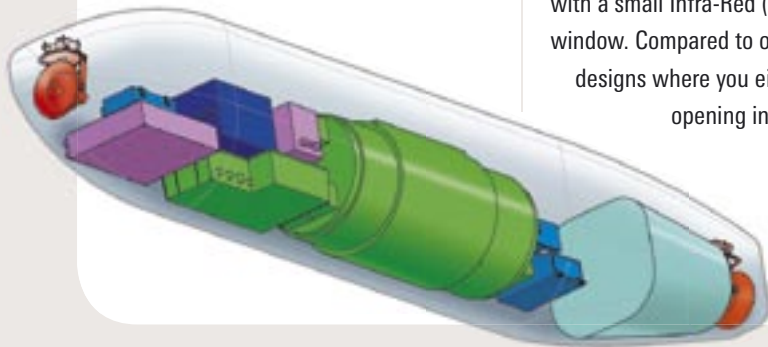
Developed by Terma this MRP provides customers with a maximum of flexibility in tailoring the sensor suite to operational requirements for airborne tactical reconnaissance.

The pod is conceptually based on the successful F-16 MRP also developed by Terma. Due to its generic design the new MRP can be carried on various aircraft platforms. It is easily integrated into the aircraft by a data bus and a video interface to the displays in the cockpit.

Rotating Window Section

The MRP employs a circular cross-section on the lower 180° of the pod and an advanced rotating section with a small Infra-Red (IR) translucent window. Compared to older pod designs where you either had an opening into free air or horizon-to-horizon windows,

this MRP design takes advantage of a small IR translucent window. This design is cost beneficial and gives a better background for managing the pod internal environment. The rotating window section is attached directly to the MRP strongback and can be positioned at various positions along the length of the pod mid-section, which allows it to accommodate a variety of different sensors and caters for variations in pod stuffing, weight and balance restraints. The section's 360° rotation is electronically synchronized to the sensor aiming – except for take-off and landing, where the window is rotated to a position in the strongback and, thus, providing protection of the glass during these phases of the flight.



Facts about the Gripen Pod

Reconnaissance Pod for Swedish JAS 39 Gripen Fighter Aircraft

In 2001 Terma was awarded a contract with Saab Tech AB of Sweden for the development and supply of advanced reconnaissance equipment for the JAS 39 Gripen aircraft of the Swedish Air Force.

The contract comprises development and supply of pods and a number of vital control systems for the complete reconnaissance system. Delivery will take place during the period 2004 – 2006.

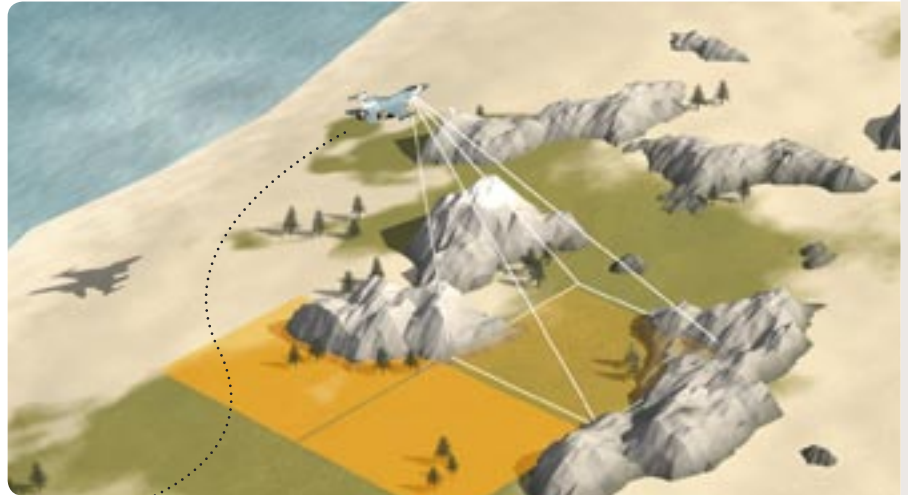
Under contract from prime Saab Tech AB Terma has developed, qualified and supplied the JAS 39 Modular Reconnaissance Pod (MRP), including the Environmental Control System, Electrical System, Ground Support System, and part of the Reconnaissance Management System (RMS) for the MRP.



Design for Optimum Performance

The upper part of the MRP employs a square cross-section providing room for the strongback, ducts for the environmental control system, cabling, etc. This 'hybrid' concept permits the main advantages of the MRP, namely internal pod space and separation between sensor attachments and outer fairings required to eliminate or limit buffeting and dynamic vibrations, which is very important for the performance of the sensitive sensors installed in the pod. Furthermore the MRP provides the advantages of a round structure in terms of aerodynamics and rotating devices.

The nose and tail sections of the MRP are designed to hold data link



antennas providing the system with an active role in network centric warfare operations.

Reconnaissance Management System

The Reconnaissance Management System, RMS, provides management and control of all equipment and functions in the pod. It has a modular open architecture housed in a chassis

One of the key improvements is the ability to capture imagery while the aircraft is maneuvering.

with Commercial-off-the-Shelf (COTS) Circuit Card Assemblies for I/O interfaces, communications, computer and image chain processors.

Facts about the MRP

Intelligence, Surveillance and Reconnaissance

Terma has provided decision-makers in many Air Forces with Intelligence, Surveillance, and Reconnaissance (ISR) equipment. Our systems are built up around a specially designed Modular Reconnaissance Pod (MRP) which can accommodate the most common and future sensors. The MRP contains Management System, Imaging Sensors, Environmental Control System, Recording Media and all necessary support.

Terma has delivered reconnaissance systems For F-16 to Belgium, the Netherlands, the United States and Denmark including the Tactical Reconnaissance System (TRS) for the Royal Danish Air Force. The supplying of TRS comprises a

full installation and all integration including cockpit control, training and logistic support. With its automatic mode of operation, the system can day and night capture any geographical location without pilot intervention and thereby add valuable time to the pilot's primary task of flying the aircraft. Using the cockpit display, the pilot can verify image capture and perform a primary assessment of the area of interest. The system is fully digitized and interfaces with the aircraft through standard protocols.

Terma supports the development of Standardization Agreements (STANAG) within the NATO ISR community.

Financial Highlights

DKK M	2003/04	2002/03	2001/02	2000/01	1999/00
Sales	1,096	963	1,017	903	871
Sales share abroad	883	804	593	552	596
Profit for the year, before tax	73	60	60	44	50
Equity Capital, year end	320	309	249	238	216
Assets, total	1,131	1,061	933	944	1,055
Order intake	864	1,266	1,076	1,035	602
Order book, year-end	1,450	1,672	1,369	1,311	1,179
Number of full-time employees – Average for the year	1,010	945	855	850	936

We Provide Mission Critical Solutions

Terma develops and markets high-tech solutions, systems, and products for civilian and military applications.

Terma A/S headquarters is located in Lystrup near Aarhus, Denmark. The company is 100 per cent Danish owned.

Terma's high-tech solutions and products are developed and designed for use in extreme mission critical environments and situations, where human lives and valuable material assets are at stake.

The main business area, Aerospace & Defense, covers:

- Aerostructures for aircraft
- Self-protection systems for aircraft and ships
- Audio system solutions for pilots
- Reconnaissance systems for fighter aircraft
- Command and control systems for navy, army, and air force applications
- Tactical communication solutions
- Electronics manufacturing

In addition, Terma has business areas within:

- Radar surveillance systems
- Solutions, services and products for space applications
- Air traffic management systems
- IT services

Domestic Terma facilities are located at Lystrup, Grenaa, and Herlev.

Abroad, Terma locations include Leiden, the Netherlands; Besozzo, Italy; Weiterstadt near Frankfurt, Germany; Washington DC, and Warner Robins, GA, USA.

Terma A/S was established in 1949. For many years, Terma has worked closely with defense forces, public authorities, and international organizations around the world. Through these relationships, Terma has gained in-depth knowledge of and insight into our customers' working environment and an equally deep understanding of their situations and needs.

Terma is ultimately owned by the Thomas B. Thrige Foundation.

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