

The Right AAW System for CSC



STATE-OF-THE ART RADAR FROM THALES NEDERLAND

BY DAVE SCHARF

The Royal Canadian Navy is called upon, not only to monitor and defend Canada's three coasts, but also to deploy on extended, multi-national operations on the far side of the world where allied navies come together to ensure the safety of vital sea lanes, support operations ashore, and suppress global terrorism and piracy.

These increasingly common expeditionary deployments often take place in confined

coastal waters like the Mediterranean Sea, Persian Gulf, Black Sea, and South China Sea where some potentially belligerent navies now are armed with anti-ship cruise and ballistic missiles and an ever increasing number of countries have short and medium range missile capability. Even asymmetric threat actors like Hezbollah and ISIS have acquired missile or rocket launching capability.

The RCN's CSC (Canadian Surface Combatant) programme will replace the RCN's three Iroquois class air defence destroyers and 12 Halifax class frigates with 15 new warships and it is clearly anticipated that the new CSC ships will need to meet a variety of threats in either the open ocean or littoral waters, so the new Canadian ships will need a robust capability to simultaneously meet and engage multiple airborne threats.



APAR offers the largest available number of simultaneous guided ESSM and SM-2 missile engagements



The Royal Danish Navy's Iver Huitfeldt Class frigates employ an AAW suite that incorporates APAR radar from Thales Nederland

ships of the German, Danish and Dutch navies.

For a variety of reasons Canada's Halifax-class ships did not adopt the original APAR radar but the original research that Canada was involved in did result in the development of the world's first naval AESA (Active Electronically Scanned Array) multi-function radar. APAR was designed for destroyers and frigates, intended to provide task forces with air defence against multiple, simultaneous threats. In particular, APAR is intended to defend against saturation attacks.

John Pokinko is VP, of RF and Optical Engineering at Sanmina and he recently told CDR how his company has signed an MOU with Thales Nederland to help develop APAR Blk 2, an enhanced version of APAR that Thales Nederland would like Canada's Navy to take a serious look at for its CSC requirement.

Sanmina, a Silicon Valley high tech company, has a significant operation in Kanata with over 400 employees, and it specializes in RF microwave technologies especially in the design area. Because of expected growth due to advancements in the RF area and in particular, its MOU with Thales Nederland, it has built additional manufacturing space there.

The RCN's System Requirements Document for the new CSC ships remains classified but pre-qualified warship designers (WD) and combat systems integrators (CSI), including Thales Nederland, have viewed a draft. What is not in doubt is that the complex, changing role for Canadian Surface Combatant makes it certain that these new vessels will be more versatile and carry more firepower than the present fleet.

"Thales Nederland may partner with a warship designer to be the lead CSI in a bid," says Albert Wildenberg, Manager Business Development. "Or, our APAR (Active Phased Array Radar) could be part of one or more other CSI bids. We are in many discussions. We are certain that the Royal Canadian Navy will give serious consideration to our radar."

A PROVEN AAW SENSOR SYSTEM

Thales APAR is a proven AAW sensor system. It is operational. It is at sea with the Dutch, German, and Danish navies. And, it meets or exceeds the Canadian AAW performance specifications right now, with no further research and development needed. However, for Canada's CSC requirement, Thales Nederland is proposing APAR Blk 2 – a complete technological refresh of the

existing APAR sensor system – for operation with the RCN.

APAR offers the largest number of simultaneous, guided ESSM and SM-2 missile engagements in the air of any sensor system in the world and as Wildenberg says, "We have already demonstrated that we can do what we say we can."

As other AAW radar providers may require more development to meet Canadian requirements, it is no surprise that pre-qualified CSIs and warship designers have opened discussions with Thales Nederland and they are very interested in determining how best to include APAR within their combat systems integrator bids for CSC.

KANATA-BASED SANMINA CONTRIBUTES TO APAR PROJECT

APAR was originally developed as part of the Trilateral Frigate Cooperation Program where, back in the 1990s, Canada contributed funding of \$50 million to help develop the technology along with Germany and the Netherlands. Sanmina, a Kanata Ontario based technology company, and Thales Canada, were involved in the development of the original APAR system which was eventually installed on

SIMULTANEOUSLY TRACKING 1000 TARGETS

Old AAW radars are dual system – a large, primary radar searches for tracks using a radio frequency beam sweeping the horizon with a rotating antenna. Once a track is detected, it can be assigned a secondary slaved radar to provide weapon guidance if required. This is cumbersome and too slow for effective management of a modern frigate's AAW package.

APAR does not work this way. In Thales' APAR sensor systems, RF modules (manufactured by Sanmina in Kanata) transmit digital "pencil beams" in essentially unlimited numbers. It's expected the AAW sensor system for CSC would involve two radars working in tandem.

A Thales Sea Master 400 provides medium and long range surveillance of airborne targets to 450 km and surface targets to 70 km. This is a non-rotating volume search radar with higher update rate, fast track initiation, and improved performance against maneuvering targets. Up to 1000 targets can be simultaneously tracked.

This radar would be paired with a Thales APAR digital, fixed, X-band multi function

radar for detection and tracking of low elevation threats providing ESSM and SM-2 missile guidance.

The Sea Master 400 is optimized for long range detection, while the APAR X-band is optimized for exceedingly accurate tracking of medium range targets, early detection of anti-ship cruise missiles, as well as missile guidance. X-band would put the CSC's counter measures on target quickly.

There are several immediate advantages to Thales' phased array radar combo.

The AAW sensor system is non-rotating; it is fixed as part of an integrated mast structure. There is no waiting for a dish to sweep. S-band continuously monitors airspace out to 450 km. APAR X-band continuously monitors short to medium range hemispheric air space and sea surface for targets in the littoral environment.

IDENTIFYING HIGH ALTITUDE THREATS

The long reach of the S-band identifies high altitude threats at long range. Modern, multi-role fighters are detected in a timely fashion; similarly identifying high altitude launched weapons like AS-17 Krypton missiles or guided bombs. This type of threat combination is becoming more and more common and prevalent in areas of the world where the RCN can be expected to operate.

The shorter reach of the X-band provides early detection of supersonic sea skimming missiles. SSMS can normally only be detected at relatively close range. Fixed panel X-band provides extremely fast track updates enabling APAR to provide guidance support to active and semi-active missile countermeasures quickly.

As track acquisition and guidance occur simultaneously, APAR provides more time on target. To appreciate the nature of each threat takes time so APAR acquires more data about the size, speed, and trajectory of targets. More is known about everything in the air in the CSC's operating area, meaning there is less likelihood of misidentification, so the Thales APAR AAW sensor systems makes less mistakes than more conventional naval radar systems.

The two premier AAW sensor systems which currently provide simultaneous search and targeting functions are APAR and Aegis. But there are differences between the two.

MISSION ADAPTABLE

"In Aegis there is one big radar for search and three slaved illuminators to guide the missiles," says Wildenberg. "This limits an Aegis driven combat system to fewer missiles in the air."

But, APAR does not have this significant limitation. The RF modules from Sanmina provide digital pencil beams, simultaneously performing search and targeting, while illuminators and slave Fire Control radar are not required. The precise upper limitation on the number of missiles that APAR can have simultaneously in the air is classified, however the increase in firepower allowed by APAR is significant.

To date, APAR has proven its system performance in more than 40 live firings.

Defence against a saturation attack is, perhaps, the greatest advantage of the Thales Nederland APAR sensor system. Modern threat tactics will attempt to saturate a ship's defences, but APAR can handle saturation attacks and provide the best defence against future threats, especially in

“ *We are certain that the Royal Canadian Navy will give serious consideration to our radar* **”**

the littoral environment.

"There is no system out there, anywhere, that can guide as many missiles simultaneously in the air as APAR," says Wildenberg.

APAR is software-defined which means that it is mission adaptable. Modification of the software suite for European Union Naval Force Somalia provided outstanding capability against asymmetric attack. Dhows, skiffs, and other small objects were detected at unprecedented distances.

IMPROVED APAR BLK2 FOR CSC

Thales Nederland is proposing an improved APAR Blk 2 system for CSC by means of a technology refresh.

APAR Blk 02 will incorporate the latest technologies, will see a new GaN Tx-Rx module, and reduces significantly in footprint by porting software to new hardware, all resulting in superior operational usability.

It was in 2015 that Thales Nederland signed a memorandum of understanding with Sanmina and this strategic cooperation between Thales and Sanmina targets areas of joint development, engineering and

production of components and sub-systems for Thales' radar equipment. This equipment will be for export worldwide, but it is particularly intended to support APAR Blk 2 for the CSC program.

It is also expected that this Thales/Sanmina cooperation will extend to future technologies for radar components and sub-systems.

MOU WITH SANMINA FOR RADAR DEVELOPMENT

Thales Nederland, Thales Canada and Sanmina support the need for a strong Canadian-based value proposition for the CSC program and other Canadian defence projects so this recent agreement is designed to deliver on these commitments to Canada and in anticipating CSC and future projects, Sanmina has moved into a new facility in the Ottawa suburb of Kanata where it can immediately expand manufacturing capacity as required by the CSC programme or other contracts that may flow from its development work on APAR Blk 2 or other defence, aerospace, or transportation projects.

Thales APAR AAW sensor systems are currently in service on the Royal Netherlands Navy's four De Zeven Provinciën class air defence and command frigates since 2002, the

German Navy's three F 124 Sachsen class air defence frigates since 2003, and the Royal Danish Navy's three Iver Huitfeldt class air defence frigates since 2011.

These vessels have executed successful live firing exercises involving numerous ESSM and SM-2 missiles.

Interestingly, the new federal government has indicated that it is considering moving to an off-the-shelf reference ship design to reduce costs, reduce technical risk, and reduce delivery time. Although whatever design is chosen, modification for Canadian needs will be required but any of these Dutch, German, or Danish ships could prove to be strong candidates for Canada's CSC requirement.

It is very possible that the RCN will be considering a warship designer/CSI bid that will be based on a ship that already boasts a Thales Nederland APAR AAW sensor system, so it would seem only natural that this highly effective system be included on the new CSC ship – especially as it is due to be upgraded specifically for that program. ■

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