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Due Diligence Environmental Effects Determination (DD EED) Report

2018 Sea-Trial Series in Bedford Basin

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Abstract

As part of the Canadian Arctic Underwater Sentinel Experimentation (CAUSE) Project 99ab and the Force ASW (Anti-submarine Warfare) project 01ca, a series of small sea-trials were conducted in the Bedford Basin (NS), Canada. These trials took place as part of the Distributed Underwater Sensor Network (DUSN) international collaboration between Canada, Norway and Sweden.

A significant component of this trial involved the performance assessment of acoustic recording equipment, which required the use of acoustic projectors emitting underwater sounds. This report evaluates the environmental impact of transmitting such sounds on marine life, and in particular on marine mammals present in the area.

Significance to defence and security

The protection of the environment is a priority of the Department of National Defence (DND) and Defence Research and Development Canada (DRDC). As such, this report illustrates the use of the latest scientific evidence to assess the impact of using underwater and anthropogenic sound sources on marine life.

Résumé

Dans le cadre du projet 99ab de Recherche expérimentale d'une sentinelle sous-marine pour l'Arctique canadien (RESSAC) et du projet 01ca de Guerre anti-sous-marine (GASM) de la force, une série de petits essais en mer ont été effectués dans le bassin de Bedford (N.-É., Canada). Ces essais ont eu lieu dans le cadre de la collaboration internationale entre le Canada, la Norvège et la Suède pour le Réseau distribué de capteurs sous-marins (RDCS).

L'évaluation du rendement d'appareils d'enregistrement acoustique à l'aide de projecteurs acoustiques émettant des sons sous-marins a constitué une portion importante de ces essais. Le présent rapport évalue les incidences environnementales de l'émission de ces sons sur la vie marine, en particulier sur les mammifères marins dans la région.

Importance pour la défense et la sécurité

La protection de l'environnement est une priorité du ministère de la Défense nationale (MDN) et de Recherche et développement pour la défense Canada (RDDC). Sur ce plan, le rapport démontre comment les recherches scientifiques les plus récentes peuvent aider à évaluer les répercussions de l'utilisation de sources sonores sous-marines et anthropiques sur la vie marine.

Department of National Defence (DND)

**Due Diligence Environmental Effects
Determination (DDEED) Report**

Activity: Sea-trial in Bedford Basin

Prepared by: Stephane Blouin

DRDC Atlantic

Date: 2018-01-15

Version: 0

Executive Summary

An internal due diligence environmental assessment was conducted for DRDC Atlantic's experiment documented in [1]. The trial will take place in Bedford Basin, Halifax Harbor, Nova Scotia.

Potential significant adverse effects of the activity were assessed and mitigation measures have been identified to minimize or eliminate these effects on the following Valued Environmental Components.

- Atmosphere
- Surface Water
- Ambient Noise
- Sediment/Ocean Bottom
- Fish, Aquatic Animals, and Habitat (Marine)
- Species at Risk, Migratory Birds
- Marine Mammals
- Recreational Areas

On the basis of this Environmental Effects Determination report, it has been determined that the activity is not likely to cause significant adverse environmental effects. Therefore the activity can proceed with application of the mitigation measures found in [1] and Annex B.

Part 1. Activity Information

1.1 Title of Proposed Activity

Sea-trial in Bedford Basin

1.2 Originating Directorate, Base, or Unit

DRDC Atlantic (DRDCA)

1.3 Location of Proposed Activity

The area of operations for the trial is located in the Bedford Basin in Halifax Nova Scotia, as shown in Figure 1.

1.4 Activity Summary

This experiment will be run in Bedford Basin and will employ DRDC's technology, in order to test mechanical design and hardware, to calibrate, to experiment with and debug algorithms, and to collect datasets for progressing deliverables of DRDCA projects. Furthermore, acoustic sources will be used as targets, communication device, sonar, etc..



Figure 1. General location for the trial; Bedford Basin (the Basin), Nova Scotia, Canada.

1.5 Applicability of CEAA 2012

This activity is not associated with a "Physical Work" and does not meet the definition of a project in Section 66 of the CEAA 2012 and therefore Section 67 is not applicable. However, according to the DRDC and DND Environmental Impact Assessment Directives, a determination on the likelihood of adverse environmental effects is required as an exercise of due diligence before the activity can proceed.

1.6 EED Start Date

As specified in [1].

1.7 DGIEGPS EED number

2017-80-101174

1.8 Provincial and Municipal Government Involvement

None contacted-This is a typical scientific trial activity, with activities that are frequently completed in the area of work (Bedford Basin) by DRDC, BIO, DND, Canadian Forces, universities, and private companies. Environmental effects and the related mitigating measures are well defined and presented in establishment procedure and/or policy documents.

1.9 Other Federal Departments

None contacted-This is a typical scientific trial activity, with activities that are frequently completed in the area of work (Bedford Basin) by DRDC, BIO, DND, Canadian Forces, universities, and private companies. Environmental effects and the related mitigating measures are well defined and presented in establishment procedure and/or policy documents.

1.10 Contacts

1.10.1 EED Point of Contact

- a) Name, Rank, and Title: : David Hooper, Project Manager, DRDC Atlantic
- b) E-mail Address: david.hooper@forces.gc.ca

1.10.2 Activity OPI

- a) Name, Rank, and Title: Stephane Blouin, Defence Scientist, DRDC Atlantic
- b) E-mail Address: stephane.blouin@drdc-rddc.gc.ca

Part 2. Environmental Effects Discussion

The scope, activities, equipment, and personnel information can be found in [1].

2.1 Description of Activity Components and Activity Site

This experiment is a DRDC trial where contractors/visitors may be present to provide support or observe, assuming security clearance/access is granted. The experiment will focus on equipment including, but not limited to, underwater nodes/targets, gateway buoys, and autonomous underwater vehicles (AUV). Acoustic sources will be used as communication devices, targets, or sonars, and vessels may also be used as targets of opportunity. The primary objectives include, but are not limited to, the following: (1) test mechanical design and hardware, (2) experiment, test, and de-bug algorithms, (3) calibrate, (4) test deployment and recovery procedures, and (5) collect data for on-going and future research projects.

All activities will occur within Bedford Basin, Nova Scotia. The trial/experiment area is defined by a polygon described in Figure 2 and Table 1. The polygon contains most of Bedford Basin, which provides a wide range of water depths (up to 71 meters at its deepest point) and varying environmental conditions, including soft and hard sediments.

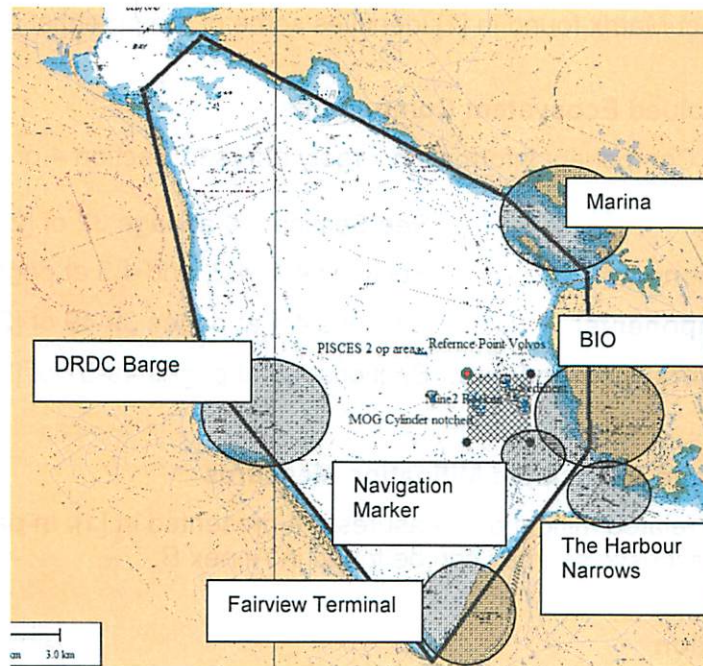


Figure 2. The overall sea-trial area.

Table 1. The coordinates for the sea-trial area

Description	Lat	Long
South near Mackay Bridge	44.6812	-63.6127
South near Fairview Terminal	44.6635	-63.6310
West, near Barge	44.6875	-63.6580
Northwest Point	44.7116	-63.6657
Northeast Point	44.7161	-63.6588
Near Degaussing Range	44.7027	-63.6226
Near Degaussing Range	44.6961	-63.6127

A primary environmental consideration of the trial is the use of acoustic sources in an area known to be populated by marine mammals and any related impacts to the surrounding environment in the Bedford Basin.

2.2 Primary Trial Components and Equipment

The specific location of assets and their description is documented in [1]. Such description includes the source level and frequency band of acoustic sources to be used.

Support vessels like Zodiac, RHIB (Rigid Hull Inflatable Boat), or contracted boats will be employed to serve many functions such as deployment/recovery, monitoring, etc.

2.3 Activity Schedule

The schedule for the in-water part of the testing program can be found in [1].

2.4 Identification of Valued Ecosystem Components (VECs)

The Environmental Effect Matrix found in [1] identifies some of the potential adverse effects.

2.5 Description of Valued Ecosystem Components

The Valued Ecosystem Component information largely refers to Section 4 of document [2].

General Description: See Section 4.0 at page 32 of [2].

2.5.1 Physical Components: Sections 4.1, 4.2, and 4.3 at pages 33-39 of [2]

2.5.2 Biological Components: Sections 4.4 at pages 39-49 of [2]

2.5.3 Social and Cultural Components: Sections 4.5 at pages 49-52 of [2]

2.6 Activity Effects and Associated Mitigation Measures

The activity effects and related mitigation measures are presented in [1]. In particular, the mitigation measure for acoustic sources can be found in Annex B.

2.7 Public Participation

Public participation was not warranted for this activity. The scientific trial includes activities that are frequently completed in the area of work (Bedford Basin) by DRDC, BIO, DND, Canadian Forces, universities, and private companies. Environmental effects and the related mitigating measures are well defined and presented in establishment procedure and/or policy documents.

2.8 Aboriginal Community Engagement

Aboriginal community engagement was not warranted for this activity. The scientific trial includes activities that are frequently completed in the area of work (Bedford Basin) by DRDC, BIO, DND, Canadian Forces, universities, and private companies. Environmental effects and the related mitigating measures are well defined and presented in establishment procedure and/or policy documents.

2.9 Expertise from Other Federal Government Bodies

Other Federal Government Body engagement was not warranted for this activity. The scientific trial includes activities that are frequently completed in the area of work (Bedford Basin) by DRDC, BIO, DND, Canadian Forces, universities, and private companies. Environmental effects and the related mitigating measures are well defined and presented in establishment procedure and/or policy documents.

Part 3. Environmental Effects Determination

On the basis of this DND EED Report, it has been determined that the impact of this activity on the environment is as follows:

- ☒ Activity is not likely to cause significant adverse environmental effects. The activity **can** proceed with application of the mitigation measures specified in the interaction tables in this report.
- ☐ Activity is likely to cause significant adverse environmental effects that cannot be mitigated. The activity **cannot** proceed.

DND EED Report Prepared by:

Name: Stephane Blouin

Title: Atlantic Research Centre, Defence Research and Development Canada

Contact: 902-426-3100 x216, stephane.blouin@drdc-rddc.gc.ca



Signature

15-01-2018

Date (dd-mm-yyyy)

DND EED Report Reviewed by (DRDC Environment Representative):

Name: Carol Thomas

Title: Atlantic Research Centre, Defence Research and Development Canada

Contact: 902-407-0460, carol.thomas2@forces.gc.ca



Signature

16-01-2018

Date (dd-mm-yyyy)

DND EED Report Accepted and Approved by (Project OPI):

The undersigned accepts the determination and recommendations of this environmental effects determination report. The undersigned also accepts the responsibility to incorporate the recommendations of the report into the activity design and implementation.

Name: David Hooper

Title: Project Manager, DRDC Atlantic

Contact: 902-426-3100, david.hooper@forces.gc.ca



Signature

16-01-2018

Date (dd-mm-yyyy)

Annex A: References

1. DUSN Local Sea-trial Activities For 2018, document dated December 21 2017.
2. Stantec Consulting Limited, 2016. Updated Environmental Baseline Study of the DRDC Atlantic Acoustic Calibration Barge. March 2016.

Annex B: Marine Mammal Mitigation Procedure

Ref: NAVORD 4003-6 Marine Mammal Mitigation Procedures for Active Sonar Use

Introduction

1. DRDC-Atlantic performs various acoustic experiments in Bedford Basin. This SOP (Standard Operating Procedure) is to ensure that such experiments do not harass or injure any marine mammals in the area in accordance with the reference.

Scope

2. This SOP covers only DRDC-Atlantic acoustic activities as they affect marine mammals. It does not cover any noise level issues for the personnel involved.
3. This SOP is to be observed by all DRDC-Atlantic personnel performing acoustic experiment in Bedford Basin. If the experiment takes place at the Acoustic Calibration Barge, then the procedure found in reference [2] supersedes this SOP.

Overview

4. NAVORD 4003-6 stipulates that for activities planned for Halifax Harbor and the MARLOAs, MARLANT are recommending following the marine mammal mitigation procedures within the Halifax Class SEMS [A]. As per NAVORD 4003-6 paragraph 2.3, a Mitigation Avoidance Zone (MAZ) must be calculated and reference [A] mentions a sound level (SL) of 160 decibel (dB) relative to 1 micro-Pascal at the marine mammal location as a reasonable and diligent planning figure for use in defining the boundary of MAZ.

5. Most of DRDC-Atlantic acoustic experiments will be at lower intensities than the Halifax Class acoustic sources listed in Table SOP-E05B.1 of reference [A]. This SOP provides a procedure for much less powerful acoustic sources and it follows an approach similar to that of reference [B].

6. Definitions

- a) SL Source Level – The level of sound radiated by an acoustic projector, measured in decibel (dB) referenced to 1 micro-Pascal at a distance of 1 meter
- b) SPL Sound Pressure Level - The level of sound measured at a particular point, measured in dB relative to 1 micro-Pascal

c) TL Transmission Loss – The quantity of power lost from the source signal as it travels through water

d) Sonar Equation (from [C]) $SPL = SL - TL$ where $TL = 20 \log_{10}(r) + \alpha(r)$ for spherical spreading and $TL = 10 \log_{10}(r) + \alpha(r)$ for cylindrical spreading, where r is the distance in meters, α is the absorption coefficient calculated based on salinity, temperature, depth, pH, and frequency as per references [D] or [E].

e) Marine Mammal Survey. A visual and or acoustic survey of the area

7. The following table gives an approximate reduction in SPL to distance dependent on frequency. The equation used is $TL = 20 \log_{10}(r) + \alpha(r)$ for distances up to 400 m and $TL = 20 \log_{10}(400) + 10 \log_{10}(r/400) + \alpha(r)$ for distances beyond 400 m.

Frequency ->	0.1 kHz	0.3 kHz	1 kHz	10 kHz	30 kHz	100 kHz	1000 kHz
alpha (dB/km) ->	0.001	0.01	0.06	1.13	7.63	28.78	404.3
Distance (m)	Approximate reduction in SPL						
3	9.5	9.5	9.5	9.5	9.6	9.6	10.8
10	20.0	20.0	20.0	20.0	20.1	20.3	24.0
30	29.5	29.5	29.5	29.6	29.8	30.4	41.7
100	40.0	40.0	40.0	40.1	40.8	42.9	80.4
400	52.0	52.0	52.1	52.5	55.1	63.6	213.8
900	55.6	55.6	55.6	56.6	62.4	81.5	----
1500	57.8	57.8	57.9	59.5	69.2	101.0	----
3000	60.8	60.8	61.0	64.2	83.7	147.1	----
4500	62.6	62.6	62.8	67.6	96.9	192.1	----

Table 2. Approximate reduction in SPL (dB relative to 1 micro-Pascal) for some common frequencies. Above values are based on default settings of a pH of 8, a salinity of 35 ppt (parts per trillion), a water temperature of 5 degree Celsius, and a depth of 50 metres.

Procedures

8. Before any experiment involving an acoustic source, the maximum expected SPL shall be calculated. Each day, the projector details, maximum transmitted SPL, and frequency shall be entered in a log book for further reference.

9. If the expected SPL during a specific evolution is less than 170 dB, no mitigation is required.

10. If the expected SPL during a specific evolution is between 170 dB and 190 dB, the area within a 100 meter radius of the acoustic source location shall be surveyed and clear of marine mammals.

10. Marine Mammal surveys will be done 10 minutes before transmissions start and every hour thereafter, except as covered in paragraph 12

12. When the expected SPL during a specific calibration is greater than 180 dB, the following sequence shall be undertaken:

a) Starting at a level less than 180 dB, transmit for 5 min, followed by a mammal survey of area;

b) Transmit at level between 180 dB and max power for 5 min, followed by another mammal survey of the area; and

c) Transmit at full power for 5 min, followed by a final mammal survey of the area.

13. If the expected SPL during a specific evolution is greater than 190 dB, the entire basin up to Mill cove and to the McKay Bridge shall be surveyed for marine mammals and should mammals be observed in this larger area, no experiment shall be performed until area is clear.

14. Any sightings within the exclusion area shall institute the termination of any kind of transmissions until cleared. Sightings shall be recorded in a log book for future reference

References

[A] HALIFAX CLASS SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEM (SEMS) MANUAL, May 2010

[B] FINAL REPORT Updated Environmental Baseline Study of the DRDC Atlantic Acoustic Calibration Barge, DCC Project # DRDC1516-5, March 29, 2016

[C] Urick, Principles of Underwater Sound, p105

[D] <http://resource.npl.co.uk/acoustics/techguides/seaabsorption/>

[E] Ainslie, M.A., McColm, J.G., A simplified formula for viscous and chemical absorption in sea water. JASA, 103, 3 (1998)

List of symbols/abbreviations/acronyms/initialisms

AUV	autonomous underwater vehicles
DDEED	Due Diligence Environmental Effects Determination
DND	Department of National Defence
DRDC	Defence Research and Development Canada
DUSN	Distributed Underwater Sensor Network
R&D	Research & Development
RHIB	Rigid Hull Inflatable Boat
SL	source level
SOP	standard operating procedures
SPL	sound pressure level
TL	transmission loss
VEC	Valued Ecosystem Components

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As part of the Canadian Arctic Underwater Sentinel Experimentation (CAUSE) Project 99ab and the Force ASW (Anti-submarine Warfare) project 01ca, a series of small sea-trials were conducted in the Bedford Basin (NS), Canada. These trials took place as part of the Distributed Underwater Sensor Network (DUSN) international collaboration between Canada, Norway and Sweden.

A significant component of this trial involved the performance assessment of acoustic recording equipment, which required the use of acoustic projectors emitting underwater sounds. This report evaluates the environmental impact of transmitting such sounds on marine life, and in particular on marine mammals present in the area.

Dans le cadre du projet 99ab de Recherche expérimentale d'une sentinelle sous-marine pour l'Arctique canadien (RESSAC) et du projet 01ca de Guerre anti-sous-marine (GASM) de la force, une série de petits essais en mer ont été effectués dans le bassin de Bedford (N.-É., Canada). Ces essais ont eu lieu dans le cadre de la collaboration internationale entre le Canada, la Norvège et la Suède pour le Réseau distribué de capteurs sous-marins (RDCS).

L'évaluation du rendement d'appareils d'enregistrement acoustique à l'aide de projecteurs acoustiques émettant des sons sous-marins a constitué une portion importante de ces essais. Le présent rapport évalue les incidences environnementales de l'émission de ces sons sur la vie marine, en particulier sur les mammifères marins dans la région.