In less than three months during the autumn of 2007, six Tornados from Schleswig-Jagel Air Base were upgraded with a Special Dispenser System, SDS, to give protection against infrared guided missiles for Luftwaffe reconnaissance missions in Afghanistan. See page 2.

The Apache Modular Aircraft Survivability Equipment, AMASE, upgraded with Directional Infrared Countermeasures, DIRCM, has now passed flight test on the Dutch Apaches. See page 4.

Building on the experience from the AMASE program for the Dutch Apache Helicopters, Terma and the Royal Netherlands Air Force have developed a similar solution for the new Chinook CH-47F. See page 8.

In this Update issue

Tornados equipped for Afghanistan Missions

Contents

- Special Dispenser System, SDS for German Air Force Tornados / 2-3
- Flight test of AMASE with DIRCM on RNLAF Apaches / 4-5
- Royal Danish Air Force installs MWS on F-16s / 6-7
- New Modular Aircraft Survivability Equipment for the Royal Netherlands Air Force CH-47F Chinook Helicopters / 8-9
- Terma develops new version of the ALQ-213 / 10
- Terma has successfully finalized P-8A EW Self-Protection SW development / 11
Terma Aerostructures and F-35 Joint Strike Fighter

The Joint Strike Fighter Program heavily involves the Aerostructures Business Area.

The Program establishes Terma as an international center with competencies in lightweight and composite materials for the aerospace industry. Terma Aerostructures is engaged in design and manufacture of Alternate Mission Equipment, and in the manufacture of components and assemblies for airframe and engine for the F-35, JSF.

Several Design and Manufacturing agreements for the JSF aircraft have been finalized in the System Design and Documentation phase, and deliveries are taking place.

Recently, Terma secured contracts for production of components for the JSF engines, for production of wing pylons, and agreements for production of control surfaces, fuselage, and surface components for the Program.

In a quick reaction program carried out in less than three months during the autumn of 2007, Terma has equipped six Luftwaffe Tornados in preparation for reconnaissance missions in Afghanistan. The program is termed SDS, Special Dispensing System. It is based on Terma’s standard Modular Counter Measures Pod (MCP), adapted to fast jet aircraft by adding a pointed nose for supersonic flight and winglets for stability. Each pod contains eight chaff/flare magazines and the system is controlled by Terma’s Electronic Warfare Management System, ALQ-213(V).

Each of the pod’s four modules carries two magazines. Modules can be rotated in 15 deg. increments to ensure maximum effectiveness against threats from various directions. The pod has provisions for installation of Missile Warning Sensors and other countermeasures systems.

The SDS is seen as a forerunner for FDS, Future Dispenser System, which has been under preparation for some time. It is expected that FDS will be announced for competition later in 2008 and that it may include missile warning sensors. Terma has already developed a solution, where not only magazines, but also missile warning sensors and RF countermeasures are part of the modular podded solution.

Other users have already shown interest in Terma’s modular pod solution for protection of the Tornado.
Flight Test of AMASE with DIRCM on RNLAF Apaches

The Apache Modular Aircraft Survivability Equipment, AMASE, with laser-based Directional Infrared Countermeasures, DIRCM, has now passed flight test on the Dutch Apaches.

The modular AMASE pod, which was installed on the stub wings of the Dutch Apache helicopters in 2004, has since operated satisfactorily during operations in Iraq and Afghanistan. The AMASE originally used infrared flares as countermeasures against infrared guided missiles, but in view of the continued development with infrared guided missiles becoming still more ‘intelligent’, the AMASE has now been upgraded to include a laser-based DIRCM. Successful flight tests were performed in March 2007.

AMASE provides full 360 deg spherical coverage

The positioning of the MWS sensors in the stub wing mounted pods provides full 360 deg spherical coverage of the Apache helicopters, whereas fuselage installed sensors would cause obscuration problems. Similarly, the coverage by the DIRCM is un-obscured and ideal compared to the alternative installation behind the main rotor.

In addition to the unique coverage features of this concept, the AMASE stub wing pod solution also provides:

- Increased operational flexibility, since the pod can be easily demounted when not needed, and pods can be shared over a larger number of aircraft
- No alteration of center of gravity
- Minimum impact on aircraft modifications and therefore limited downtime during upgrade
- Easy and cost-effective route for future technological upgrades, such as active RF jammers.

The modular AMASE solution for the Dutch Apaches comprises the following elements:

- Cockpit-mounted AN/ALD-213(V) EWMS, Tactical Data Equipment, TDE, and Tactical Threat Display, TTD, from Terma
- AMASE pod with the following subsystems:
  - AN/AAD-24(V) DIRCM from Northrop Grumman
  - AAR-54 MWS from Northrop Grumman
  - Advanced Countermeasures Dispensing System, ACMDS, from Terma.

Over the past months, RNLAF, Northrop Grumman, the Dutch Aerospace Laboratory, NLR, and Terma have worked closely together to secure a successful outcome of the total of 31 predetermined flight test events carried out at the Vliehors test range in the Netherlands. The AAD-24 DIRCM system performance was unprecedented with 100% successful results in the following areas:

- Handoffs from the MWS to the DIRCM
- Handoff from turret 1 to turret 2
- Engagement during fast roll rates and roll reversals
- Jamming through the rotor blades
- Engagement during rearward and lateral flight
- Fast repeat engagements

The DIRCM upgrade was based on the AN/AAD-24(V) Nemesis DIRCM, which is a joint cooperative program between the United Kingdom and the United States. The system uses infrared laser energy to disrupt the guidance system of even the most advanced infrared guided missiles. Nemesis is in production and combat proven, and installed on fixed and rotary wing aircraft in the US, UK, and other allied countries including Australia and Denmark.

Terma and Northrop Grumman have already worked together on a number of previous programs. The successful results from the AMASE testing now puts the two companies in a position to offer the AMASE pod, complete with DIRCM capability.

Enhanced Smart Triple Ejector Rack

One multi-carriage rack for the weapons of yesterday, today, and tomorrow

The Enhanced Smart Triple Ejector Rack, ESTER, jointly developed by Terma and EDO, constitutes a unique carrier for legacy Mk-82/83 iron bombs, current J-class weapons including GBU-49 and JDAM, and next generation stores, such as the Small Diameter Bombs.

The basic requirement from the F-16 MLU community was a multiple carriage of J-class weapons using aircraft BBU-57 software. The Terma/EDO team decided to expand the capability of the ESTER beyond these basic requirements, and by applying their combined capabilities, the TER-9/A, above and beyond the BBU-57, has been developed.

The rack has only one hardware configuration which supports all three operation modes. These modes include:

- TER-9/A mode where the ESTER will interface with the aircraft as a BBU-57. The aircraft only needs BBU-57 software which will support carriage of two or three J-class bombs, such as JDAM and GBU-49
- ESTER mode where all the capabilities are utilized. The rack will carry up to three J-class weapons or Small Diameter Bombs, SDB, in class I or class II Universal Armament Interface as well as Launch Acceptability Region, LAR, calculations.

For improved performance and reliability, the team has selected the Field Replacable Connector System, FRCS, to replace the standard MIL type bomb interface connector on the J- and SDB-class bombs.

The team has secured contracts with two customers for provision of hardware and services, and the first lot of prototypes has been delivered.

Ground tests and initial flight tests were conducted successfully during the summer of 2007.
In today’s asymmetric warfare, the F-16s often operate from forward deployment bases that may themselves be safe, but the corridors for take-offs and landings may provide potential hidings for launching of shoulderborne infrared-seeking missiles which cannot be detected by the current F-16 equipment. Therefore, to protect crew and equipment, the Royal Danish Air Force has decided to install integrated Missile Warning Systems, MWS, on its F-16 aircraft.

**Missile Warning System Performance**

It is essential that a missile attack is detected as soon as possible and that false alarms are kept to a minimum. For this purpose, the RDAF has selected the EADS AAR-60(V)2 MILDS F. This system is a fighter version of the MILDS system of which more than 4,000 units have been ordered. It is an ultra violet-based system, characterized by low false alarm rate and a broad operational envelope, up to 45,000 feet+.

**Weapons Pylon Installation**

Three MWS sensors installed in each of the weapons pylons on stations 3 and 7 give a near-360 deg spherical coverage against missile attack, even with a full weapons load. A Terma-developed Countermesures Signal Processor, CSP, correlates inputs from the sensors to avoid duplication of warning messages. The MILDS(V)2 version includes ruggedizing and repacking of the sensors to fit into the limited space of the F-16 pylon. The software has been updated with vastly improved processing speed. Advantages of the pylon installation are reduced aircraft downtime for modification, reduced cost because of minimum impact on the airframe, and the possibility of sharing modified pylons across the F-16 fleet.

**Reduced Reaction Time**

By installing the MWS systems on the F-16, the detection of a threat can be performed faster, thereby increasing the pilot’s situational awareness. The radar system is complemented with the AESA (Active Electronically Scanned Array) Radar and EWMS, which receives the threat information. Based on the aircraft parameters, such as attitude, speed, altitude, and not least trial results, the EWMS selects the optimum flare dispensers to counter incoming threats.

In case of aircraft malfunction, the warning panel can ‘speak’ to the pilot, alerting him to the situation. In a formation, a wingman can talk to his lead from his actual position, thus giving the lead an immediate clue to the wingman’s position. In case of aircraft malfunction, the warning panel can ‘speak’ to the pilot, alerting him to the situation.

**Active Noise Reduction, ANR**

The noise level in an aircraft cockpit can be very high. Levels of up to 114 dB have been measured. This means stress on the crew and risk of developing hearing damage. As part of the AAMS, Terma has introduced a high performance Active Noise Reduction system, ANR, which significantly lowers the noise level perceived by the pilot. This eliminates the need for earplugs and allows for reduced volume of the intercom system. The result is reduced pilot fatigue and stress levels.

**F-16 MWS Integration Contract**

Terma received the integration contract from the RDAF in late 2007, and design and manufacturing are progressing as planned. The first phase of the program focused on data collection of the F-16 physical and operational environment. These data have been used for designing sensor hardware and software as well as pylons installation. The sensors have been installed to optimize coverage against the most likely attack directions. The first flight tests of the AAR-60(V)2 were performed in late 2007 and early 2008. The system is now being certified by the USAF Seek Eagle office. The complete system will then be operational and ready for the F-16 Midlife Update MS software.
The Chinook will carry two CHASE pods installed on each side of the helicopter. Each pod contains three missile warning sensors and one laser turret. The pods are mounted directly on the helicopter main frame to minimize dynamic in-flight impact, which could otherwise cause optical sensor distortion. The six-sensor solution provides a 360 deg spherical coverage against missile attack as shown on the sketch to the left. The collocation of the sensors and the DIRCM in the same pod ensures easy mechanical integration, which is of utmost importance to the overall performance of the system with respect to the level of false alarms and handover from one laser turret to the other. Installation of sensors elsewhere on the fuselage would have to deal with airframe twist, which on a CH-47 can be significant during extreme maneuvers — an effect which causes misalignment between the sensors and the DIRCM system, which again results in distortion of overall performance and an increasing number of false alarms.

From an overall view, operational, technical as well as economic, the CHASE solution provides the following advantages, similar to those of the AMASE solution:

- Minimum impact on aircraft modifications, and thus downtime for the upgrade
- Easy and cost-effective routes for future technical upgrades, such as active jammers
- Possibilities of sharing of CHASE units across the Chinook fleet rather than each helicopter being fully equipped

Building on the experience from the AMASE program for the Dutch Apache helicopters, Terma and the Royal Netherlands Air Force have developed a similar solution for the new Chinook, CH-47F, soon to be delivered to the RNLAF. The system has been labeled CHASE for Chinook Aircraft Survivability Equipment. New Modular Aircraft Survivability Equipment for the Royal Netherlands Air Force CH-47F Chinook Helicopters

The Dutch Defence Materiel Organisation, DMO, and Terma jointly decided on a pod solution for installation and integration of DIRCM, Directional Infrared Countermeasures, with a laser beam to divert attacking missiles. The DIRCM system is manufactured by Northrop Grumman.

Initial flight tests were carried out in July 2007, and final delivery will take place as an integrated part of Boeing’s delivery of the new helicopters during 2008 and onwards. The illustration on the opposite page shows the initial mechanical integration of the CHASE pod on the CH-47D. It gives a good impression of the final pod solution.

Full 360 deg spherical coverage

Illustration showing the installation of the CHASE Pod which hosts all of the missile warning sensors and laser-based Directional Infrared Countermeasures, DIRCM.

To attain the required static and dynamic accuracy, the CHASE pods are mounted on both sides of the helicopter.

The sensors and DIRCM system, together with the ACMDS system, will be controlled by the ALQ-213A EW Management System installed as an integrated part of the CH-47 suite and cockpit.

Full 360 deg spherical coverage
Terma Develops New Version of the ALQ-213

The ALQ-213, Electronic Warfare Management System, was originally developed in the early nineties. Over the past fifteen years, it has gone through a large number of upgrades and add-ons. Terma has therefore taken the natural next step, combining these improvements and additional units into a new version called AN/ALQ-213A(V) Defensive Aids Controller, DAC.

Like its predecessor, the ALQ-213A, DAC is a universal controller, that will integrate and control anycombination of EW subsystems into any type of aircraft. The ALQ-213A combines the functionalities of the EW Management Unit, the Tactical Data Unit, the Programmable Interference Blanking Unit, and the Countermeasures Signals Processor into one single unit that can be operated from Terma’s Advanced Threat Display or from an existing mission display, MPD or MFD. The ALQ-213A makes use of the latest novel and sophisticated technology, including additional processing power and memory capacity, inertial measurements, time and position, provisions for special interfaces, and at the same time, significantly lower weight.

The launch customer for the ALQ-213A will be the Royal Netherlands Air Force for the new CH-47F Chinook helicopters, where it will control the entire EW suite including the Terma-developed Chinook Aircraft Survivability Equipment, CHASE (see article on page 8).

New RSIP for AWACS Japan

Terma is awarded contracts to deliver major parts of the Radar System Improvement Program, RSIP, for the Japanese 767 AWACS fleet.

RSIP increases the radar sensitivity of the AWACS aircraft, allowing it to detect and track smaller targets. It also improves the radar’s existing computer with a new high reliability multi-processor and rewrites the software to facilitate future maintenance and enhancements.

The RSIP kit, built by Terma for Northrop Grumman Electronic Systems, Baltimore, MD, under a subcontract to Boeing, consists of a new radar computer, a radar control maintenance panel, and upgrade of other electronic units.

The RSIP upgrades will improve E-767 surveillance capability by increasing the Pulse-Doppler radar sensitivity and enables the aircraft to detect and track smaller targets. It also improves the radar’s electronic countermeasures, human-machine interface, and reliability and maintainability.

RSIP kits built by Terma have been installed on the US, UK, NATO, and French AWACS fleets. The 767 AWACS program takes advantage of modern manufacturing facilities and processes which ensure a high-quality Boeing defense product.

The basic 767 airplane is manufactured by the Boeing Commercial Airplane Group in Everett, WA, and is modified to accommodate the prime mission equipment.

Production of the first derivative airborne was completed in October 1994. First flight with the rotodome installed occurred in August 1996.

Terma has Successfully Finalized P-8A EW Self-Protection SW Development

At the end of 2005, Terma was asked by the Northrop Grumman Corporation, NGC, to integrate the EW Self-Protection System for the US Navy Multi-Mission Maritime Aircraft, MMA, designated P-8A. Eighteen months later, Terma delivered the integration software following a successful integration test.

The new US Navy Submarine Hunter, the MMA, is developed by Boeing based on the well-proven Boeing 737 platform. The P-8A will replace the P-3 Orion that has been in service since 1982.

The EW Self-Protection System for the P-8A is provided by the Northrop Grumman Corporation and is integrated into the aircraft by use of the Terma AN/ALQ-213 EW Management System. On a contract given by NGC in late 2005, Terma has now successfully finalized the development activities of the Integration SW, making the EW Self-Protection System ready for the launch customer for the ALQ-213A.

New threats call for new countermeasures: “This was applicable when the RAF Nimrod MRZ got a new assignment in potentially hostile environments. In a time-compressed program, risk reduction is paramount; so within a couple of weeks after initial mutual understanding was established, Terma took an MCP-10 to Kinloss Air Force Base for a fit check and assessment of dispense angles. This hands-on session convinced the team that the program was feasible, and a trial installation program was agreed on. Terma provided a set of ALQ-213 units and two MCPs for the program. All equipment was successfully installed in April 2007, and flight tests were conducted in late 2007.

The Terma solution comprises the AN/ALQ-213 EW Management System and two MCP-10 units. The solution provides a major improvement in performance and integration of the Nimrod EW systems as well as provisions for future upgrades of the EW suite.

Nimrod Enhanced Defensive Aids Suite

“New threats call for new countermeasures”: This was applicable when the RAF Nimrod MRZ got a new assignment in potentially hostile environments. In a time-compressed program, risk reduction is paramount; so within a couple of weeks after initial mutual understanding was established, Terma took an MCP-10 to Kinloss Air Force Base for a fit check and assessment of dispense angles. This hands-on session convinced the team that the program was feasible, and a trial installation program was agreed on. Terma provided a set of ALQ-213 units and two MCPs for the program. All equipment was successfully installed in April 2007, and flight tests were conducted in late 2007.
Financial Highlights

<table>
<thead>
<tr>
<th>USD million</th>
<th>2006/07</th>
<th>2005/06</th>
<th>2004/05</th>
<th>2003/04</th>
<th>2002/03</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>171</td>
<td>165</td>
<td>202</td>
<td>183</td>
<td>161</td>
</tr>
<tr>
<td>Profit for the year before tax</td>
<td>14</td>
<td>12</td>
<td>14</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Equity capital, year-end</td>
<td>62</td>
<td>57</td>
<td>57</td>
<td>53</td>
<td>52</td>
</tr>
<tr>
<td>Assets, total</td>
<td>173</td>
<td>151</td>
<td>167</td>
<td>189</td>
<td>177</td>
</tr>
<tr>
<td>Order intake</td>
<td>163</td>
<td>166</td>
<td>189</td>
<td>145</td>
<td>211</td>
</tr>
<tr>
<td>Order book, year-end</td>
<td>227</td>
<td>227</td>
<td>228</td>
<td>241</td>
<td>279</td>
</tr>
<tr>
<td>Number of full-time employees</td>
<td>965</td>
<td>1,014</td>
<td>1,034</td>
<td>1,010</td>
<td>945</td>
</tr>
</tbody>
</table>

We Provide Mission Customized Solutions

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

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.

In Denmark, Terma facilities are located at Aarhus, Copenhagen, and Grenaa.

Terma’s international locations include Leiden, the Netherlands; Darmstadt near Frankfurt, Germany; Washington, DC; and Warner Robins, GA, USA; and Singapore.

Terma A/S was established in 1949. For 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 fully owned by the Thomas B. Thrige Foundation.

Terma’s business areas cover:

- Aerostructures for Aircraft
- Airborne Systems, including
  - Self-Protection Systems for Aircraft
  - Audio Systems Solutions
  - Reconnaissance Systems for Fighter Aircraft
  - Electronics Manufacturing
- Integrated Systems, including
  - Self-Protection Systems for Naval Vessels
  - Command and Control Systems for Navy, Army, and Air Force Applications
  - Air Traffic Management Systems
  - Public Safety & Emergency
- Radar Surveillance Systems
- Solutions, Services, and Products for Space Applications