sonacom Pty ltd

SUBMISSION ON COASTWATCH

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1. INTRODUCTION

Sonacom Pty Ltd was formed in Sydney in 1996 with its core business in the field of surveillance of the maritime environment. Within this field, Sonacom's particular expertise is in the area of acoustic surveillance, where it has grasped the rapid advances in digital signal processing technologies and communications technologies to develop low cost solutions to several major, worldwide surveillance, fisheries/environmental and defence challenges. The company is in the process of commercialising several products that have the potential to provide a major impact on the way current, maritime surveillance operations are performed.

Noting that Surveillance Australia is under contract to the Australian Customs Service to provide fixed wing aircraft coastal surveillance services, Sonacom is about to sign a Memorandum of Understanding with Surveillance Australia with a view to incorporating acoustics into surveillance operations. Sonacom will also be undertaking a trials programme in mid-July with the Great Barrier Reef Marine Park Authority (GBRMPA) involving the acoustic monitoring and tracking of vessel activity in the Great Barrier Reef area.

2. BACKGROUND

Australia and many other countries with extensive coastlines face worrying issues of illegal immigration and people smuggling; transnational crime including the importation of banned substances; the protection of natural resources under sovereign control; and particularly, the destruction of fishing resources, the protection of natural marine environments, and the defence of foreshores.

The worldwide increase in the number of illegal vessel movements has highlighted the deficiencies of current surveillance systems. Sonacom Pty Limited, an indigenous Australian company, has developed advanced maritime sensor and surveillance technologies to help address these concerns. These new, dual use, commercial/defence products will also enable Australia, its allies and friends, to dramatically improve current capabilities. Thus, Sonacom's products also have significant export potential.

The capability for enhanced surveillance of the maritime environment is being achieved by Sonacom through miniaturisation of advanced digital signal processing technologies and incorporation of them in what have historically been called sonobuoys. Sonobuoys are surveillance devices, deployed from maritime patrol aircraft and Navy helicopters, with components that float on the surface of the sea supporting Radio Frequency (RF) antennas, with acoustic listening devices suspended beneath them.

Sonacom's leading-edge buoys are designed to be deployed from aircraft or ships and be self-anchoring in waters up to 300 metres deep. They are solar powered, incorporate a Global Positioning System, can transmit data via RF link or satellite, and can be left at sea unattended for up to six months.

In the past these acoustic devices, ie sonobuoys, were designed to detect and track submarines in deep water, and in fact could not be deployed in shallow water. The Sonacom systems allow deployment of buoys in both deep and shallow waters, enabling acoustic surveillance of areas that previously could only be monitored at high cost by manned ships or aircraft. Utilising modern, commercial-off-the-shelf (COTS) digital technologies, Sonacom's systems obviate the need for very high cost maritime patrol aircraft and their highly sophisticated airborne signal processing equipment. Sonacom's buoys can be monitored using a personal computer or laptop computer-based system.

Sonacom's long-life buoys are designed for surveillance of environmentally sensitive areas like the Great Barrier Reef in order to detect illegal activities such as the pumping of bilges and dumping of oil; illegal fishing; and tracking, identifying and protecting marine mammals, fish and other marine resources. It facilitates the establishment of barriers, ie "acoustic fences", against intruders in focal areas and other vulnerable and sensitive littoral waters. One version of the long-life buoy incorporates an in-air microphone, enabling detection of airborne vehicles.

Sonacom has also developed and trialed a relatively low cost, free drifting buoy designed primarily for defence applications. This buoy is half the size and weight of the current equivalent, can operates in shallow waters, and can be tailored to detect a range of specific targets. Whereas the full-size sonobuoys are currently used by defence forces primarily to detect submarines, Sonacom's half-size buoys offer a low cost, passive surveillance option for both defence and non-defence applications, for example, in tracking surface vessels for Coastwatch and Customs activities. The size and weight advantage of half-size buoys equates to more buoys being available per sortie, or longer times on task/lower fuel usage for monitoring aircraft.

In addition to its work on acoustic buoys, Sonacom has entered into a joint venture with the University of Sydney to develop an Unmanned Aerial Vehicle (UAV). Known as the *Mirli*, this vehicle has a unique ability to take off vertically then pitch over to normal, forward flight. To land, the vehicle again pitches up to a vertical attitude and descends vertically like a helicopter. The aircraft is designed to have a range of up to 1200 kilometres and carry a payload of 95 kilograms. *Mirli* can be used to deploy stores such as Sonacom's half-sized buoys, or to carry surveillance sensors such as cameras, radar or infra red detectors.

3. SONACOM'S MARITIME SURVEILLANCE PRODUCTS

3.1 ACOUSTIC BUOYS

- "SeaVigil"- a remote acoustic sensor system, with omni-directional in-water sensors and with both satellite and Radio Frequency (RF) data links for long-life monitoring of fisheries and the marine environment.

- Sea and Air Surveillance (SAS) Buoy, similar to SeaVigil but incorporating an in-air microphone, with both satellite and RF data links for long-life surveillance of coastal regions, focal areas, and other sensitive littoral waters.

- C-Buoy sonobuoy (both standard military “A” size, and “G” half-size versions), with an in-water sensor array for higher sensitivity and directionality, for use by defence forces and government agencies for surveillance activities and covert tracking.

The SeaVigil and SAS Buoys share the following general characteristics:

- Adapted from proven Defence technology
- Designed and manufactured in Australia
- Rapidly deployable in any area of current interest, for a fraction of the cost of conventional surveillance systems
- Deployable from ships, fixed wing aircraft, helicopters, or Unmanned Aerial Vehicles
- Omni directional sensors providing detection ranges up to 20 nautical miles
- Long-life capability
- 24 hours per day surveillance monitoring
- RF or satellite uplink for forwarding data to a central monitoring station
- Variable depth tethering system for operations in most littoral waters
- Sophisticated signal processing for vessel location, classification, and identification of operating state/activity
- Recording of vessel signatures to build data bases for ongoing identification and monitoring
- Packaged in compact 914mm x 125mm containers.

3.1.1 SeaVigil

Sonacom’s ***SeaVigil*** technology is designed to facilitate continuous monitoring of a coastline or fishing areas over short or long periods. The system is intended primarily for fisheries and marine park authorities, and environmental protection agencies. It can be used as a stand-alone system forming an ***acoustic fence***, or barrier; or it can supplement existing Vessel Monitoring Systems and surveillance infrastructure with a number of strategically placed remote acoustic sensors.

SeaVigil combines technologies that have been developed under a number of projects for the Royal Australian Navy. The buoys have already been developed and are being trialed at sea. Figure 3-1 is a photograph of a SeaVigil Buoy.

Figure 3 -1 Picture of SeaVigil Buoy

The system incorporates omnidirectional acoustic sensors (hydrophones) in the water to optimise the detection performance over a wide range of threats and environmental conditions. A unique feature of Sonacom's buoys is that signal processing is incorporated within the buoys to facilitate transmission of the signals to a shore-based facility. Data segments from the in-water sensors are multiplexed into a data stream which is transmitted to a monitoring station via an RF link or satellite communication channel. The latter is the preferred option, but RF transmissions may be more convenient for monitoring near-shore areas. A number of strategically placed buoys can be used as an acoustic fence in offshore areas by utilising a single satellite communication channel.

At the monitoring station, hydroacoustic signals from intruding vessels can be analysed to give their approximate position and trajectory. Signal processing is provided to analyse the spectral content of the signals to give classification information in addition to information on the speed, bearing and activity of the vessels detected.

In July 2000, Sonacom will deploy its SeaVigil buoys in a trials surveillance programme with the Great Barrier Reef Marine Park Authority (GBRMPA). These trials will be monitored by the Department of Defence and by Customs/Coastwatch.

3.1.2 Sea and Air Surveillance (SAS) Buoy

Like the SeaVigil Buoy, Sonacom's Sea and Air Surveillance (SAS) Buoy incorporates acoustic sensors to optimise detection performance over a wide range of threats and environmental conditions. The *SAS* Buoy is distinguished from SeaVigil by also incorporating a microphone in the surface floating section to provide detection and monitoring of airborne platforms. This is expected to provide important capability in detecting low flying light aircraft crossing the sea-air gap to Australia's north.

In deep water, the SAS Buoy's omni-directional hydrophone provides long-range detection of surface and subsurface targets, and also airborne platforms when there is good coupling of acoustic energy into the water column.

In shallow water, the hydrophone continues to provide good detection against surface and subsurface vessels but has limited capability against airborne vehicles unless the aircraft is very close to the buoy. In these situations, Sonacom has shown that a microphone above the sea surface gives detections at much longer ranges.

Again, signal processing is incorporated within the SAS Buoys to facilitate transmission of signals from the buoys to a land-based facility. Signal conditioning is used to compresses the data, enabling selection of only those segments of the data during which events of interest are occurring. These data segments from both the microphones and hydrophones are then multiplexed into a data stream which is transmitted to a monitoring station via a satellite communication channel or RF link. As with hydroacoustic signals from ships and submarines, airborne acoustic signals can also be analysed to identify the type, course, speed and altitude of the aircraft.

The SAS buoys are normally in stand-by mode until interrogated, thus reducing the power drain and prolonging buoy life. The interrogation signals are programmed from the land-based control centre and buoy modes can be changed as necessary.

In order to achieve a high probability of detecting an intruder crossing an acoustic fence formed with SAS Buoys, the buoys are spaced about 20 nautical miles apart. This allows, at a reasonable cost, the continuous monitoring of some 200 nautical miles of coast using a single commercial satellite phone channel. However, the number of channels used can be selected and optimised for any given situation. The satellite telephone links are independent of the restrictive military communications systems and can therefore be expected to continue working in times of crisis. By using a satellite link, the whole of Australia could be monitored from one shore-based facility. Figure 3-2 shows a concept of operations using SAS Buoys.

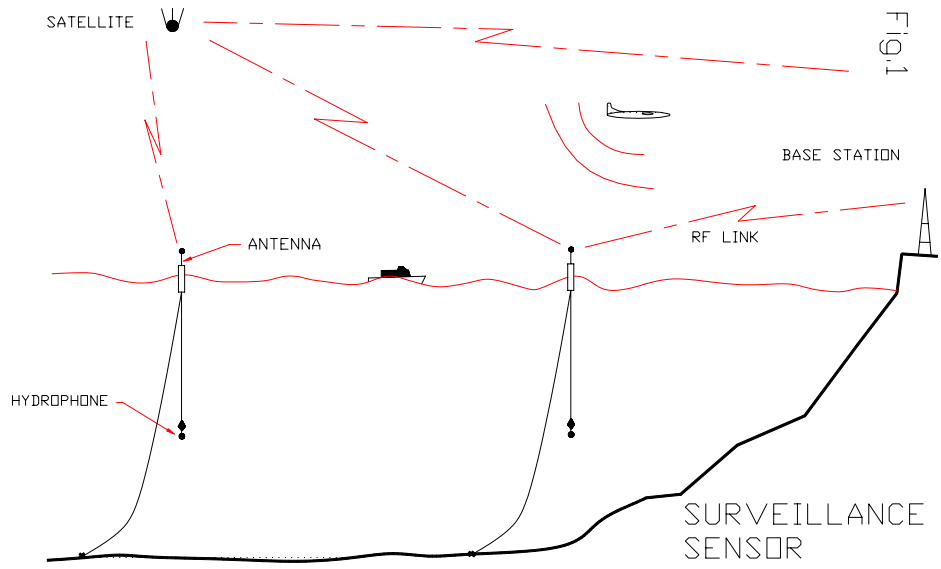


Figure 3-2 Concept of Operation of Sea and Air Surveillance Buoys

3.1.3 C-Buoy

The Australian designed digital C-Buoy is deployable from fixed wing aircraft, helicopters or coastal patrol vessels and is packaged in either “A” size or the smaller “G” size canister. A recent Teaming Agreement between Hermes Electronics of Canada, owned by the UK company Ultra, and Sonacom has resulted in Sonacom’s digital electronic sensor units being integrated into the Hermes production sonobuoys for trials. The standard Hermes sonobuoys are currently in the inventory of the Australian Defence Force (ADF).

Sonacom’s unique acoustic/electronic design improves detection performance dramatically while also providing substantial operational cost savings compared with conventional “DIFAR” sonobuoys. The C-Buoy array consists of five hydrophones arranged as two orthogonal dipoles with a central, omni-directional hydrophone. The array of hydrophones coupled with in-buoy signal processing enables the buoy to focus on signals of interest and null the effects of unwanted noise, such as from breaking surf or interfering shipping.

Thus, the C-Buoy is a low cost option for improved detection of submarines, protection of borders and resources, and for covert tracking of illegal shipping.

3.2 PC-BASED SIGNAL PROCESSING SYSTEM

Sonacom’s PC-based signal processing system performs all buoy interrogation, signal analysis and intruder alert functions. It can be provided as part of a complete surveillance system package. The processing system is compatible with the Australian Defence Force’s (ADF) processing systems and in-service sonobuoys.

Sonacom’s Graphical User Interface includes a geo-referenced display of naval charts, enabling the operator to show the positions of buoys and simultaneously display the tracks of surface vessels, sub-surface vessels and aircraft transiting the surveillance zone. The software and displays alert the operator whenever intruders enter the defined exclusion zone. A typical display page is shown in Figure 3-3.

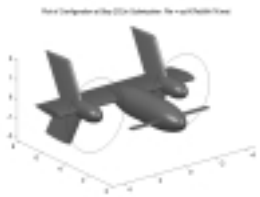
Figure 3-3 Geo-referenced chart display

3.3 The "Mirli" Vertical Take-off and Landing Unmanned Aerial Vehicle (VT-UAV)

Sonacom has entered into a joint venture with the University of Sydney to develop an Unmanned Aerial Vehicle (UAV). Known as the *Mirli*, this vehicle has a unique ability to take off vertically then pitch over to normal, forward flight. The aircraft has a range of up to 1200 kilometres and can carry a payload of 95 kilograms. To land, the vehicle again pitches up to a vertical attitude and descends vertically. The aircraft can carry significant radar/optical sensor package or can be used as be used as a sonar communication platform. Other advantages are:

- No runway or landing facilities are required;
- Can hover or fly conventionally;
- Can be adapted to specific altitude and range requirements;
- Can supports current assets

A prototype Mirli aircraft has been built and flight trials commenced in May 2000.



4. SUMMARY

Sonacom Pty Ltd submits that the detection and analysis of acoustic signals, both airborne and through-water, can be an important adjunct to traditional methods for conducting maritime surveillance. With this in mind, the company has developed a range of relatively low-cost acoustic buoys suitable for use in both deep and shallow waters. Data from the buoys, self-tethering or free drifting, may be relayed to a land-based monitoring station by RF or satellite links. At the monitoring station, the geo-referenced locations of the buoys and the tracks of vessels and air platforms can be displayed on charts of the region under surveillance. The technology is compatible with, and complements, in-service Vessel Monitoring Systems.

In this regard, Sonacom will soon be conducting trials of its SeaVigil surveillance system in conjunction with the Great Barrier Reef Marine Park Authority; and the company is about to sign a Memorandum of Understanding with Surveillance Australia to investigate incorporation of acoustic buoy technology with Surveillance Australia's current surveillance assets, particularly for covert tracking of Suspected Illegal Entrant Vehicles. The Mirli VT-UAV is a low-cost solution for maritime surveillance, coastal surveillance and monitoring operations.

Current Directors of Sonacom include Vice Admiral Don Chalmers AO, former Chief of Navy and Dr Paul Scully-Power former astronaut and current Chairman of CASA.