COMMUNICATIONS AT SPEED AND DEPTH

An investigation into methods and technologies is required to improve the speed and depth performance of tethered and deployable antennas. This research topic focuses on improving antennas with servicing frequency bands from VLF to VHF. Low frequency bands are a significant challenge due to the large physical size of the required antenna, in particular for communication transmissions.

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.

VISUALIZATION OF BIOLUMINESCENCE DATA

Mitigation of bioluminescence is a prime focus for accomplishing submarine detection avoidance. However, current bioluminescence information is presented quantitively in the format of numerical data, which demands substantial effort and experience from the submarine operators to determine the risk to overall submarine signature.

This research topic aims to address two high-level questions around detection and visualisation of bioluminescence:

1) What data would the visualization of bioluminescence include? And

2) How would the trail be presented? This research topic consists of the following objectives:
   - Identification of critical bioluminescence input data required to develop a model
   - Development of the bioluminescence data model
   - Visualisation of bioluminescence data
   - Integration and presentation of the bioluminescence data to submarine operators

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.

ABOVE WATER LASER COMMUNICATION

Laser communication using optical electromagnetic radiation has been recognized as a potential alternative to traditional radio frequency (RF) signals. There are however several challenges associated with laser communication systems, such as atmospheric effects and the acquisition/tracking of receiving/transmitting system that need to be overcome. This research topic aims to investigate the viability of laser communication systems mounted on a submarine mast to exchange information with above-water units such as ships, aircrafts, and satellites.

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.

NOVEL RECOVERY APPROACHES OF SUBMARINE-LAUNCHED UUVS AND UAVS

This research aims at investigating potential methods of recovering submarine-launched UUVs and UAVs through both traditionally sized torpedo tube and other novel approaches. Installation of temporary support equipment may be included as part of the recovery system design. This study will explore non-conventional recovery approaches and evaluate their pros/cons against methods currently being considered.

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.

INTELLIGENT MISSION RECORDING

The amount of raw data recorded during the duration of submarine operation is enormous. Reducing the amount of archived data by selectively recording the information of interest could potentially reduce SWAP space and associated support facilities on the submarine, which may also speed up post-mission analysis.

This research topic aims at developing an intelligent system capable of monitoring the submarine operations, and determining the relevance and criticality of the data that warrants recording. The developed learning engine could also take in inputs from operators that manually control data retention to refine its operation.

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.

INVESTIGATING EFFECTIVE ANTI-FOULING AND ANTI-CORROSION TREATMENTS

Investigating effective anti-fouling and anti-corrosion treatments to mitigate Sonar array degradation.

Fouling on the submarine points to the build-up of unwanted marine materials on the solid surface, which degrades the performance of the platform and its sensors. The phenomenon causes a negative effect on acoustic sensor performance, maintenance, hydrodynamics, and the overall propulsion efficiency of the submarine. This research topic aims to investigate effective antifouling and anti-corrosion treatments to mitigate sensor degradation. Whilst there are currently anti-fouling coatings applied to naval vessels, the treatments are generally effective only for approximately 5 years. Development treatments of greater efficacy will reduce the rate of sensor degradation, mitigate acoustic signatures, and therefore increase the overall stealth capability of the submarine.

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.

RESEARCH SUPPORTING THE DEVELOPMENT OF VISUAL SENSOR PREDICTION (RANGE OF THE DAY) TOOL

An understanding of the performance characteristics of visual sensors in the current environmental conditions is critical to situational awareness. Accurate determination of sensor performance requires derivation from meteorological, biological, operational parameters and atmospheric conditions that are constantly changing and difficult to predict.

This research topic aims to develop methods and algorithms to predict the performance of visual sensors by determining the critical input data required, the feasibility of acquiring such data with the required currency and fidelity, and the potential application of the data collected. Consideration should also be given to evaluate the uncertainty/noise level of the data, and to develop effective methods in order to validate the accuracy and performance of the overall system.

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.

ASSET MAINTENANCE TECHNIQUES

This research topic aims to develop a predictive maintenance system leveraging the operation profile data (power/ temperature/ vibration/ transmission rate) collected via submarine data structures, built-in wireless sensors, and self-noise monitoring system. These operational data, when profiled using next-generation artificial intelligence, will serve as benchmark to evaluate the health status of each equipment, and in return provide submariners the ability to support the conduct of remote maintenance, develop maintenance training programs, and simulate/plan scheduled/un-scheduled maintenance.

R&D deliverable's will include a report comprising a detailed literature review of the relevant areas and methods; identification and evaluation of appropriate models and methods; a detailed plan proposing future research; and the identification of suitable measures of effectiveness and/or measures of performance to help quantify the value of the research.