

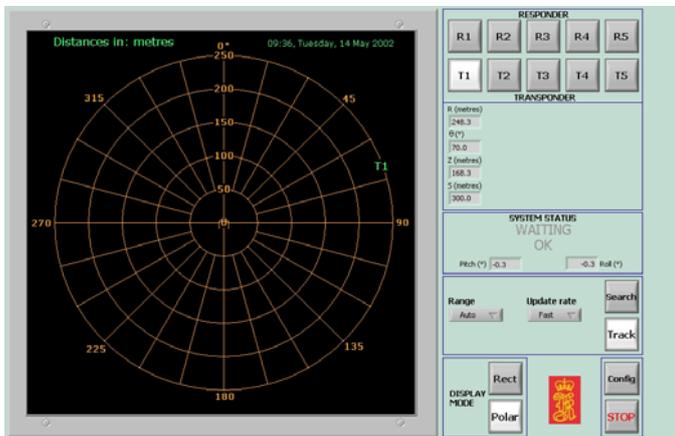


System Description

Acoustic Tracking System

Sonar Type 2059

Sonar Type 2059 is a military off the shelf (MOTS) Acoustic Tracking System specifically designed for naval applications including Mine Counter Measures (MCM).



The portable ruggedised equipment is manufactured to provide a high degree of reliability and durability in the harshest of marine



environments. All assembly is carried out in a low-magnetic environment.

With over 30 systems supplied for naval applications ranging from submarine rescue to MCM and salvage operations, the performance is well proven with components, spares assemblies and "Special to Type" test equipment all NATO codified.

The system comprises three main units: the control unit, the transducer assembly and the underwater transponder (or responder).

Control Unit

The portable control unit contains: the transceiver, interface modules and MMI. The control unit comprises a laptop PC and a number of data acquisition cards to perform sonar processing and data presentation within a standard Windows® format. The MMI allows the operator to correct for weapons datum reference, transducer alignment and several other parameters.

A **vertical reference unit (VRU)** would normally be incorporated within the system to compensate for vessel motion. This may be an



interface from the vessel's MRU or can be provided by a dedicated self-contained 2059 VRU unit. The VRU connects to the control unit via an interconnecting cable and transmits the vessel's pitch and roll movement information in an analogue form, which is then used in the position calculations.

Transducer Configurations

There are three options available for the transducer array: SSBL, SBL and LBL depending on the operation requirement.

The **SSBL** configuration allows for ease of installation. The transducer is a miniature hydrophone array containing three receiving elements and one transmitting element. The transmitting element generates the interrogation

pulse to which the underwater transponder replies. The three receiving elements are arranged in an orthogonal pattern and the transponder return signal direction is computed from the phase differences between the three elements.

The SSBL transducer is deployable 'over the side' with a portable deployment system or via a hull outfit (as on the HUNT Class MCMV) or via special adapter plates for submarine installation.

Each SSBL transducer is submitted for analysis on an acoustic range after manufacture (or repair). Transducer response is tested in 5° azimuth (0° to 355°) and 5° depression steps (0° to 85°). The resulting unique data is supplied on a CD-ROM with the corresponding transducer. Upon downloading onto the laptop PC a calibrated combination is achieved.

NATO codified as 5845-99-768-6317, the SSBL transducer comprises three raised ceramic elements allowing improved shallow water tracking performance. Accurate target tracking is dependent upon correct alignment of the transducer with the VRU and the vessel's datum. It is also important to ensure accurate and timely provision of target depth data (Manual, Telemetry and External depth options) and correct entry of the velocity of sound (VOS) in water.

In an **SBL** configuration, the three receive elements are mounted some distance apart in a known pattern along with a transmit element (for transponder operations). The system calculates position from the time delay from the responder/transponder to each of the receive elements. Receiver elements may be vessel mounted or deployed on the seabed for precision positioning of ROV mounted responders and diver transponders.

The **LBL** configuration may be useful when positioning the vessel accurately on a noise or magnetic range facility. Up to five seabed transponders deployed in known positions can be used to accurately calculate and display the vessel position. The LBL principle has been adopted for positioning a rescue vessel (or MOSUB) using Submerged Signal Ejector (SSE) launched transponders in close proximity to the DISSUB and for monitoring a three point moor on Sal Class vessels.

Transponders/Responders



Transponders generate an acoustic pulse in response to the acoustic interrogation signal from the transducer. The acoustic response can be configured to provide a depth telemetry signal. One transponder must be fitted to each underwater unit that is required to be tracked.

The system can also be used with underwater responders in place of transponders. These are very similar with the exception that they provide an acoustic reply to an electrical trigger supplied via an umbilical cable.

The system also has the capability of tracking a free running 30kHz acoustic pinger in place of transponders/responders.

A range of transponders and responders are available to suit particular MCM vehicle configurations, SSE deployment mechanisms and other naval applications.

System Performance

Limitations can be avoided by careful installation of the acoustic elements of the system. It is particularly important that the transducers are mounted away from any props and thrusters that may introduce air into the water surrounding the acoustic elements. It is recommended that the transducer be lowered several metres beneath the hull to reduce vessel generated noise and aeration effects. The quality of cabling between the transducer and the control unit can also impact upon the performance of the system as well as correct alignment of the VRU.

It is also important that effective frequency management is practiced in the immediate underwater environment. The control unit is provided with a synchronisation facility to manage transmissions into the water.

System performance can be enhanced by integration of ROV depth information directly into the control unit. Alternatively the control unit has the options to calculate depth from the received signal, interpret depth telemetry or take manually entered depth into the positional

algorithms. Accuracy is enhanced by providing the system with the correct local water sound velocity.



HUNT Class MCMV



Vanguard Class acting as MOSUB



Torpedo Recovery ROV



Submarine Rescue ROV

Technical Overview

SSBL System Performance Characteristics

Tracking Range (Slant Range)	Up to 2500m (Transponder dependent) Typically 1000m with the VTM2 Transponder (186dB source level at 30kHz)
Range Resolution	0.1m displayed at MMI
Range Accuracy (Wide Vertical Beam $\pm 90^\circ$)	$\pm 0.3m$ (95% of 200 sample readings) at a range of 300m – measured at the MoD Acoustic Test Facility
Operating Depth	Up to 2500m (Transponder dependent)
Depth Telemetry	$\pm 0.9m$ over 95% of 500 sample readings at a static target depth of 16m – recorded at the MoD Acoustic Test Facility. (Transponder dependent)
Tracking Coverage	0° to 360° azimuth over full hemisphere – 5 transponders and 5 responders sequentially
Bearing Repeatability	$\pm 1.0^\circ$ (95% of 400 sample readings) at a range of 250m – recorded at a NATO

	Acoustic Test Facility on a MCM vessel
Bearing Resolution	0.1° metres displayed at MMI
Bearing Accuracy	Calibrated to $\pm 1.0^\circ$ azimuth for depression angles 0° to 85° - recorded at the MoD Test Facility
Interrogation Rate	ASAP – 1.2 seconds at 500m range using a transponder Fast – 3.2 seconds at 500m range using a transponder Slow – 5.2 seconds at 500m range using a transponder
Polar Format	Range (R), Bearing (θ), Depth (Z), Slant Range (S), Concentric rings at 20%, 40%, 60%, 80% and 100% of display range
Rectangular Format	Athwartships distance (X), Alongships distance (Y), depth (Z), Slant Range (S), Horizontal lines at 20%, 40%, 60%, 80% and 100% of display range

Note: Accuracy figures can be misleading; the realistic figures provided above were measured at internationally approved acoustic test facilities. The bearing repeatability figure is based on a minimum 20dB SNR at the receiver.

NATO Stock Numbers

Control Unit	5845-99-323-1070
SSBL Transducer	5845-99-768-6317
VRU (Vessel fit)	5845-99-746-5152
VRU (Transducer fit)	5845-99-841-9142
Naval, Versatile Transponder Marker 2	5845-99-957-6424
Submarine Launch Transponder	5845-99-325-0387
Transducer Deployment System	5845-99-500-8446
Sonar Test Set	5845-99-765-3974
Transponder Test Device	5845-99-160-3880
Transducer Tester	5845-99-795-1015

Note: Specifications may be changed without notice

Publication Ref: KS2059

KONGSBERG MARITIME LTD

11 The Briars Waterberry Drive Waterlooville Hants PO7 7YH
tel: +44 23 9224 7800 fax: +44 23 9224 7808 email: km.waterlooville.uk@kongsberg.com
www.kongsberg.com