

update

Naval and Surveillance Systems



© Royal Danish Navy

In this Update issue

In August 2008, the Royal Danish Navy's new ocean patrol vessel KNUD RASMUSSEN left for Greenland, where it will patrol the Greenlandic waters. For this task, the KNUD RASMUSSEN has been equipped with a SCANTER 4100 radar system, Terma's new digital surface surveillance radar which is also used for onboard helicopter operations.

Terma has also supplied C-Flex combat management systems for the KNUD RASMUSSEN and its sister ship EJNAR MIKKELSEN. Further, three new Royal Danish Navy frigates, delivered to the Navy between 2009 and 2012, will have C-Flex systems of a similar size and complexity as those for the ABSALON-class installed.

Contents

- SCANTER 4100** installed in new **OPVs** / 2
- SCANTER 2001** selected for French **FREMM Program** / 3
- C-Flex** Combat Management Systems / 4
- Multi Link capability** for the Royal Danish Navy / 5
- Small target **detection** / 6-7
- Radar Systems **Demo Container** concept / 8
- Global** radar service organization / 9
- Strong presence in **Singapore** / 10
- C-Flex** for Danish OPVs and Romanian frigates / 11

TERMA[®]



SCANTER 4100 installed in new OPVs

In August 2008, the Royal Danish Navy's new ocean patrol vessel (OPV) KNUD RASMUSSEN left for Greenland. In the future, it will patrol the Greenlandic waters.

For this task, the KNUD RASMUSSEN has been equipped with a SCANTER 4100 radar system, Terma's new digital surface surveillance radar which is also used for onboard helicopter operations.

The installation consists of a stabilized double-beamed reflector antenna mounted at the top of the main mast. The SCANTER 4100 radar transceiver is installed immediately below the antenna in its own equipment room.

The radar is prepared for the IFF functionality (Identify Friend or Foe) via an IFF antenna which is integrated in the reflector antenna.

The SCANTER 4100 is operated from the ship's command and control system (C-Flex) via a data network which is also supplied by Terma. The SCANTER 4100 can be operated from the bridge and from the operations room. A SCANTER workstation is integrated into the C-Flex application for the distribution of information, plots, videos, and tracks.

Following delivery from the shipyard in February 2008, the KNUD RASMUSSEN underwent extensive tests in Danish waters for about a month. In March and

April 2008, the tests were continued along the west coast of Greenland to the Disko Bay where the vessel was tested in ice with a thickness of 70 cm.

After the sea trials, Terma staff participated in routine patrol assignments along the coast from Aasiaat to Nuuk in order to optimize the radar parameters for the Greenlandic waters.

The KNUD RASMUSSEN will replace the previous patrol vessels in the surveillance of Greenland's east and west coast; a job that will be shared with the OPV EJNAR MIKKELSEN effective spring 2009.

© Royal Danish Navy

SCANTER radars selected for the French FREMM Program

Kongsberg Defence & Aerospace and DCNS have selected Terma to supply the SCANTER 2001 Navigation and Surveillance Radar to be fitted on the French Frigate Européenne Multi-Missions (FREMM) Program.

Initiated in early 2008 and continuing until the summer of 2010, Terma is tasked with delivering two SCANTER 2001 radar systems in the newest version with 7' antennas and SCANTER Tracking Units for each ship.

One of the radar systems will be utilized primarily for navigation and surveillance, whereas the other will guide helicopters when landing on the frigates.

The SCANTER 2001 radars were selected because of their high-tech quality and performance. Previously,

the SCANTER 2001 radar was selected for the UAE Navy Baynunah Missile Boats, the Singapore Delta Program (2004-06), the Swedish Visby Program, and the Danish Flexible Support Ships.

The FREMM Program comprises 17 sophisticated frigates for France. The first eight have been ordered, and construction has commenced with planned commission into the French

navy in 2011. A second batch of nine units is expected to be ordered around 2013.

The French navy requires a modern fleet of multi-purpose frigates to perform a wide range of patrol, anti-submarine warfare (ASW), anti-surface warfare (ASuW), and land attack missions.



The instrumented range of the SCANTER 4100 air coverage is up to 100 NM. The maximum range for surface detection is limited by the earth curvature and propagation conditions.

The SCANTER 4100 is based on X-band transmitting frequencies within the following two bands:

- 8.850 to 9.000 GHz for Air coverage
- 9.225 to 9.450 GHz for Surface coverage



Technical data SCANTER 4100

Transmitter	TWT Amplifier
Peak Power (TWT)	12 kW
Average power (TWT)	600 W
Instrumental Range	100 Nm
Cooling	Air or water
Transmitter & Utility Rack Size (including shock mounts)	2054 x 1140 x 1127 mm
Transmitter & Utility Rack Weight	800 kg
Antenna	Dual Beam Parabolic Reflector
Polarization Air Beam	Switchable CP/HP
Polarization Surface Beam	Switchable CP/HP
Stabilizing Platform	Mechanical
Dimensions	15'
Swing Radius	2320 mm
Height	2530 mm
Weight Antenna System	1300 kg
Power consumption Antenna System	26 kW
Environment	-40°C to +55°C

C-Flex

Combat Management Systems

C-Flex is a highly efficient Combat Management System for naval applications running entirely on commercial computers.

Since 2001, when the Royal Danish Navy (RDN) first requested an effort to upgrade the Navy's Combat Management Systems (CMS), Terma has invested significantly in the development of a CMS based on an Open Architecture and fully utilizing the wide range of commercially available computers and operating systems. Thus, the systems can be maintained and kept up to date with the ever changing technological evolution at affordable prices. Available are also a

whole range of commercial software packages, tools, and functions which until recently were reserved for private desktop machines or had to be especially created for military systems.

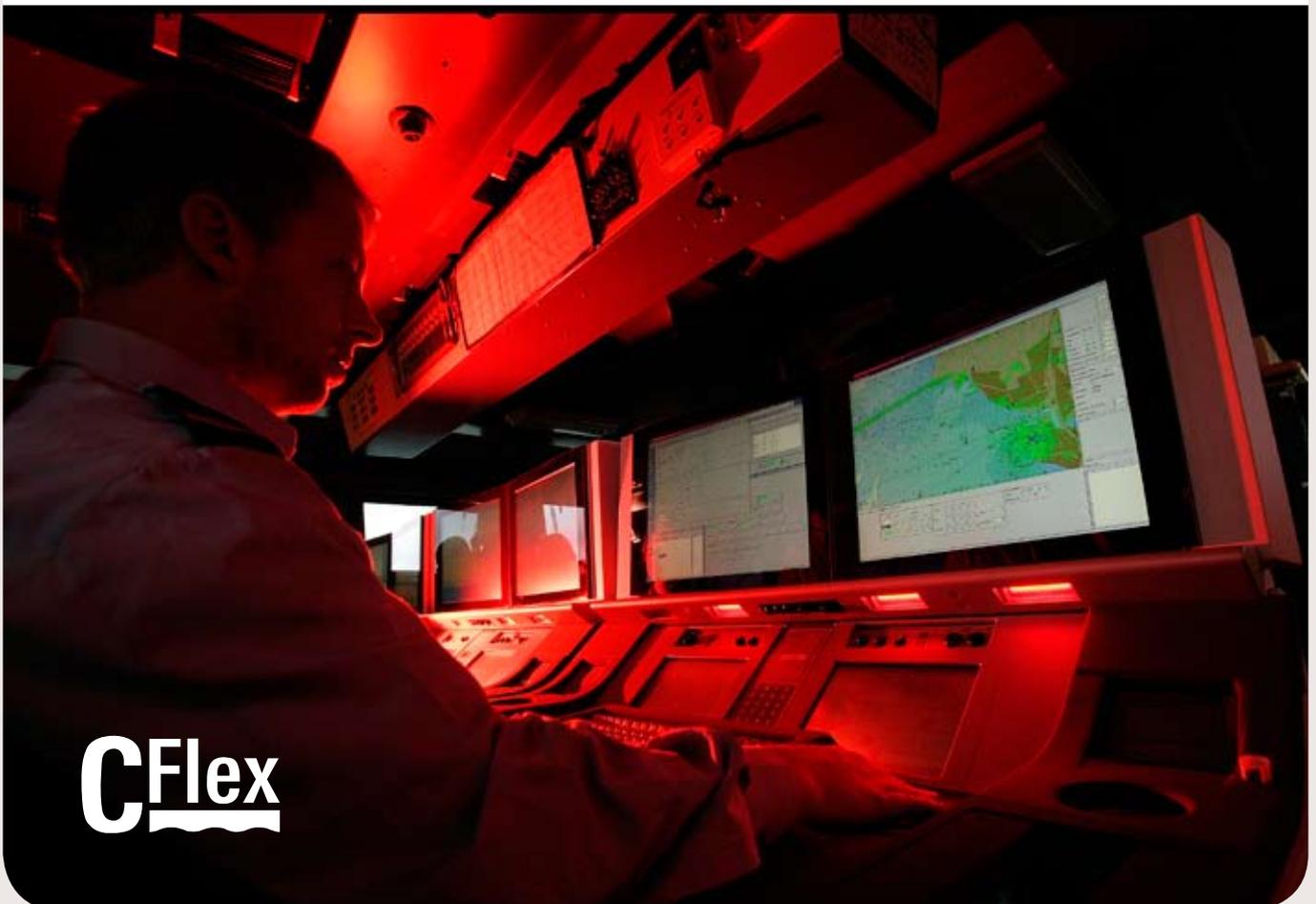
C-Flex is running on a software platform called T-Core which Terma developed as the platform for all command and control systems be it for naval, army, or air force purposes and use.

T-Core holds all basic C4I functions required in any system and is designed to adhere to the standards of the "US Navy Open Architecture Computing Capability and Environment".

The software platform can be utilized in large as well as small configurations

without software changes or costly adaptations, and the T-Core is not limited to naval applications as mentioned above. Army and air force command systems are also based on T-Core with equally great effect, already demonstrated by Terma in the Danish Army Low Level Air Defence program and the Austrian Army air defense system.

T-Core is designed to be part of any Combat Management System – irrespective of choice of hardware, operating system, weapon and sensor interfaces, and human/machine interface.



CFlex

Multi Link capability for the Royal Danish Navy

Terma has been tasked with providing a Multi Link capability for the Royal Danish Navy's five Flexible Support Ships and frigates. The Multi Link solution will be integrated into the Terma C-Flex command and control system on board the ships. The application provides the ships with Link-11 and Link-16 network participation and is prepared for a future Link-22 capability.

C-Flex is the new generation of Terma's command and control systems for a wide range of naval ships and patrol vessels. Depending on the type of ship, the systems are balanced in complexity and cost and range from very small, single operator systems to large systems of 35+ operators.

The modular and highly scalable C-Flex architecture is designed to support multiple configurations. The concept of installing software in each individual ship based on the actual installed systems provides for a basic system with variations according to the ship's configuration and class. The combat

system will thus support upgrades, variations between ships, and even transfer of equipment from one ship to another. In short, C-Flex ensures flexibility in equipment and low cost in development, training, and maintenance.

The tactical data link processor chosen to interface with C-Flex is the Ultra Multi Link System (MLS) based on the Multi Link Processor (MLP) family of products providing critical data exchange capabilities to airborne, land, and maritime users. The MLS is a single Line Replaceable Unit (LRU) with embedded Link-11 Crypto, Data Terminal Set (DTS), and processor card. The combination of the MLS and C-Flex thus provides the possibility of an extremely compact and price competitive solution providing full situational awareness including Link-11 and Link-16 network participation with nearly no platform limitations as a result.

Ultra has more than 65 years of experience within design,

development, and certification of Crypto products. The BID/2200 crypto, used for this program, is the only NATO approved Link-11 crypto enabling interoperability with legacy KG-40A systems.

The modular architecture of the MLS allows the functionality and capability to be tailored to meet the Danish navy's requirements. For the Danish navy, the MLS will host Link-11 and Link-16 Air Defense Systems Integrator (ADSI) software delivered by Ultra Electronics – Advanced Tactical Systems (Austin, Texas). More than 750 ADSI systems have been sold worldwide ensuring interoperability with many nations.

The MLS configuration will complement Ultra's existing range of data link products which are in service around the world, and it offers the Danish navy upgrade paths into Link-22 in the future.

C-Flex is the new generation of Terma's command and control systems for a wide range of naval ships and patrol vessels.





Small target detection

Today's security surveillance requirements for navy ships reveal a strong need for improved small target detection capabilities in most navies.

In view of the threat of asymmetric warfare both in the harbors as well as at sea, navy ships and coast guards face a difficult task - detection of potentially dangerous objects.

In most cases, the radar functions as the prime sensor, especially to detect small non-cooperative targets at long and short ranges in harsh weather. Radar is the only sensor providing

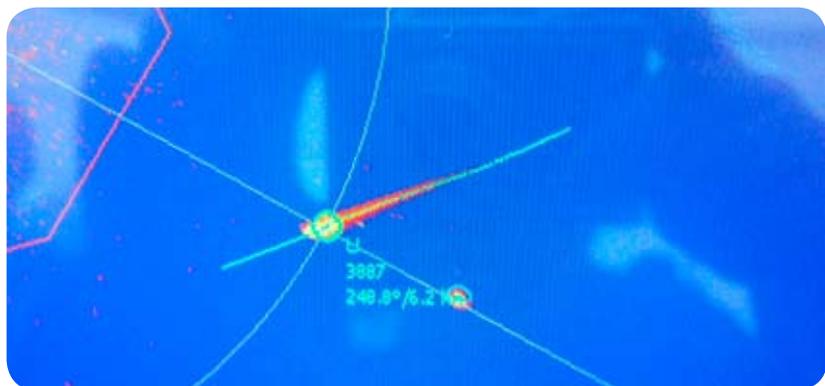
The most challenging task is the detection and classification of very small objects such as rubber or wooden boats, swimmers, and jet skis

complete coverage of very large areas in all weather conditions.

The most challenging task is the detection and classification of very small objects such as rubber or wooden boats, swimmers and jet skis. Hostile entities in today's world have shown the ability to employ sophisticated techniques to avoid detection and sufficient knowledge of

radar technology to exploit radar system weaknesses.

Weather and sea conditions may worsen the situation by introducing rain and sea clutter. Resting and low-flying flocks of birds may cause unwanted radar returns and add another layer of complication when attempting to discriminate wildlife from targets of interest.





Detection of larger objects, e.g. coasters, ferries, large cargo vessels, and tankers, seldom create a problem for independent tracking. But small targets used for illicit activity have been known to hide in the shadows of large targets in an attempt to pass without being detected.

In order to address these issues, Terma has gained invaluable and in-depth experience from more than 30 locations and test sites worldwide. The different locations comprise climate conditions ranging from tropical to arctic and sea conditions ranging from inland waterways to open oceans.

The results of these comprehensive research and development measures are exploited in our radar technology to cope with the demanding task of small target detection which by far

exceeds the typical technical requirements used for target identification within a traditional harbor setting.

The research conducted by Terma in recent years has greatly improved radar capabilities and the objectives targeted just a few years ago have been reached and even fulfilled. With respect to Surface Surveillance Radars and Surface & Air Surveillance Radars, numerous tests have stated that Terma has developed and possesses a technology directly applicable to cope with the threats of asymmetric attacks:

- Improved detection of all kinds of surface targets under cluttered conditions, especially small targets which are typically used in illegal operations and asymmetric warfare.

- Improved discrimination of targets (for example discrimination of a small vessel hiding beside a larger vessel) which is also relevant for detection of illegal operations and asymmetric threats.
- Excellent performance with regard to helicopter detection & control radar (both for naval operations as well as for search & rescue operations).
- Excellent performance with regard to air detection (airliners, fighter aircraft, helicopters).

Radar Systems Demo Container

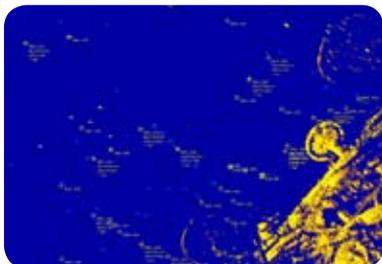
To demonstrate the features of radar sensors and antenna systems, Terma has developed a Demo Container concept to be stationed on location. Thereby, our customers and end-users may experience the functionalities of the equipment first-hand and in their local surroundings. Terma's Demo Containers have been in operation on most continents.

Recently, one of the containers was part of the HPT 08 – NATO's Harbour Protection Trial in Eckernförde, Germany, while another container was tested close to the Port of Sydney, Australia.

The Demo Container is always manned with highly qualified Terma staff. They are experts within the radar field and capable of setting up the system for the exact location and the special requirements of the actual customer. During the tests/demos, our employees function as operators and demonstrators of the equipment.

The Demo Container enables easy worldwide demonstration and test of the SCANTER 2001 radar and the SCANTER Video Distribution and Tracking unit (VDT).

To demonstrate the features of radar sensors and antenna systems, Terma has developed a Demo Container concept to be stationed on location.



The standard 20ft container is typically equipped with a SCANTER 2001 Frequency Diversity Radar, a VDT, and a SCANTER Workstation to display tracks and radar video.

The radar is configured with the unique FiveStepVideoPassing® technology, enabling detection of small targets in harsh weather conditions.

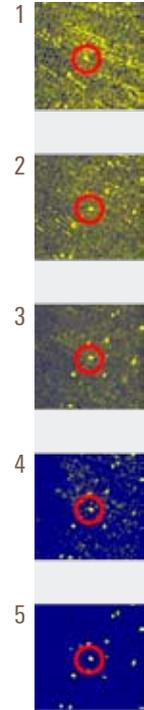
The VDT is a multi-channel tracker, handling all detected plots and distributing them (and digital video) over a LAN network to the SCANTER Workstation.

The antenna is a 21ft High Gain antenna, mounted on top of the container on a 2 m pedestal with supporting rods for stabilization.



FiveStepVideoPassing Setting Terma apart from the competitors

With superior performance in terms of small target detection, target separation, weather adaptability, and high reliability, SCANTER radars are the preferred choice for professional users and the responsible authorities throughout the world. Terma's unique FiveStepVideoPassing® technology is the core of all our radar solutions and what sets us apart from the competitors.



Besides the radar installation, the container is also fitted with large windows, air-conditioning, and plenty of desk space, providing a safe, office-like environment at even the most remote locations.



Terma's Global Service Team

Throughout the years, Terma has gained experience with customers all around the world. In this process, a Service Team has been set up to support international customers to the extent required.

The Terma Service Team consists of highly qualified and experienced technicians and systems engineers with a profound knowledge of both details and general functionality of our radar sensor systems.

Based primarily at the Terma headquarters in Lystrup, the Service Team consists of ten technicians and engineers who spend up to 100 days a year travelling the world to assist customers with installation, maintenance, and on-location service of radar sensor systems. The team's devotion to its tasks is incontrovertible:

- Our work is never finished before the customer is satisfied, says Senior Technician in the Radar Aftersales & Support Department, Svend Erik Kjær Jensen.

The team's primary fields of activity include vessel traffic systems, off-shore-, harbor- and coastal surveillance as well as national and international airports. At the moment, the team's main base in Lystrup constitutes the starting point for most of the team's travelling, but the Service Team is also represented in Singapore, and over time, the team will be expanded with new team members at the Radar Systems office in the U.S. These future team members will receive thorough training at the Lystrup headquarters before being entrusted with the responsibility of maintaining and servicing Terma radar sensor systems world-wide.

- More than anything, being part of Terma's Service Team requires flexibility and a willingness to adapt to the needs of the team, says Service Engineer Brian Mikkelsen, who arrived to work on this Wednesday morning not knowing that by the end of the week he will be in China. He mentions that a positive outlook on life and the

invariable support of one's family are fundamental for having a busy and globally founded job:

- The fact that I can be in Denmark today and in India tomorrow is what makes this job fantastic.

Terma's Global Service Team supports international customers to the extent required.





Strong Terma presence in Singapore

Since January 2007, Terma's Singapore regional office has been up and running. Effective mid 2008, the office changed status to a 100 % subsidiary of Terma A/S, named Terma Singapore Pte. Ltd. This is a marked and important signal to our many customers in the region.

Terma's five Business Areas have several ongoing activities in Asia. In particular, Radar Systems has numerous radar sites in operation in Asia, including the ports of Singapore and Hong-Kong, several coastal surveillance and vessel traffic system installations in e.g. China and Malaysia, as well as Surface Movement Radar Installations in the airports of Bangkok, Guangzhou, and Beijing. Therefore, Singapore was chosen for its location in the middle of the huge Asian markets as it is the perfect traffic hub to reach any part of the Asian region in a matter of hours. The political stability, the transparent working system, a well-educated workforce, and the use of the English

language within the business community further support this choice.

The initial success of Terma Singapore Pte. Ltd. or merely Terma Asia Pacific became evident as the office during 2007 secured the order for the replacement program of radar sensors for the Maritime & Port Authority in Singapore. The port of Singapore is one of the busiest ports in the world. Our local presence and service support in the region along with the superior performance of our SCANTER 2001 radar system were key factors when the SCANTER radar systems were selected for the upgrade program. The installation was completed by our local Service Engineer Wee Lee Peck.

Terma has identified a considerable potential for our SCANTER 2001 systems within coastal surveillance and vessel traffic systems in the region. During the last couple of years, we have made efforts to position our radar systems and competencies in relation to a number of large projects. We have done this with success,

primarily because of our presence in the region and because our employees master the local languages and are familiar with the Asian cultures.

Terma expects to secure significant service agreements related to radar systems with key customers in the near future. Service and support are focus areas in this connection. With local service engineers as part of our staff, we can offer efficient and rapid response during and after the period of guarantee. We are currently building up a local spare part stock and will thereby improve our systems' support relative to our customers.



C-Flex for arctic OPVs and new frigates

In continuation of the C-Flex contract for the ABSALON-class, Terma has supplied C-Flex Combat Management Systems for the Royal Danish Navy ocean patrol vessels (OPV), KNUD RASMUSSEN and EJNAR MIKKELSEN.

The OPV systems include two workstations, but will be using the same software as other C-Flex systems and thus have similar capabilities. The KNUD RASMUSSEN OPV-class has fewer weapon and sensor interfaces, but may at any time be expanded with necessary weapon and sensor interfaces.

The three new frigates, which will be delivered to the Royal Danish Navy (RDN) between 2009 and 2012, will have advanced Anti Air Warfare

capabilities supported by the C-Flex system and will be designed for participation in international operations. As for the ABSALON-class ships, the frigates will have container positions to house the containerized weapon systems, which are commonly used – and interchangeable – throughout the RDN fleet of ships. In addition, the ships will be equipped for participation in large scale theater missile defense with long range sensors and weapon systems.

The RDN and Terma have worked closely together in the design of system configurations, software functionality, and HMI for the users to



© Royal Danish Navy

Terma has supplied C-Flex Combat Management Systems for the Royal Danish Navy ocean patrol vessels, KNUD RASMUSSEN and EJNAR MIKKELSEN.

receive useful tools for the operational work on board. In addition, the range of advanced interfaces of modern defense electronics has expanded Terma's insight and the functionality of C-Flex.

C-Flex Combat Management Systems for Romanian frigates

Based on an initial contract signed in 2006, Terma has delivered a NATO interoperable C-Flex Combat Management System with Multi Link capability for the Romanian frigate MARASESTI.

The contracted C-Flex system, equipped with advanced Multi Function Consoles and subsystem interfaces, is prepared for future Link-16 and Link-22 implementations and thus ensures the Romanian navy a data link interoperability with other NATO nations far into the 21st century.

The development of the C-Flex system is a result of a close cooperation with the Royal Danish Navy (RDN). Since 2004, when the RDN first decided to install C-Flex as a standard feature on all operational units including the Flexible Support Ships of the ABSALON-class and the new Danish frigates, the system has undergone continuous expansion to include new functions and interfaces



for new subsystems, such as weapon and sensor systems. With that, Terma commands a strong and advanced C4I platform that greatly enhances the C-Flex strategic market potential.



Financial Highlights

USD million	2007/08	2006/07	2005/06	2004/05	2003/04
Sales	195	171	165	202	183
Profit for the year before tax	18	14	12	14	12
Equity Capital, year-end	83	62	57	57	53
Assets, total	215	173	151	167	189
Order intake	270	163	166	189	145
Order book, year-end	325	227	227	228	241
Number of full-time employees – Average for the year	1,020	965	1,014	1,034	1,010

We Provide Mission Customized Solutions

Terma develops and markets high-tech solutions, systems, and products for defense and non-defense 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 in Lystrup, 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 the Defense, 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 Thrige Holding A/S.

Terma's Business Areas:

Aerostructures: Development and production of advanced structures and engine components for defense and non-defense aircraft

Airborne Systems: Self-protection equipment for fighter aircraft, transport aircraft, and helicopters

Integrated Systems: Command and control systems for defense and non-defense purposes

Radar Systems: Advanced radar systems for coastal surveillance and surveillance of airports

Space: Mission-critical products and software for space applications.

TERMA UPDATE . OCTOBER 2008

Editor Kasper Rasmussen, kar@terma.com

Terma A/S
Hovmarken 4
8520 Lystrup
Denmark
T +45 8743 6000
F +45 8743 6001

Terma A/S
Fabrikvej 1
8500 Grenaa
Denmark
T +45 8743 6000
F +45 8743 6001

Terma A/S
Vasekær 12
2730 Herlev
Denmark
T +45 8743 6000
F +45 8743 6001

Singapore Pte. Ltd.
International Business Park
#04-31 Nordic European Centre
Singapore 609927
T +65 6561 0060
F +65 6562 0060

Terma North America Inc.
2461 South Clark Street,
Century Two, Suite 810,
Arlington, VA 22202, USA
T +1 (703) 412 9410
F +1 (703) 412 9415