FACT SHEET -
SEA 1659 - Fibre Laser Sensors

What is a CTD?

The Defence Capability and Technology Demonstrator (CTD) Program, managed by the Defence Science and Technology Organisation, assists in the improvement of priority Defence capability by providing Australian industry with an opportunity to demonstrate their technology. This enables Defence to assess the potential of the technology to enhance military capability as well as the likely risks associated with acquiring the technology.

Title

Fibre Laser Sensor (FLS)

Objective

This CTD demonstrates the key benefits of fibre laser acoustic array technology in an operationally meaningful context to address a capability that can not be achieved with existing technology. The main focus is to develop and demonstrate an array of fibre laser based underwater acoustic sensors of similar performance to the prevailing piezo ceramic based hydrophone technology. This disruptive technology would enable the realisation of long, thin and lightweight arrays deployed from a greater mix of naval platforms, with simpler interfaces to inboard signal processing equipment.

Organisations Involved

- Defence Science & Technology Organisation (DSTO), Edinburgh, SA
- Thales Australia – Naval Systems, Rydalmere, NSW

Scope of Activities

The FLS CTD was composed of four distinct phases:

- System Definition
  - Proposal, study, definition and selection of sensor concepts.
  - Final sensor concept selection.
- Engineering Prototype
  - Definition and feasibility of the selected sensor concept.
  - Preliminary design of the sensor, array packaging, deployment system, and the inboard photonics system.
  - Acoustic Tank tests and field trials.
- Demonstrator System - Design and Test
  - Finalisation of the selected sensor concept.
  - Finalisation of the new sensor, array packaging, deployment system, and inboard photonics system.
- Demonstration and Reporting
  - Demonstration of the new fibre laser sensor based electro-optic hydrophone array concept.

Achievements

The FLS CTD contract commenced in October 2006 and is due to complete with a Final Design Review (FDR) in November 2008 after the formal Demonstration that was successfully completed at Jervis Bay in October 2008.

The major challenge of the CTD was the development of a robust, reliable hydrophone and a repeatable build standard sufficient to provide sensors with similar performance and suitable for a demonstrator array. The design drivers were frequency response, hydrostatic depth compensation, temperature compensation, vibration sensitivity as well as the difficulty of fabricating and assembling "microtechnology" parts and the general fragility of fibre optical components.

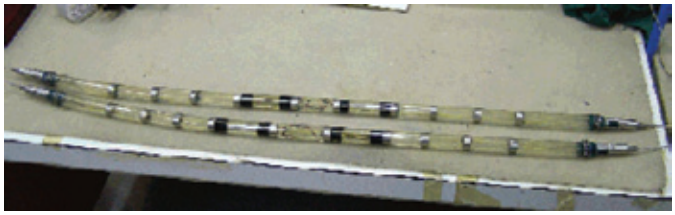

Photo 1 : Electro-optic hydrophone (two shown side by side)

A suitable design was achieved by the use of an innovative two-part hydrophone device for which a patent application is being processed by Thales Australia.

The outboard system to be used in upcoming sea trials is made up of an eight hydrophone array and a 1.5km fibre optic lead-in cable and is deployed from a RAN standard 7.2m Rigid Hull Inflatable Boat (RHIB). The inboard system is located ashore and contains all the photonics and electrical equipment to provide source laser power and demultiplex and demodulate the received hydrophone signals. These signals are then fed into a standard sonar linear array signal processor and displayed in the usual fashion.

Capability Benefits

Compared to the existing piezo-ceramic based array systems, an FLS-based array would potentially provide the ADF with an ultra-thin, lightweight acoustic array with the potential for a very long fibre optic lead-in/tow cable.

The opportunities it offers are:

- Rapidly deployable seabed arrays from small vessels (e.g. RHIB);
- Towed arrays for surface ships and submarines, providing small winch systems, smaller and simpler platform interfaces and less power and weight;
- Submarine hull mounted arrays as an alternative to the current complex outboard electronics approach;
- Arrays for unmanned underwater vehicles that need low power and small size.

Probably the most immediately applicable and practical application in the near term is force protection, where the array is deployed in a trip wire configuration around a high value asset while in a potentially hostile harbour.

Photos of FLS Deployment System Trials at Jervis Bay in July 2008