

SOP A-352-2

Preliminary Trial Plan

Trial Name: ARC_U_UWW_2022001 MARPS in Arctic

Planned Trial Dates: 15th to 24th August 2022

Written By:

Approved by:

Signature, Date
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Signature, Date
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1. Trial Overview

This trial addresses a request by the Maritime Forces Atlantic Fleet Commander, to explore the possibility of deploying maritime autonomous and remotely piloted systems (MARPS) from an arctic offshore patrol ship (AOPS) in the Canadian arctic. The trial provides the opportunity to strengthen the strategic messaging of arctic sovereignty as well as exploring the technical and scientific challenges of deployment, operation, and recovery of MARPS in the arctic. This trial also directly supports the Defend North America (DNA) Strategic Focus Area (SFA), as well as Canada's involvement in the NATO Anti-submarine warfare (ASW) Smart Defence Initiative (SDI).

The trial will take place on board the HMCS 431 – Margaret Brooke, in Pond Inlet, Nunavut, as part of Operation NANOOK 2022 with the objective of demonstrating interoperability between mobile and stationary MARPS in an ASW Hold at Risk scenario. A hold at risk scenario is the monitoring of a port or transit choke point with the intent of detecting submarines entering or exiting the area. In this case, a stationary seafloor MARPS will detect a target (surface or underwater) within its proximity, and subsequently trigger a request for automatic identification system (AIS) data from a surface MARPS patrolling the area. The relaying of this data from the surface asset enables the seafloor MARPS to evaluate the status of the detected target.

2. Classification of Trial

This trial is UNCLASSIFIED.

3. Scientific & Technical Objectives

The main scientific and technical objectives of this trial can be summarized as follows:

1. Testing the interoperability between mobile and stationary MARPS to demonstrate an ASW concept of employment in the Arctic environment.

2. Evaluation of alignment performance and quality of a new inertial navigation system (INS), on board an autonomous underwater vehicle (AUV), following stationary and moving calibration at high arctic latitudes.
3. Collection of high-frequency (450 kHz) sonar data from an uncrewed surface vessel (USV) to evaluate the performance characteristics of this sonar in the arctic ocean where the presence of freshwater layers affect the sound velocity profile.
4. Development of safe and efficient procedures for arctic MARPS operation, including deployment and recovery from an RCN platform.
5. Provide DRDC personnel with Arctic training and experience for MARPS, onboard an RCN platform.

4. High Level Trial Activities

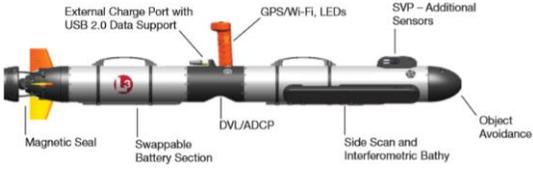
The major activities / types of activities that are planned to achieve scientific and technical objectives are listed below:

1. Load all equipment on to Margaret Brooke (MAR) on July 15th, 2022
2. Ship equipment to near Pond Inlet, Nunavut
3. Calibrate new INS onboard AUV during transit
4. Deploy a seafloor Distributed Underwater Sensor Network (DUSN) node close to Pond Inlet
5. Deploy the USV close to DUSN node and set to patrol on a predetermined survey pattern
6. Recover DUSN node
7. Collect a data set of high-frequency sonar data close to the Pond Inlet shore line in shallow water depth
8. Recover USV

A detailed list of the trial activities will be included in the Detailed Trial Plan.

5. Major Equipment

A list of the planned major equipment for the trial is provided below:

#	Equipment	Photo	Point of Contact	Equipment Status
1	Sea Robotics USV-2600		Jacob Marshall	Operational
2	Seafloor DUSN node		Val Shepeta	Currently undergoing software upgrades
3	Radio frequency surface buoy for communication with DUSN		Val Shepeta	Currently undergoing software upgrades
4	IVER-3 AUV (Klein UUV3500)		Sean Spears	Cuurently awaiting return from manufacturer following upgrades
5	CTD sensor		Owen Shuttleworth	Operational

6	AIS transmitter		Owen Shuttleworth	Operational
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A detailed equipment list will be included in the Detailed Trial Plan.

6. Preliminary Trial and Travel Schedule

The preliminary schedule for the major trial activities and travel is provided below:

12 August 2022: Travel from Halifax, NS to Nuuk, GL

15 August 2022: Embark on Margaret Brooke in Nuuk, GL

15 to 22 August 2022: Transit from Nuuk, GL to Pond Inlet, NU. Calibrate the new INS onboard the AUV while in transit (AUV is not deployed in water).

22 to 23 August 2022: Conduct MARPS trial & collect high-frequency sonar data close to Pond Inlet, NU.

24 August 2022: Disembark personnel in Pond Inlet, NU.

25 to 27 August 2022: Travel from Pond Inlet, NU to Halifax, NS.

A detailed schedule will be included in the Detailed Trial Plan.

7. Location

The core activities of the trial will take place near Pond Inlet, Nunavut as shown in Figure 1. The coordinates of assets and trial activities are given in the table.

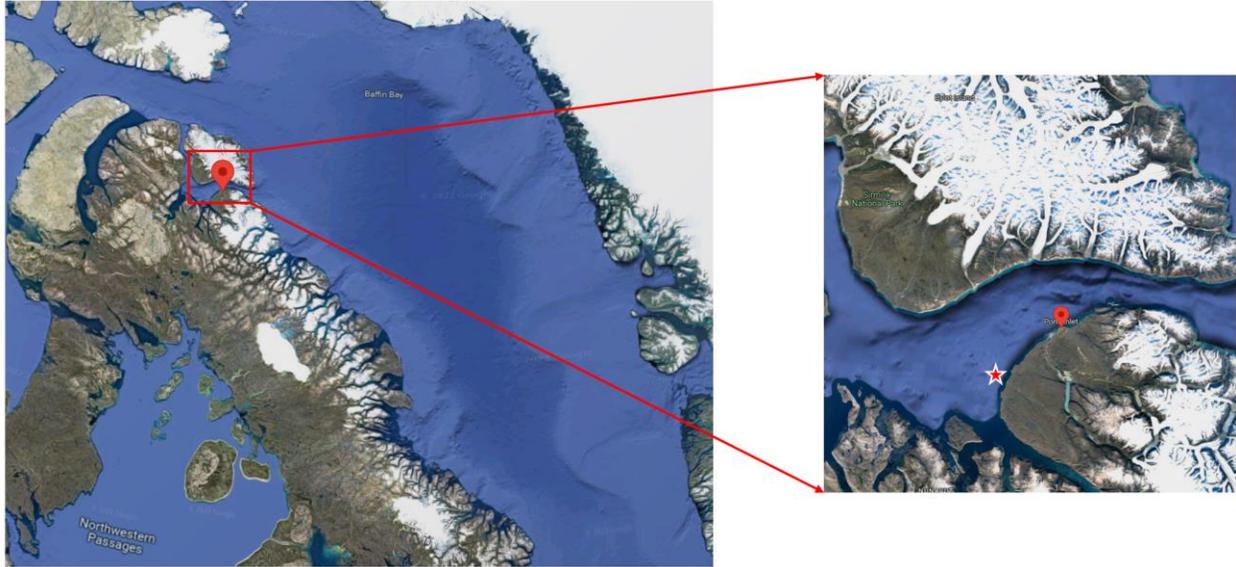


Figure 1: Location of trial activities close to Pond Inlet (shown as red marker). The DUSN node will be deployed at the location of the red “star” at 72.54094°N, -78.58181°W.

#	Asset	Latitude (deg°)	Longitude (deg°)	Depth (m)
1	DUSN node	72.54094	-78.58181	60m
2	USV-2600	North edge of box: 72.5508N South edge of box: 72.53278N	West edge of box: -78.5795W East edge of box: -78.58195W	At surface
3	CTD	Various locations around experiment	Various locations around experiment	Full water column

8. Permissions / Clearances – Water, Air and Land Space

As this trial is part of OP NANOOK 2022, all water clearances or permissions will be arranged by the Maritime Component Commander (MCC) of RCN for OP NANOOK.

9. Contact List

1. Trial Lead: Reza Mir, Mobile: 416-454-9690, Reza.Mir@forces.gc.ca
2. Lead Technologist: Owen Shuttleworth, Owen.Shuttleworth@forces.gc.ca
3. UWW Section Head: Warren Connors, 902-407-0524, Warren.Connors@forces.gc.ca
4. RED Section Head: Erin MacNeil, Erin.Macneil@forces.gc.ca

10. Participants

A preliminary list of trial participants is provided below:

#	Name	Organization	For DRDC: Section, Classification	Role in Trial
1	Reza Mir	DRDC	UWW, DS-04	Trial lead
2	Owen Shuttleworth	DRDC	RED, EG-05	Technical lead
3	Jacob Marshall	DRDC	RED, EG-05	Technical support
4	Val Shepeta	DRDC	RED, EG-06	Technical support

This list is subject to change as the trial planning progresses. A detailed list of participants and their roles will be included in the Detailed Trial Plan.

11. Data Handling

The following data / types of data will be collected during the trial:

Data	Security Requirements	Special Data Handling
Acoustic data recorded by DUSN	SECRET	Upon the end of the trial, DRDC personnel with appropriate security clearance will remove the hard drive from the DUSN node and physically transport it back to a secure DRDC lab.
Acoustic (PingDSP sonar)	UNCLASSIFIED	None
CTD	UNCLASSIFIED	None
Ship position data	UNCLASSIFIED	None
Environmental (wind speed, direction, ice floes, etc.)	UNCLASSIFIED	None
Notes, photos, videos	UNCLASSIFIED	None

12. Security

The general security risks for the trial are listed below. Risk reduction measures will be included in the Detailed Trial Plan.

1. Acoustic data recorded by the DUSN node during the trial could include the raw acoustic data from *Margaret Brooke* which will be treated as SECRET in accordance with the NAVORD 3470-1 Maritime Operational Acoustic Policy. At the end of the trial, DRDC personnel with appropriate security clearance will remove the hard drive from the DUSN node and physically transport it back to a secure DRDC lab. No other contacts of interest are anticipated to be in the vicinity during the trial.
2. While the DUSN node is not categorized as controlled goods (CG), several components fall into that category including: the hydrophones, DUSN firmware, and onboard Benthos acoustic modem.

- The new Inertial Navigation System (IxBlue PHINS C3 INS) aboard the IVER-3 AUV is Export Controlled.

Note: SOP A-734 Trial Security will provide additional guidance on trial security risk assessment and mitigation (at the time of writing, SOP A-734 had not been developed).

13. Health & Safety

The major health and safety risks for the trial are listed below, along with the measures that will be taken to reduce the risk:

#	Potential Health & Safety Risks	Risk Reduction Measures
1	<i>Personnel will be working from a large ship and/or small boat in the ocean</i>	<ul style="list-style-type: none"> • <i>DRDC personnel will have a valid Health Canada Field Medical</i> • <i>DRDC personnel will have Standard First Aid Training</i> • <i>Personal Protective Equipment (PPE) will be worn</i>
2	<i>Personnel will be deploying and recovering bulky equipment over the side of the ship</i>	<ul style="list-style-type: none"> • <i>Personal Protective Equipment (PPE) will be worn</i> • <i>Personnel with appropriate experience will be used and they will be briefed on the deployment/recovery procedures for the equipment as part of a safety brief prior to commencing work</i>
3	<i>Personnel may be working with equipment capable of producing high voltages</i>	<ul style="list-style-type: none"> • <i>Personal Protective Equipment (PPE) will be worn</i> • <i>Setup and operation will only be performed by personnel familiar with the equipment</i>
4	<i>Operating in a COVID-19 environment</i>	<ul style="list-style-type: none"> • <i>All trials personnel will abide by the CAF COVID-19 risk mitigation procedures in effect at the time of the trial</i>

Note: SOP A-783 Health & Safety will provide additional guidance on trial health and safety risk assessment and mitigation (at the time of writing, SOP A-783 had not been developed).

14. Environmental Impacts

The environmental risks associated with this trial are covered under an existing due diligence environmental assessment, being prepared by NETE for Op NANOOK 2022. The mitigation measures that will be used during the trial to reduce the environmental risk are being finalized through NETE modelling and consultation with MARLANT Safety and Environment. These mitigation measures will be part of the Op NANOOK 2022 Environmental Effects Determination (EED).

Note: SOP A-781 Environmental Impact Assessments (EIA) will provide additional guidance on trial environmental impact assessment and mitigation (at the time of writing, SOP A-781 had not been developed).

15. Overtime

Overtime (OT) must be pre-approved iaw DRDC Atlantic SOP A-109 Overtime Approval and Administration (at the time of writing, SOP A-109 had not been finalized).

During the trial, DRDC participants will be on Sea Trial / Field Pay, as per their collective agreement. While on travel, participants will be on Travel Duty, per their collective agreement.

The estimated overtime for the trial is approximately 98 hours for EG and 54 hours for DS for an approximate total of total of \$30,000. These figures are calculated based on 9 days for the trial and 4 days for travel; with 7.5/15 hours OT for weekdays/weekend for EG and 3/9 hours OT for weekdays/weekend for DS. A more accurate figure will be available once the Project Manager for this project (David Hooper) arranges the travel dates for DRDC personnel.

16. Travel

Travel from Halifax, NS to Nuuk, Greenland will be required and conducted via chartered aircraft. Travel back from Pond Inlet, NU to Halifax, NS will be required and conducted via chartered aircraft. All travel for DRDC participation in Op NANOOK will be submitted by the Project Manager for this project (David Hooper). An accurate cost estimate will be available once the Project Manager arranges the travel details for the DRDC personnel.

17. Reporting

The following reports will be produced during or after the trial:

1. Logbook
2. Trial report (post-trial report)
3. Daily report, sent to SH/UWW, SH/RED, and PM each day of the trial as/when possible.
4. Summary report, produced within one month after completion of the trial to document the work that was done and preliminary results.

18. Glossary of Abbreviations

Abbreviation	Description
AUV	Autonomous Underwater Vehicle
USV	Unmanned Surface Vehicle
DRDC	Defence Research and Development Canada
AIS	Automated Identification System
DCS	Direct Client Support
MARPS	Maritime Autonomous and Remotely Piloted Systems
AOPS	Arctic Patrol Ship
DNA	Defence of North America
ASW	Anti-Submarine Warfare
SDI	Smart Defence Initiative

