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Title - Sujet
MULTISTATIC ACTIVE SONAR EMPLOYMENT

Solicitation No. - N° de l'invitation	Date
W7707-135646/A	2012-11-27
Client Reference No. - N° de référence du client	**GETS Ref. No. - N° de réf. de SEAG**
W7707-13-5646	PW-$HAL-210-8840
File No. - N° de dossier	**CCC No./N° CCC - FMS No./N° VME**
HAL-2-69288 (210)	

Solicitation Closes - L'invitation prend fin
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THIS DOCUMENT IS ISSUED TO ATTACH ANNEX A, B, C, D, E, F AND G

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

REQUEST FOR INFORMATION

Introduction

A Request for Information (RFI) is not a bidding opportunity but a document requesting information from the Supplier community based on a potential requirement. In this case, industry feedback is sought from Suppliers on their ability to satisfy potential requirements for the proposed procurement strategies described herein before the issuance of a solicitation document.

This RFI is issued by Defence R&D Canada - Atlantic, herein referred to as "DRDC", to gather information related to the procurement strategy for the Advancing Multistatic Active Sonar Employment (AMASE) Technology Demonstration Project (TDP), herein referred to as the "project". DRDC has a requirement to obtain research, design, development, software implementation, systems integration and testing services for the project, herein referred to as the "requirement". The approximate value of the requirement will be in the range of $2M to $3.25M depending upon which procurement strategy is ultimately employed. The intended meaning of the terms "Supplier", "Contractor", "Industry" and "Industrial Partner" are interchangeable for the purposes of this RFI.

Suppliers may also provide ideas and suggestions on how the eventual solicitation might be structured. While not a bid document, it is an opportunity to help shape the resulting requirements and provide Supplier input and advice to the Crown. No contract will be awarded as a result of a RFI. This RFI, or any supporting information provided with this RFI, shall not constitute an authorization by the Crown to undertake any work that would result in any obligation or costs to the Crown.

Participation in this RFI is not a pre-qualification for procurement, nor a prerequisite to participation in any subsequent request for proposals (RFP) from DRDC.

Intent

The RFI will assist DRDC in its understanding of the viability of the proposed procurement strategies for the requirement with the overall aim to mitigate procurement risk associated with the competitive tendering process. The RFI may assist DRDC to:

- Determine whether to proceed with requirements/strategy as planned, and if so, further developing internal planning, approval and solicitation documents that may potentially lead to a solicitation;
- Refine the procurement strategy, project structure, cost estimate, timelines, requirements definition, and other aspects of the requirement;
- Become a more "informed buyer" with an enhanced understanding of industry offerings in the areas of interest, and;
- Assess potential alternative solutions that would meet the requirement.

The RFI will allow Suppliers to:

- Assess and comment on the adequacy and clarity of the requirements as currently expressed;
- Offer suggestions regarding potential alternative solutions that would meet the requirement;
- Comment on the procurement strategy, preliminary basis of payment elements, and timelines for the project.

How supporting information for this RFI is organized

Annex A: Project overview

Annex B: Multistatic sensor use cases and initial concept

Annex C: Trials campaign and assets

Annex D: Proposed system engineering process

Annex E: Proposed procurement strategies and draft solicitation information for the requirement

Annex F: Potential for in-kind contributions

Annex G: Glossary and acronyms

Request for Information

Participation in this RFI is entirely optional and is not a pre-qualification for procurement, nor a prerequisite to participation in any subsequent request for proposals (RFP) from DRDC.

If Suppliers would like to provide feedback based on the information expressed in this RFI, the following questions are provided as guidelines.

The project

1. Please comment on the adequacy and clarity of the background and description of the project as currently expressed. What other type of information would be required to provide an adequate background and description for future solicitation documents?

The procurement strategies for the potential requirement

2. Please comment on the adequacy, clarity and feasibility of the procurement strategies as currently expressed.

Suggestions for alternatives

3. Offer suggestions regarding potential alternative solutions or strategies that could be achieved within the preliminary basis of payment elements, funding and timeline envelopes.

4. Are there commercial off-the shelf (COTS) solutions available that may be tailored to meet the requirement presently expressed?

5. Does the cost of integrating an existing supplier solution potentially offset the cost of extending the DRDC System Test-bed (STB) for certain functionality?

In-kind contributions:

6. Are there industrial in-kind contributions that could be offered to share the costs associated with performing the project? This includes non-monetary contributions of goods or services such as equipment, staff-time and facilities that may be either donated or evaluated as point rated criteria in future bid solicitation and evaluation.

Other questions:

7. Please provide other questions and comments to DRDC based on this RFI.

Available documentation:

[1] DRDC Atlantic System Test Bed (STB) Overview, DRDC Atlantic CR 2007-271, October 2007

[2] Description of the Sonar Test Bed Data Architecture, DRDC Atlantic CR 2003-042, June 2003

[3] Non-exclusive System Test Bed License Agreement Template.

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ANNEX A: PROJECT OVERVIEW

Background:

1. Current Canadian Forces (CF) naval and air undersea warfare platforms employ anti-submarine warfare (ASW) sensor systems intended for stand-alone operation against submarines operating in deep water. Largely based on passive-sonar technology, they are not optimized for the noisy, acoustically challenging environment of littoral waters, particularly against quieter submarines (targets).

Passive-sonar:

2. CF platforms can use passive-sonar sensors to listen for the radiated noise or signals transmitted from the submarine (target).

Active-sonar:

3. CF platforms can use active-sonar sensors such as hull-mounted sonars or dipping (tethered) sonars to transmit a signal and listen for a returned echo to the transmitting sensor, a concept known as monostatic active-sonar. This technique does not depend on the submarine (target) making noise but on the submarine's reflectivity in the direction of the transmitter.

Multistatic active-sonar:

4. The advantageous characteristics of active-sonar, its ranging capability and independence of the target's radiated noise, can be combined with stealthier passive-sonar techniques to detect echoes from a transmitted signal. This can be accomplished by using an active-sonar transmitter that works in conjunction with one or multiple spatially separated receiving platforms to detect echoes from the transmitted signal, provided that the receivers are advised of the transmission time and location.

5. Multistatic active-sonar operations conducted by a combination of platforms, including ships and maritime fixed- and rotary-wing aircraft, have a number of potential operational advantages. The first advantage results from the improved detection coverage compared to standalone active- or passive-sonar systems. Secondly, multistatic operations should permit ships to remain well away from the target in order to transmit signals at a distance (as a transmitting platform) or to receive signals undetected (as a receiving platform).

6. There are several scientific challenges that are introduced when considering multistatic active-sonar:

> a. Clutter mitigation: One impediment to the successful use of active sonar is the presence of clutter, a term that refers to target-like echoes from objects such as sea-mounts and ship wrecks. A high-clutter environment can dramatically increase the false-alarm rate and reduce sonar effectiveness. Methods of data classification or association that are being developed may prove useful for mitigating clutter.
>
> b. Waveform design and scheduling: Using a mix of Doppler-sensitive and Doppler-insensitive waveforms is important for maximizing detection opportunities. In a

multistatic scenario, the various processing nodes must have information on the waveform parameters in order to achieve maximum processing gain; in lieu of real-time information exchange, standardized ping types and schedules may be necessary. In multistatic operations where several sources may be operating, the situation is complicated by the need to manage the acoustic spectrum.

c. Target tracking and localization: Owing to the more complicated source/target/receiver geometries that occur in multistatic compared to monostatic operations, the algorithms needed for target tracking and localization must have increased complexity. Multistatic tracking and localization is a current subject of research and development among many nations.

d. Operator workload: Given the large number of receivers that may be deployed in a multistatic sensor field, the operator workload in monitoring the field is substantial. Ways must be sought to condense the acoustic data before presentation without degrading detection performance, and to automate the operator's task as much as possible.

e. Synchronization and positioning: To realize the full potential of multistatic operations, processing nodes must be aware of certain system-wide parameters. For example, to perform target localization, the processors should be informed of the geographical positions of the transmitting sources, and of the times at which transmissions occur. Receiver positions must also be known.

f. Systems Science. Multi-platform multistatic active-sonar is a fielding of complex systems.

Project Description:

7. The project will establish a multistatic active-sonar demonstrator through a combination of sensors and test-bed acoustic processors, and demonstrate the integrated capability through a graded series of at-sea trials. The project will exploit previous DRDC technology demonstrators such as the Towed Integrated Active and Passive Sonar System (TIAPS) TDP, the Networked Underwater Warfare (NUW) TDP and the Multi-Sensor Torpedo Detection, Classification and Localization (MSTDCL) TDP where applicable, or will seek alternative solutions. The DRDC System Test Bed (STB) was used as the basis to demonstrate improved dry-end processing and displays in TIAPS, inter-platform communications for passing sonar information in NUW and the integration of sensors and systems on the Halifax-Class frigate in MSTDCL. The concepts developed in these TDP's may be exploited to reduce the technical risk associated with this project's anticipated research, design, development, software implementation, systems integration and testing activities. The System Test Bed (STB) currently forms the basis of the Maritime Acoustic Processing System (MAPS) test bed for shipboard platforms and the Integrated Multistatic Passive / Active Concept Testbed (IMPACT) for airborne platforms, which are available to form the basis of the AMASE demonstrator.

8. The project will conduct a multistatic system performance modelling study (currently in process) to identify the most promising transmitter / receiver pairings under consideration. A spiral development and trials program will then be established to develop the associated multistatic capability through a combination of sensors and test-bed acoustic processor during

project implementation. The implementation phase will culminate in the demonstration of a practical multistatic network in a Canadian ASW task group context.

9. The project will have an operational focus through the application of multistatic sonar techniques and concepts of operations to typical CF ASW equipment and missions. In particular, it will develop methods to enable the CF to exploit the capabilities being delivered with the HALIFAX-class sonar suite upgrade, the introduction of the CH-148 Maritime Helicopter and the post-AIMP Block III CP-140 aircraft by developing the tactics that will apply to this combination of sensor suites in a multistatic sonar context.

Project Objectives:

10. The primary objective of this project is to develop and demonstrate new concepts which will increase the effectiveness of ASW operations through the exploitation of multistatic active-sonar techniques to detect and localize submarines in open-ocean and littoral waters. The final result is a body of knowledge tailored towards *current* and *projected* naval and maritime air sensors and systems that can be exploited by the CF to:

a) develop concepts for the employment of multistatic active-sonar systems for maritime air and surface platforms;
b) develop multistatic active-sonar training, tactics and procedures for naval and maritime air sonar operators;
c) develop the requirement specifications to implement *technology refresh* and *technology insertion* initiatives for multistatic active-sonar capability for *current* CF platforms; and
d) develop the requirement specifications to implement *major capital procurement* initiatives for multistatic active-sonar capability for *projected* (i.e. future) CF platforms.

11. The general objectives of this project are to:

a) Develop a capability for predicting the performance of multistatic operations via sonar-system modelling to determine the performance of different types of multistatic transmitter / receiver configurations and to determine the baseline values for Measures of Effectiveness (MOE) and Measures of Performance (MOP). This activity is the subject of current work conducted by DRDC and will result in defining the high-level system concept upon which the demonstrator will be based.

b) Develop/adapt/integrate the required hardware and software for the multistatic demonstration / trials program. Foremost among these will be multistatic processing system demonstrators for both shipboard and airborne installation. This work element will interact with other work elements, such as algorithm and display development. Hardware development will also encompass certain experimental systems, such as off-board free-floating source and receiver buoys (necessary for data collection), an echo repeater to act as a surrogate for a target, modified sonobuoys to work at specific frequencies, and other equipment as required. A number of laboratory in-house engineering and integration tests will be required to test and evaluate sub-system performance.

c) Conduct field trials of the following kinds:

- Engineering and system integration tests to verify that equipment works as intended while deployed at sea. The sea trials and exercises could require the use of towed arrays, sonobuoys, deployed receivers, deployed and towed sources, and environmental data acquisition systems aboard ships and aircraft.
- Experimental trials using research platforms to determine the factors that influence the performance of multistatic active sonar. Included here are trials meant to exercise different waveform types (Doppler sensitive and insensitive, continuous active), and to examine the effect of the ocean medium on multistatic sonar performance (temporal and spatial coherence, reverberation). The controlled nature of these trials will also allow the collection of ground-truth data that can be used in verifying the performance of tracking algorithms. Experimental trials may overlap and be conducted in parallel with other trials.
- Demonstration trials with a mix of CF and research platforms to verify the performance of selected multistatic sensor pairings and geometries, and to evaluate concepts of operations. The performance will be quantified through post-trial analysis and will be influenced by factors such as deployment pattern, waveform frequency and type and the extent of inter-platform communications, etc. The precise plan for such trials will depend in part on the availability of CF equipment during the lifetime of the project. A final demonstration is envisioned to fully exercise the AMASE system in an operationally relevant context.

d) Develop and evaluate improved algorithms for the processing and display of multistatic sonar data, including detection, classification, localization, and tracking. Multistatic active sonar is not a mature technology, and there is much scope for innovation in how the raw sensor data are processed and presented to the operator(s). To the extent possible, these algorithms will be inserted into the real-time test-bed processors.

e) Configure a radio-frequency (RF) communications network, or acceptable alternative, for the real-time transmission of high-level data between platforms, such as sensor positions, waveform type and schedule, etc.

f) Perform the necessary engineering changes (EC), air-worthiness certifications and network security certifications that will be requirements for demonstration trials involving in-service platforms.

g) Investigate existing mission planning and tactical development aids (TDA) for multistatic operational concept and tactical development.

h) Examine solutions to multistatic operational employment issues, including operator workload and platform coordination and interoperability.

12. A preliminary estimate of ‘high level’ work share is provided in the table below, noting that this will vary based on the procurement strategy that is ultimately employed for the requirement during implementation activities.

General Objectives (from para 11a - h)	DRDC	Main Contract Requirement *(subject of this RFI)*	Other Support*
a) in progress	S		P
b)	S	P	S
c)	P	S	S
d)	P	S	
e)	P	S	
f)	P	S	S
g)	P	S	S
h)	P	S	S

P = primary role, S = supporting role
*It is anticipated that there may be specialized and/or supporting requirements that are contracted outside of the main requirement.

Performance Objectives:

13. The principle Measures of Effectiveness (MOE) developed for this project are:

a) Increased detection and tracking performance as evidenced by the following Measures of Performance (MOP):
   i. Multistatic time in contact vs. monostatic time in contact;
   ii. Increased area coverage as inferred from experimentally demonstrated detections;
   iii. Increased ability to initiate and hold target track.

b) Decreased probability of counter-detection of an in-contact surface asset as evidenced by:
   i. The contact plot of ASW assets;
   ii. The contact plot of red force targets during trials and TGEXs.

c) The integrated operation of current and projected Canadian assets in a practical multistatic network as indicated by:
   i. The development and demonstration of multistatic tactics in a Canadian and Coalition environment;
   ii. Demonstrated hardware and software integration of multistatic capability into a tactical environment.

Excluded Work:

14. The project will not conduct the following work:

a) The installation and operation of multistatic sources and receivers on unmanned underwater vehicles (UUVs). The Centre for Maritime Research and Experimentation

(CMRE) has undertaken an extensive program of work in this area, and AMASE may collaborate with CMRE in field trials but will not duplicate their research effort.

b) The siting of long-life multistatic sources and receivers on the ocean bottom as may be used in harbour-protection or choke-point applications. This is the subject of separate work at DRDC.
c) Development of new communications methods at the lower layers in the network hierarchy, such as the physical and link layers. A communications infrastructure is required, so that any development work will be done at the applications layer. It is not intended to transmit low-level acoustic data from platform-to-platform.
d) Development of a new acoustic propagation model suitable for carrying out mission planning for multistatic operations; only existing models or new models provided through related projects will be integrated into a multistatic-sonar prediction application.
e) Multistatic torpedo detection, which would require sensors different from those intended for submarine detection.
f) Under-ice field trials.

ANNEX B: MULTISTATIC SENSOR USE CASES AND INITIAL CONCEPT

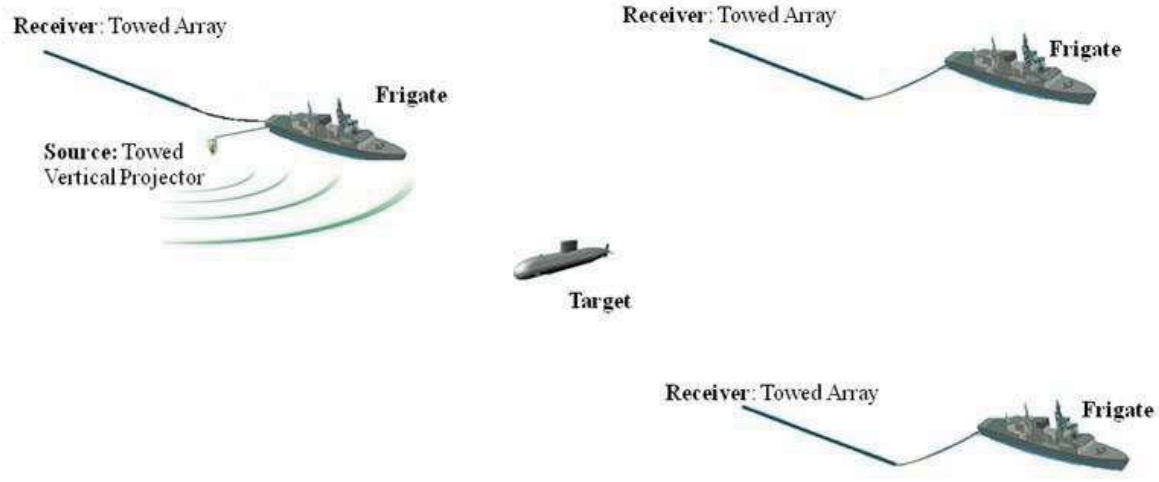
Current Work

Multistatic sensor use-cases are being examined during preliminary acoustic performance modelling by DRDC. To be explored in this investigation are the effects on system-level performance of using different pairings of transmitters / receivers, different ocean environments, and different assessment criteria. Monostatic scenarios are related to multistatic scenarios. The results will be used to:

- Select the sensor use-cases that the project demonstration and series of trials will be based upon. The final system concept may employ elements of various use cases and will be balanced against operational considerations;
- Determine baseline values for Measures of Effectiveness (MOE) and Measures of Performance (MOP).

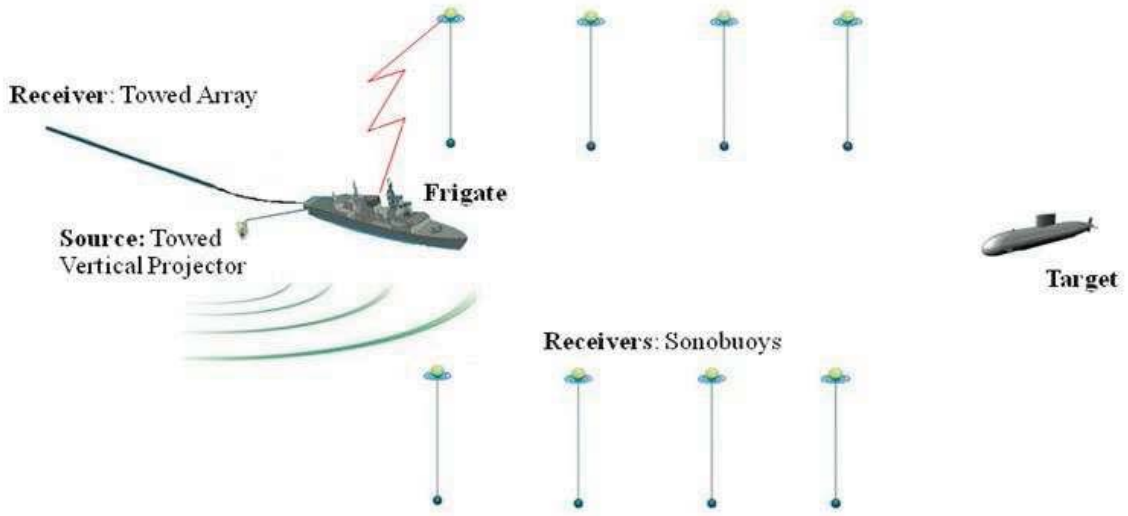
Sensor Use Case 1

A frigate in an (almost) monostatic configuration with a towed array receiver and a towed vertical projector. Then a multistatic configuration obtained by the presence of other frigates with towed array receivers.

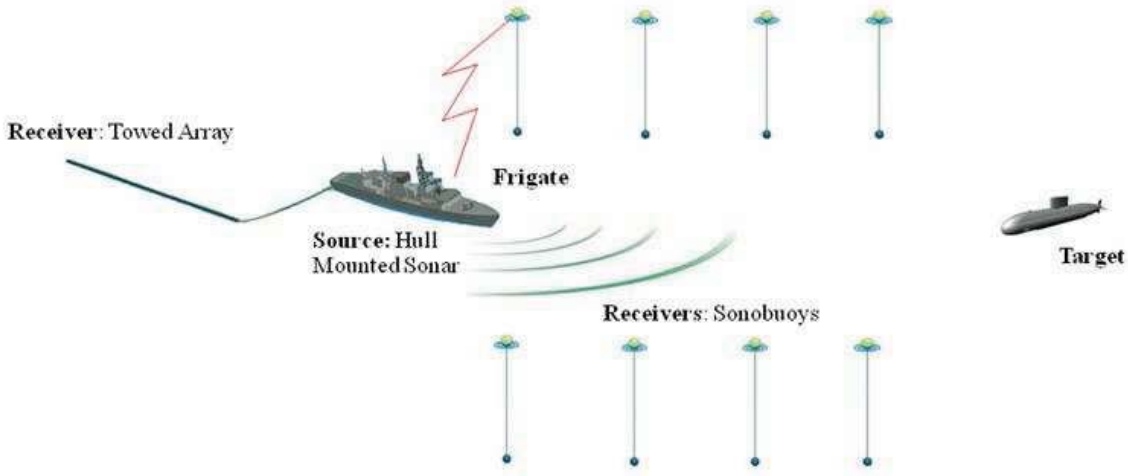


Sensor Use Case 2

(a) A frigate in an (almost) monostatic configuration with a towed array receiver and a towed vertical projector. Then a multistatic configuration obtained by the deployment of sonobuoys, such as four buoys on each side of the ship (for a total of 8 buoys) with the constraint that the buoys must remain in radio-reception range of the frigate.

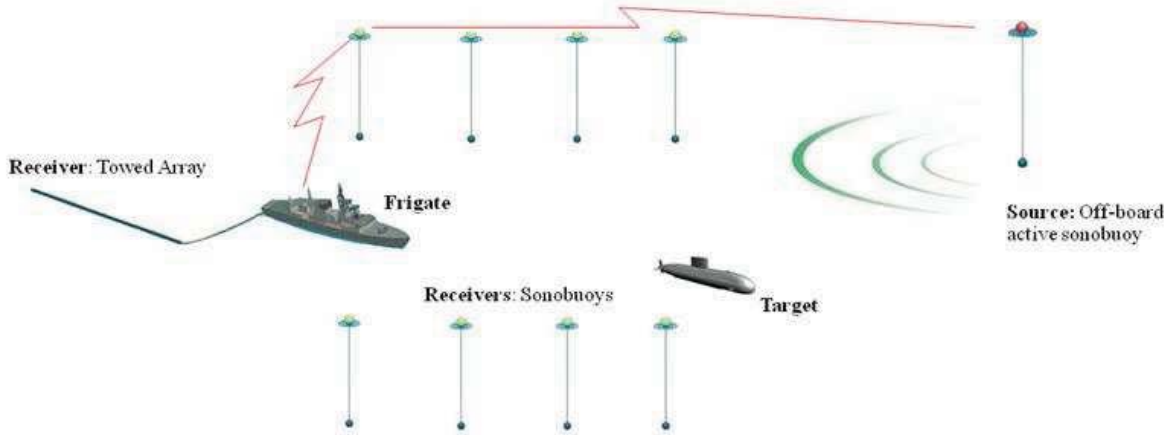


(b) Same as 2(a) except that the frigate's hull-mounted sonar (HMS) is used instead of a towed vertical projector. Cases will be considered in which the transmit frequency does and does not overlap with the frequency band received by the towed array.

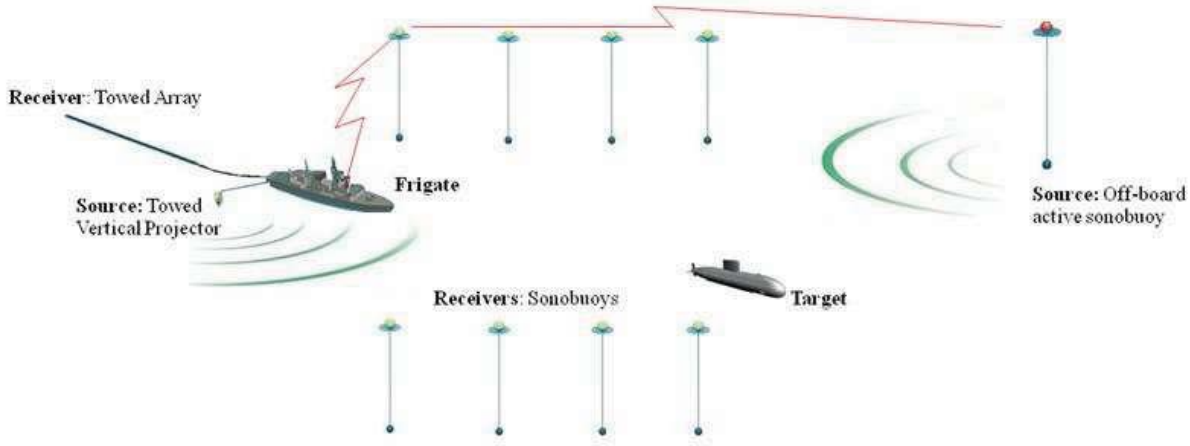


Sensor Use Case 3

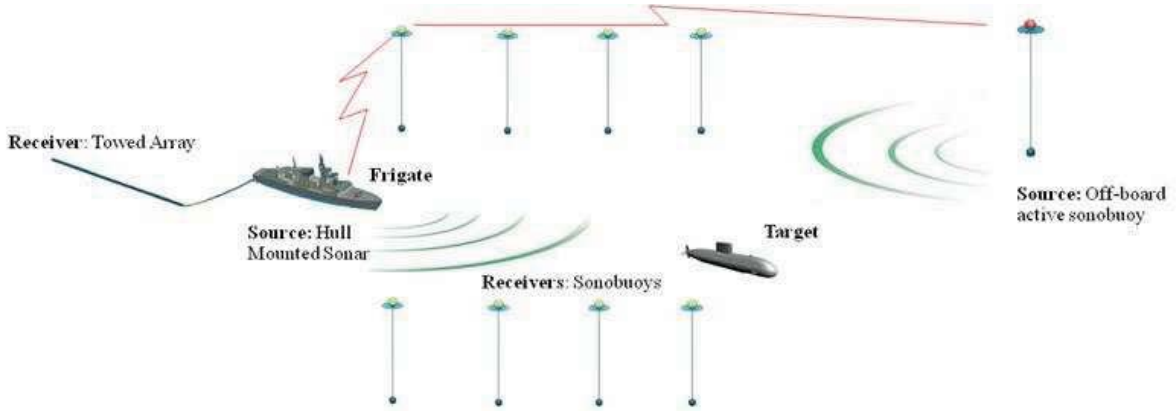
(a) A frigate with a towed array receiver. Then a multistatic configuration obtained by an off-board active sonobuoy and the deployment of sonobuoys, say four buoys on each side of the ship (for a total of 8 buoys). The range of the sonobuoys from the ship will be adjusted manually to ascertain the best range, with the constraint that the buoys must remain within the radio-reception range of the frigate.



(b) Same as 3(a) except multiple sources may be deployed such as a towed vertical projector from a frigate.

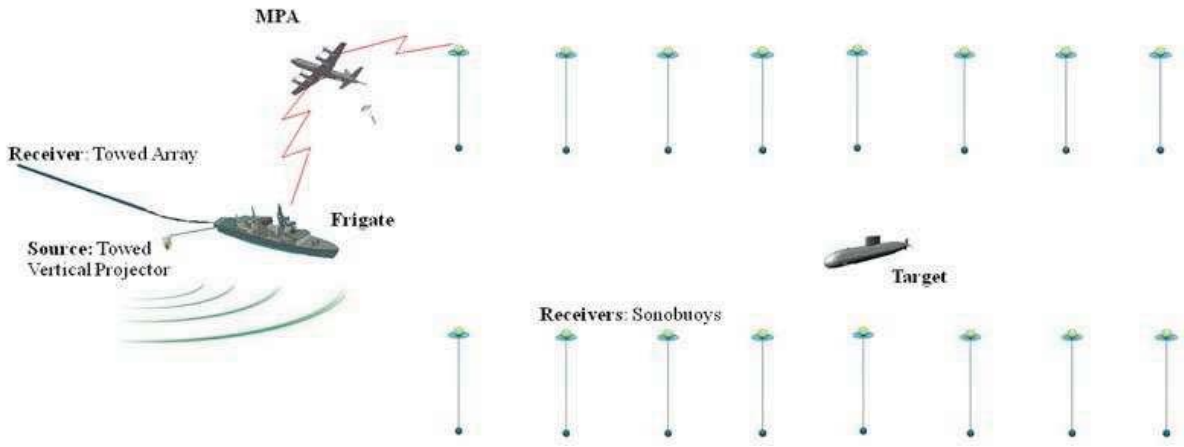


(c) Same as 3(a) except multiple sources may also be deployed such as the frigate's HMS.



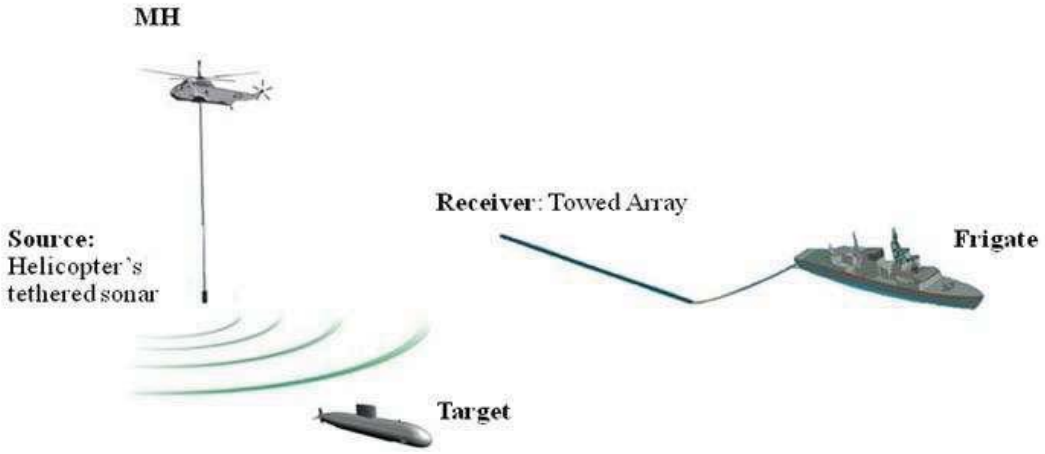
Sensor Use Case 4

The same as Sensor Use Case 2, but without the constraint that the sonobuoy receivers must remain within RF range of the frigate (it is assumed that they are being monitored by a maritime patrol aircraft (MPA)). That is, a wider field pattern may be deployed, and the number of sonobuoys may be increased up to sixteen.

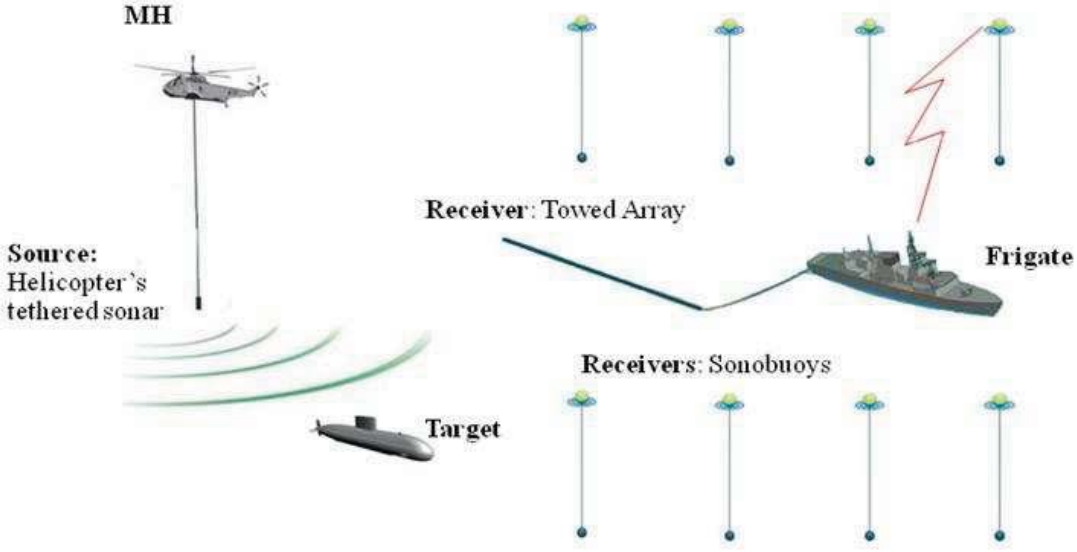


Sensor Use Case 5

(a) A Maritime helicopter's (MH) tethered sonar operating monostatically, while also being processed multistatically by a frigate's towed array.

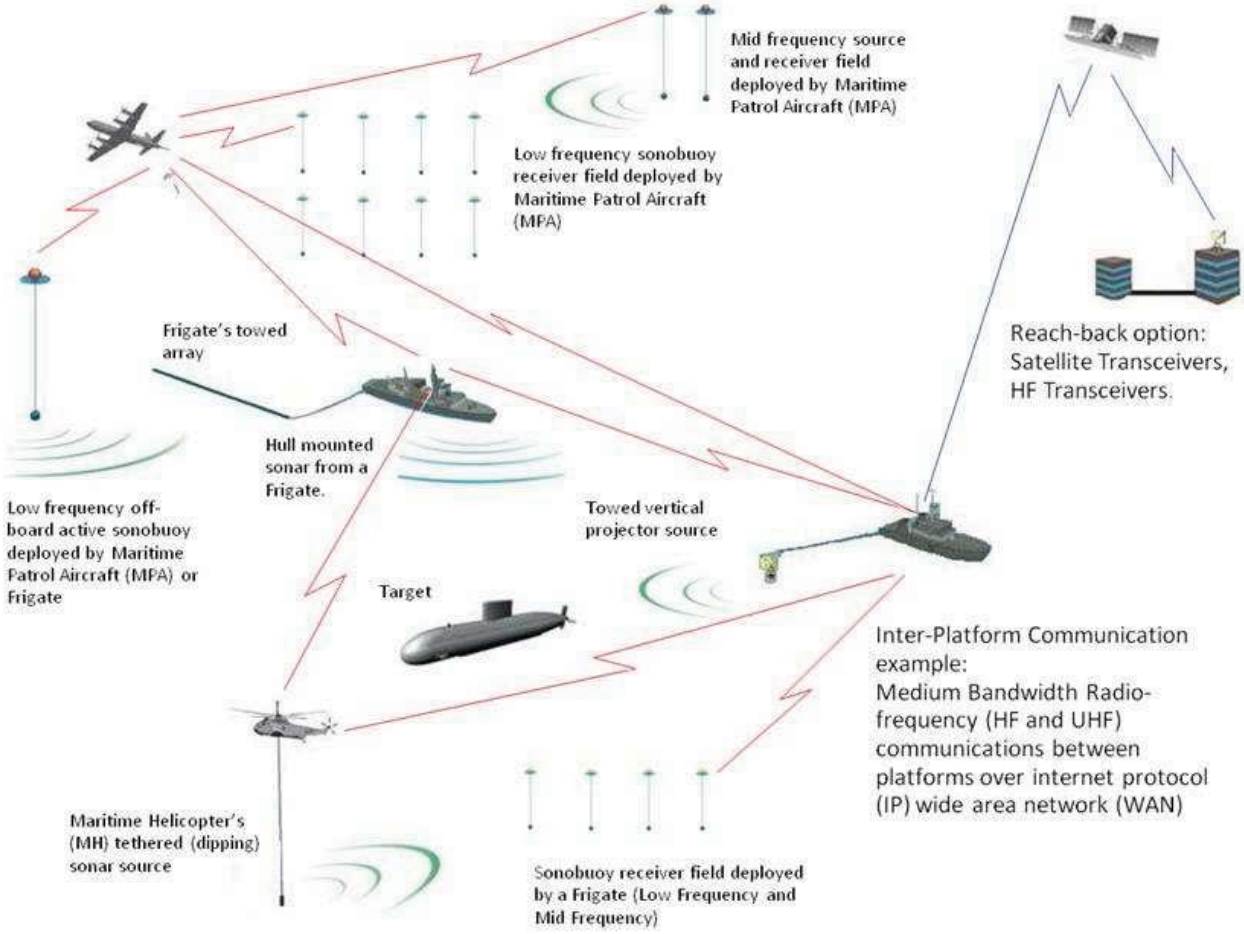


(b) Same as Sensor Use Case 5a and by a field of sonobuoys placed within radio-reception range of the frigate.



INITIAL CONCEPT OF AMASE TECHNOLOGY DEMONSTRATOR

The results of the multistatic sensor use-case modelling will be used to scope the overall development and trials program. The eventual demonstrator may be similar to and employ elements indicated in the concept diagram shown below:



System Concept Comments

In the concept diagram, there are platforms and sensors indicated that may not be selected as part of the demonstrated capability due to the refinement and scoping of experiments required to deliver the project within the resource constraints. From this concept, a sub-set of platforms, systems and sensors may be selected and which will form the basis of the AMASE incremental development and trials program.

System Network

A peer to peer network solution is preferred for communications between platforms instead of a centralized processing and data distribution or management node. This is intended to overcome the reliance on communications and specific network nodes supporting network services which may be inaccessible yet necessary to operate.

Use of surrogate systems for trials

The intent is to demonstrate the multistatic capability on in-service platforms as much as possible during CF Task group exercises of opportunity over the implementation phase of the project. However, suitable surrogate platforms/systems must be identified should ideal platforms/systems not be available during trials or integrating into in-service systems is not feasible. DRDC has scheduled access to CFAV QUEST.

Ideal Platform	Required Organic Capability	Added Capability for Demonstration	Surrogate / Back-up
Halifax-Class Frigate (FFH)	• CCS and ASW combat systems	• MAPS demonstrator for FFH • IP WAN communications network • High Dynamic Range Towed Array	• QUEST/ KINGSTON-Class with MAPS demonstrator for FFH and towed array
*CH-148 Cyclone (MH)	• Sonobuoy processor (CVAR) • Dipping sonar	• MAPS demonstrator for MH • IP WAN communications network	• KINGSTON-Class with DRDC towed vertical projector and MAPS demonstrator for MH • RHIB/Range boat with DRDC deployable source • MAPS demonstrator for MH on FFH or QUEST
Block III CP-140 Aurora (MPA)	• Sonobuoy processor (MVASP) • Low Frequency Active (LFA) sonobuoys • In service sonobuoys	• IMPACT/MAPS demonstrator for MPA • IP WAN communications network	• Leased aircraft with IMPACT/MAPS demonstrator for MPA and LFA sonobuoys • CFAV QUEST with extended communications and IMPACT/MAPS demonstrator for MPA and LFA sonobuoys
*VICTORIA Class (SSK)	• TBD	• Communications link (TBD)	• DRDC Towed Echo Repeater • CF EMATT system • Leased or Allied Submarine platform

Ideal Platform	Required Organic Capability	Added Capability for Demonstration	Surrogate / Back-up
KINGSTON-Class (MCDV)	• TBD	• Towed Vertical Projector and sources • MAPS demonstrator for FFH and MH • IP WAN communications network	
CFAV QUEST	• Towed Sources • Acoustic processing systems • IP WAN communications network • MAPS demonstrator for FFH, MPA, MH	• High Dynamic Range Towed Array	
IP = Internet protocol. For acronyms, refer to Annex G: Glossary and Acronyms *Integration into in-service (ideal) platform highly unlikely			

ANNEX C: TRIALS CAMPAIGN AND ASSETS

1. This project will develop and demonstrate the technology and concepts through a spiral development and trials campaign of maturing complexity. This will begin with laboratory development and CFAV QUEST trials over 2012-2013, then integrating into CF exercises of opportunity (e.g. TGEX, FLEETEX) over 2013-2016. The breakdown of trials is listed below:
   a. MCDV, QUEST Coordination and Engineering Trial in Oct 2012;
   b. Trial II: QUEST Trial in Jan-Feb 2013;
   c. Trial III: TGEX Trial in fall-winter 2013 which adds the CPF platform and CONVAIR;
   d. Trial III: TGEX Trial in fall-winter 2014 which adds HELO and SSK platforms; and
   e. Trial IV: AMASE TDP Final Demonstration in fall 2015 or 2016 with all above mentioned platforms.

2. Demonstrations will be phased to progress from concept development/issue exploration trials in the relatively controlled context of experiments aboard CFAV QUEST, to deployments in operational platforms, through to demonstrations associated with regularly scheduled exercises of opportunity occurring over the life of the TDP. An example of an exercise of opportunity is a Maritime Task Group Exercise (TGEX). TGEXs are conducted off both coasts as part of the Royal Canadian Navy's training, qualification and tactical development process.

3. Requests for the use of naval assets using a developmental evaluation (DEVAL) have been initiated through the Maritime Evaluation (ME) process. The ME will cue the temporary Engineering Change (TEMP EC) process required to manage the installation of demonstration equipment on naval platforms.

4. To request the use of maritime air assets the Total Air Resource Management (TARM) and Request for Effects (RFE) processes will be used. The RFE will cue the technical airworthiness certification process required to manage the installation of demonstration equipment on maritime air platforms. The rigor applied to the airworthiness certification process for the Block III CP-140 Aurora and CH-148 Cyclone is exacerbated as these platforms are considered test aircraft while undergoing modernization and/or acceptance testing. This may initially preclude the installation of demonstration equipment onto these platforms as the safety risks may be unacceptable, but these risks are anticipated to decrease over the life of the TDP.

5. Engaging in these planning processes will facilitate the direct involvement of CF personnel in the planning of the demonstrations, the installation of systems aboard platforms, and the operation of the equipment while keeping costs under control. Operational scheduling procedures will help to mitigate the risk associated with availability of CF platforms over the time period covered by the project, in that demonstrations will be planned as part of the normal exercise cycle. As the assignment authority for MEs and RFEs, the sponsoring directorates will have the responsibility of assessing the quality of the plans before committing CF resources to the demonstrations.

6. In addition, Canadian Forces Maritime Warfare Centre (CFMWC) staff has already been involved in developing appropriate operational scenarios to ensure relevant and meaningful demonstrations in the context of expected CF operations; and they will remain engaged throughout the duration of the project.

7. Due to the constraints imposed by the planning and certification processes and the risks associated with platform availability during the TDP, it is essential that the TDP develops an experimental program robust enough to mitigate the impact of these risk factors so that fundamental TDP objectives are met. For each platform and system that is identified as a high-risk element in terms of availability, a suitable surrogate will be identified and, if needed, employed for purposes of demonstration.

Trial Assets

8. Trial assets such as platforms, systems and equipment will consist of both those controlled by DRDC and those controlled by DND/CF (in-service). Also considered are external services that DRDC may seek such as leasable aircraft through interdepartmental agreements. During this project, other emerging operational or experimental sonar equipment may become available for use in development and trials. The following sections seek to inform on what is currently available as potential government furnished equipment (GFE) and assets intended to support the AMASE demonstration program.

CF Operational Equipment (in-service)

9. These are assets which may be obtained by DRDC through DND/CF sponsors. DRDC provides input to DND/CF operational planners through official requests, accompanied by detailed trial plans and DND/CF will attempt to integrate it into their operations schedule. The project will require a degree of flexibility to implement developmental activities around exercises of opportunity.

10. Canadian multi-role Frigate (CPF). It is anticipated to involve the CPF in AMASE demonstrations with installation of AMASE demonstrator systems. Organic systems of interest include:

a. The AN/SQS-510 hull mounted sonar.
b. The CANTASS AN/SQR-19 passive towed array. The AN/SQR-19 has also been deployed from CFAV QUEST.
c. Interfaces, processing, and display for the AN/SQS-510 hull-mounted sonar, the AN/SQR-19 towed array, a trial-fitted AN/ARR-502B sonobuoy receiver, and the ship-board Command and Control System (CCS) bus.
d. Communications links
e. Sonobuoys (see MPA for description)

11. Maritime Coastal Defence Vessel (MCDV). It is anticipated to involve the MCDV platform in AMASE demonstrations, with installation of AMASE equipment, such a towed vertical projector source and a communications link.

12. Maritime Helicopter (MH). The CH-148 Maritime Helicopter is not anticipated to be available until the later stages of the project and it is not expected that any developmental work relating to the integration of demonstrator systems into the MH is likely to occur. The project will seek to include the MH during demonstrations in order to support the development of concepts of employment for the helo and dipping sonar in multistatic operations.

13. Maritime Patrol Aircraft (MPA). The CP-140 AIMP Block III Aurora is not anticipated to be available upon onset of the trials program, but will be requested for participation in demonstrations occurring in the latter half of the project. Organic (and developmental) systems include:

a. MVASP sonar processing system.
b. The developmental AN/SSQ-565 A-size Coherent Active Source Sonobuoy (A-CASS) is an active sonobuoy that can transmit low frequency waveforms. These buoys are manually commanded to ping, either through MVASP or STB system.
c. The in-service AN/SSQ-62 Directional Command Activated Source Sonobuoy (DICASS), is an active sonobuoy that can transmit waveforms in the mid frequency bands and is commanded through MVASP.
d. The in-service AN/SSQ-53 and the developmental AN/SSQ-573 Directional Frequency Analysis and Recording (DIFAR) are sensors used for the passive detection of underwater sounds and transmit these sounds over a radio link back to an aircraft or ship.

14. Victoria Class Submarine (VCS). It is not anticipated that AMASE will be able to exploit organic systems or integrate demonstrator systems into the VCS platform; however, the VCS will be requested for participation and is essential for the final demonstration.

15. Training Targets. The MK-39 Expendable Mobile Anti-Submarine Warfare Training Target (EMATT) is a small torpedo-like submersible that can be programmed to travel along a given underwater trajectory.

DRDC Equipment

16. The next section covers assets which are managed and controlled by DRDC.

17. Research Ship. CFAV QUEST is based in Halifax, Nova Scotia and is an oceanographic and acoustic research vessel used by DRDC and the Royal Canadian Navy. Although CFAV is owned and operated by the Royal Canadian Navy, DRDC Atlantic controls the sailing schedule and the daily schedule while at sea.

18. Research Sensors. These DRDC sensors which are available to support AMASE are sub-grouped into sources, receivers and targets as follows:

Sources:

a. Towed LF source. The Vertical Projector 2 (VP2) is a towed body consisting of an open frame with two free-flooding ring projectors and a projector remote online monitoring system (PROMS) containing depth, pitch, roll, temperature and 3-axis acceleration sensors. The VP2 is a high power source operating in the 1-2 kHz frequency band. The VP2 is towed from the ship stern via a cable supported by the quarterdeck A-frame and deployed from a winch on the flight deck. The controls and amplifiers for the VP2 are contained in an ISO container that is attached to the ships deck.
b. Towed LF/MF source. The VFIN is a towed body housing an acoustic source, free flooding ring transducer and a pressure sensor. The VFIN is capable of

transmitting a medium source level in the frequency band of 1 to 4 kHz. The VFIN is towed from the ship stern via a cable supported by the quarterdeck A-frame and deployed from a winch on the flight deck.

c. Off-board LF source. The dynamic active retrievable buoy (DARB) is a retrievable free-floating buoy that can transmit narrowband signals, broadband noise, and shaped FM or CW pulses in the 1-2 kHz frequency band through a double barrel-stave projector suspended beneath the buoy.

Receivers:

d. Towed Array. The Directional Acoustic Sensor Module (DASM) is a high-dynamic range directional active receive sonar array that was developed during the TIAPS (Towed Integrated Active-Passive Sonar) Technology Demonstration project. The receiver consists of a horizontal line array of 96 Combined Omni-directional and Resolved Dipole Sensors (CORDS). Each CORDS has two co-located sensors, an omni-directional hydrophone group and a dipole accelerometer hydrophone, with a roll resolve sensor. Troubleshooting and refurbishment of the DASM array is the subject of current work at DRDC.

e. Off-board passive receiver. The passive DARB buoy provides a means for recording both underwater radiated noise and man-made acoustic transmissions. The buoys are self contained systems that digitally record a hydrophone channel on an internal hard-drive. The buoys record their own positions through an on board differential GPS receiver. The passive DARB buoys are deployed directly from QUEST, and allowed to drift freely during daily trials.

Targets:

f. Echo repeater. The Broad-band Underwater System for Towed Echo Repeating (BUSTER) is a small towed system for emulating echoes from submarines. BUSTER consists of power supply, control computer; amplifiers, hand winch, and cable and tow body. BUSTER is towed by a vessel and modifications required to operate the system off-board is the subject of current work at DRDC Atlantic.

19. Sonar Processing Systems. This covers the DRDC acoustic processing test bed systems that are available to develop shipboard and airborne multistatic sonar demonstrators:

a. Airborne. The Integrated Multistatic Passive / Active Concept Testbed (IMPACT) is a real-time sonar processor that is flyable on fixed-wing aircraft and was the basis for the sonobuoy-processor specification for both the MVASP processor for the CP-140 Aurora and the CVAR processor for the CH-148 aircraft. DRDC Atlantic has been improving multistatics software in IMPACT and is currently upgrading (i.e. modernizing) the hardware. Software that exploits the new hardware is being implemented using the System Test Bed (STB).

b. Shipboard. The Maritime Acoustic Processing System (MAPS) is an application of the DRDC system test bed (STB) which may be developed for shipboard multistatic sonar processing.

20. Communications Systems. This covers the equipment and systems required for inter-platform communications. The current baseline is sub-net relay (SNR) which DRDC Atlantic has experience with from work conducted under the NUW TDP which implemented this

technology on surface and air platforms. It is anticipated that the current SNR equipment sets owned by DRDC Atlantic will require refurbishment or potentially a full hardware upgrade.

21. External Platforms and Equipment. DRDC may request the use of an experimental aircraft platform (Convair 580) through an interdepartmental leasing agreement between DND and the National Research Council (NRC) of Canada. This would enable scheduled access to an aircraft in order to progress airborne multistatic processing development and experimentation.

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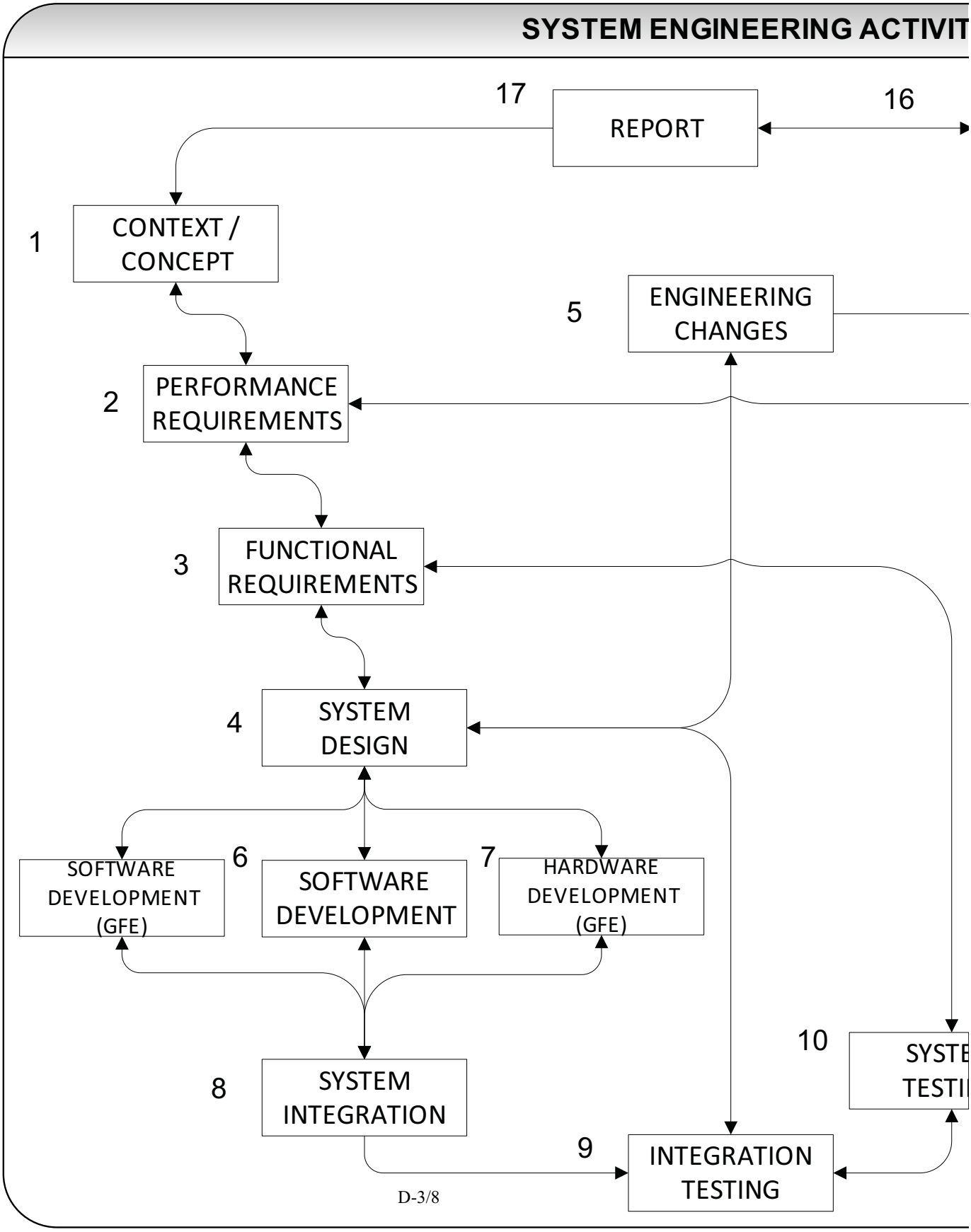
ANNEX D: PROPOSED SYSTEMS ENGINEERING PROCESS

This section provides an overview of the proposed systems engineering activities which is intended to assist in delineating the 'detailed level' of work division between DRDC and the Supplier in the procurement strategies discussed in Annex E.

Figure 1 depicts the process flow diagram of the proposed system engineering activities which will be executed during the project for each phase of development and trials. It is anticipated that at least three phases of development and trials will be conducted, with each phase culminating in an operationally relevant trial/demonstration using this systems engineering approach.

Connected with each activity in the process is an integrated project team (IPT) review and approval stage. The procurement strategy (that is ultimately employed) will establish how the responsibilities in this process are distributed between DRDC and the Supplier, and as such, will define the Contract requirements for outputs, deliverables, reviews, approval criteria, reports and meetings associated with each activity.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PERFORMANCE REQUIREMENTS
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FUNCTIONAL REQUIREMENTS
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SYSTEM DESIGN
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SOFTWARE DEVELOPMENT (GFE)
SOFTWARE DEVELOPMENT
7
HARDWARE DEVELOPMENT (GFE)
10
SYSTE
TESTI
8
SYSTEM INTEGRATION
9
INTEGRATION TESTING

Figure 1. *Proposed system engineering process for the development and trial phases. This is a simplified process diagram and the activities will interact with each other in ways not shown, and will be tailored to the specific needs of a project phase.*

This work grouping includes activities necessary to conduct requirements analysis, system design, system development, configuration control, laboratory testing, at-sea trials, analysis and reporting of the AMASE systems. AMASE development is expected to follow an iterative system integration approach that manages risk by early identification and mitigation of the activities that carry the highest operational or technical risk. Incremental system trials are intended to partition developmental work into distinct phases which allows for full testing and problem resolution before continuing onto the next phase. It is expected that by conducting numerous lab tests and trials during development, the feedback and lessons learned shall lead to a positive evolution of AMASE concepts.

System engineering activities that will be conducted for each phase include:
1. Concept development
2. Performance requirements analysis
3. Functional requirements analysis
4. System analysis and design
5. Engineering changes
6. Software development
7. Hardware development
8. System integration
9. Integration testing
10. System testing
11. Qualification testing
12. System baseline (configuration management)
13. System install
14. Installation testing
15. Trials and demonstrations
16. Data extraction and analysis
17. Reports

1. **Concept Development.** Review the current AMASE concept and investigate, identify and propose amendment as required. Activities in this work grouping include:
    1.1. (If applicable) review previous phase and provide advice on future development
    1.2. produce stakeholder supported sensor use cases
    1.3. produce stakeholder supported system concept
    1.4. review stakeholder supported system concept
    1.5. identification of project constraints (e.g. availability of platforms for trials, GFE/GFI, hardware procurement budget, external support requirements)

2. **Performance Requirements Analysis.** Review the performance requirements and investigate, identify and propose amendment as required. Activities in this work grouping include:

2.1. produce interface requirements
2.2. produce performance requirements
2.3. produce functional constraints
2.4. produce qualification test plan
2.5. review requirements analysis documents

3. **Functional Requirements Analysis.** Review the functional requirements and investigate, identify and propose amendment as required. Activities in this work grouping include:

3.1. produce functional requirements
3.2. produce design constraints
3.3. produce system test plan
3.4. review functional analysis documents

4. **System Analysis and Design.** Review the system design and investigate, identify and propose amendment as required. Activities in this work grouping include:

4.1. produce system design
4.2. produce system implementation plan
4.3. produce integration test plan
4.4. review system analysis documents

5. **Engineering Changes.** The system design will prompt or identify what engineering changes and certifications will be required for each platform in order to develop and implement engineering change packages for the installation of demonstrator systems prior to trials. This is an activity that must start as early as possible and which involves internal DND processes. Work breakdown elements include:

5.1. produce engineering change package (ECP) for sensor and handling systems to be installed on each platform
5.2. produce ECP for network and communication systems to be installed on each platform
5.3. produce ECP for acoustic processing system to be installed on each platform
5.4. implement ECP for sensor and handling systems to be installed on each platform
5.5. implement ECP for network and communication systems to be installed on each platform
5.6. implement ECP for acoustic processing system to be installed on each platform

6. **Software Development.** Development will be in the areas of data distribution, data processing, data management, interfaces, and display/graphic user interface (GUI). If DRDC IP is specified as the basis for the solution, software development activities must also be compliant with the System Test Bed architectural guidelines. The guidelines are documented in: (1) DRDC Atlantic System Test Bed (STB) Overview, DRDC Atlantic CR 2007-271, October 2007; and, (2) Description of the Sonar Test Bed Data Architecture, DRDC Atlantic CR 2003-042, June 2003. The following software development activities to implement software in modular open system architecture include:

6.1. Produce software development plan
6.2. Produce software development procedures (including bug and issue tracking)
6.3. Implement software development tools
6.4. Software development for each platform (e.g. QUEST, HALIFAX class, MCDV, MPA, surrogates)
6.4.1. Data distribution implementation
a) produce data distribution software requirements
b) produce data distribution software test plan
c) implement data distribution software
d) conduct data distribution software testing
e) produce data distribution software test report
f) review data distribution software test report
6.4.2. Data processing implementation
a) produce data processing software requirements
b) produce data processing software test plan
c) implement data processing software
d) conduct data processing software testing
e) produce data processing software test report
f) review data processing software test report
6.4.3. Data management implementation
a) produce data management software requirements
b) produce data management software test plan
c) implement data management software
d) conduct data management software testing
e) produce data management software test report
f) review data management software test report
6.4.4. Data interface implementation
a) produce data interface software requirements
b) produce data interface software test plan
c) implement data interface software
d) conduct data interface software testing
e) produce data interface software test report
f) review data interface software test report
6.4.5. Data display (GUI) implementation
a) produce data display software requirements
b) produce data display software test plan
c) implement data display software
d) conduct data display software testing
e) produce data display software test report
f) review data display software test report

7. **Hardware Development.** Review the hardware systems and investigate, identify and propose amendment as required. Activities in this work grouping include:
7.1. produce hardware development plan
7.2. produce hardware development procedures
7.3. implement hardware development tools

7.4. produce hardware test plan
7.5. implement hardware
7.6. conduct hardware testing
7.7. produce hardware test report
7.8. review hardware test results

8. **System Integration.** Perform the system integration activities of the AMASE system and associated components:
8.1. produce system integration plan
8.2. produce system integration procedures
8.3. implement system

9. **Integration testing.** Deliver the appropriate integration test procedures for the AMASE system architecture in and perform the integration testing for each platform (e.g. QUEST, HALIFAX class, MCDV, MPA, surrogates). Activities in this work grouping include:
9.1. produce integration test procedures
9.2. conduct integration test readiness review
9.3. conduct integration tests
9.4. produce integration test report
9.5. conduct integration test report review

10. **System testing**. Deliver the appropriate system test procedures for the AMASE system architecture in and perform the system testing for each platform (e.g. QUEST, HALIFAX class, MCDV, MPA, surrogates). Activities in this work grouping include:
10.1. produce system test procedures
10.2. conduct system test readiness review
10.3. conduct system tests
10.4. produce system test report
10.5. conduct system test report review

11. **Qualification testing** for each platform (e.g. QUEST, HALIFAX class, MCDV, MPA, surrogates). The system is tested by DRDC personnel and may include a team of CF operators. Testing may be laboratory (bench) or in the field depending on the phase of development. Work breakdown elements include:
11.1. produce qualification test procedures
11.2. conduct qualification test readiness review
11.3. conduct qualification tests
11.4. produce qualification test report
11.5. conduct qualification test report review

12. **System Baseline (**system configuration management). Configuration management / version control and documentation of the system to be trialed. Work breakdown elements include:
12.1. produce configuration management plan
12.2. produce configuration management procedures
12.3. implement configuration management tools

12.4. conduct configuration management

13. **System Install.** Support system installation on each platform prior to trials and demonstration. The system is installed on the intended platform(s) for trial in accordance with the engineering and technical plans/instructions. Work breakdown elements include:

13.1. produce system installation plan
13.2. generate engineering/technical documentation associated with a particular installation
13.3. conduct system installation

14. **Installation Testing**. Support set-to-work system testing prior to trials and demonstration. The system is tested on each platform after installation. This is essentially a repeat of the qualification testing to make sure what has been installed works as intended. Work breakdown elements include:

14.1. Produce installation test procedures
14.2. Conduct installation test readiness review
14.3. Conduct installation test
14.4. Produce installation test report
14.5. Conduct installation test report review

15. **Trials and Demonstration**. For each trial and demonstration work breakdown elements include:

15.1. produce trial requirements
15.2. produce trial plan
15.3. produce trial and data collection procedures
15.4. develop operator training prior to a trial
15.5. develop operator training materials on system operation
15.6. provide onboard systems support (maintenance of equipment)
15.7. conduct record keeping and data collection
15.8. analyze results
15.9. support the production of a trial quick look report (a high-level trial summary geared towards a senior military audience)

16. **Data Extraction and analysis**. Provide support after each trial to conduct analysis of selected data sets, exercise reconstruction and reporting of results. As some of the data sets will include Canadian Eyes Only data there is a corresponding security requirement on members who will be exposed to those data sets. Work breakdown elements include:

16.1. Produce data extraction and analysis procedures
16.2. Conduct data extraction and analysis (extract specific subsets of data from files recorded during a trial).
16.3. transcribing data from other systems and integrating with recorded files for exercise reconstruction and post-analysis
16.4. conduct specific acoustic analyses on data recorded during a trial
16.5. develop and calculate performance metrics and assessing system performance against them
16.6. generating exercise reconstruction reports

16.7. produce analysis reports

17. **Reports**. Documenting the results of trials and demonstrations, test procedures to include data and lessons learned, for inclusion in a DRDC Atlantic produced formal report of the trial. Original data, engineering log books, and trial logbooks will be suitably archived for subsequent research work. Work breakdown elements include:

17.1. Briefing results to Canadian and allied naval clients.

17.2. Analysis of the results and lessons learned from the major demonstration and system integration trials and documentation in the End of Phase and Project Completion reports.

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ANNEX E: PROPOSED PROCUREMENT STRATEGIES AND DRAFT SOLICITATION INFORMATION FOR THE REQUIREMENT

Requirement

The overall requirement will be to provide research, design, development, software implementation, systems integration; testing and trials support services for the (AMASE) Technology Demonstration Project (TDP).

The majority of work will be focused on three (3) phases of incremental development and trials, each phase culminating in an operationally relevant trial / demonstration and a review point to exercise either an option or off-ramp.

DRDC will be seeking an industrial partnership under future competitive procurement to support the development and demonstration of the solution. Three procurement strategies are presented in following sections (A, B and C). The strategies may vary in the division of labour (w.r.t to system engineering process discussed in Annex D), scope, level of risk and funding.

Procurement Strategy A

This approach utilizes an engineering services contract approach for software development, implementation, integration and testing which is conducted under requirements based work packages. The core of the solution will be based on the DRDC-developed System Test Bed (STB) provided to the Contractor as government furnished equipment (GFE). The STB has been designed to provide flexible, portable, reusable, scalable components for a wide variety of sonar applications. In the system engineering activities outlined in Annex D, the proposed division of labour between the Supplier and DRDC is shown in Figure 1. Some activities require joint effort.

DRDC is the technical authority and design authority and is directing use of DRDC intellectual property (IP) as the core of the solution. DRDC is responsible for activities 1, 2, 3, 4, 5, 7, 11, 12 and 13 in Figure 1.

The Supplier is the system developer, integrator and tester, and provides trials / field support. The Contractor is responsible for activities 6, 8, 9 and 10. The Contractor will support activities 14, 15, 16 and 17.

Frequent interaction between DRDC and the Supplier will be required, and as such, will be required to work on site for major portions of the work.

Intellectual Property (Strategy A)

Under this professional services contract approach, DRDC is directing use of Crown owned IP and Canada shall own the intellectual property (IP) rights in all foreground information developed during this contract.

Limitation of Expenditure (Strategy A)

$2,000,000.00 (applicable taxes extra) with preliminary cash phasing by fiscal year as follows:
FY 13/14 $750,000.00
FY 14/15 $850,000.00
FY 15/16 $400,000.00
Follow on option: unfunded

There is some flexibility to how the cash phasing is structured prior to the completion of solicitation documents. The distribution of FY cash phasing will ultimately be based upon actual contract award date.

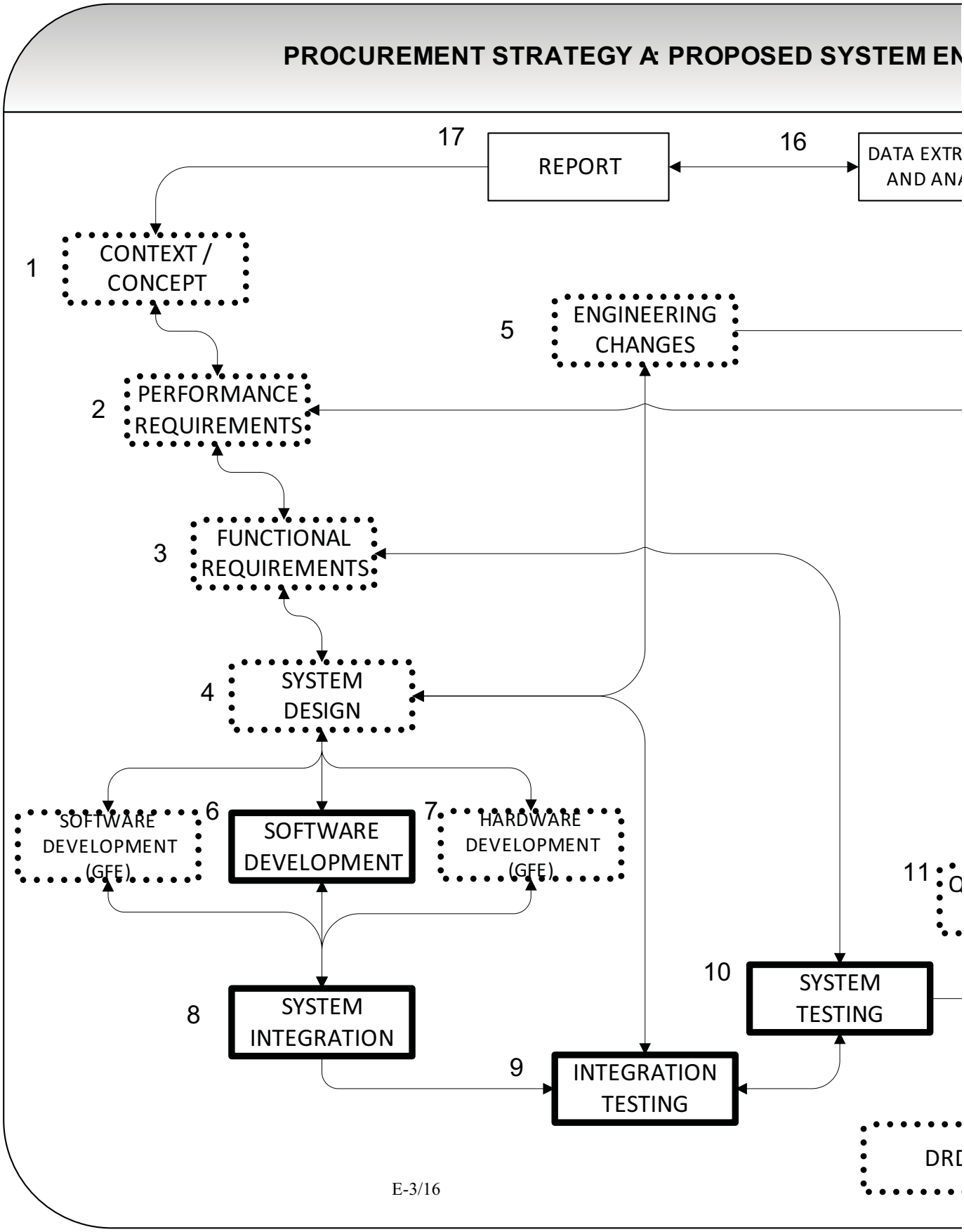
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Figure 1. *Proposed division of labour of system engineering activities for procurement strategy 'A'.*

Procurement Strategy B

This approach utilizes an R&D contract effort to deliver a solution specifying DRDC IP, the STB, as the core of the solution and building upon it to develop a capability. In this case the Supplier would be expected to license the STB from the Crown exclusively for the purposes of the Contract. The general terms and conditions of the license are provided in the DRDC Standard License Agreement for the System Test Bed Software (refer to RFI available documentation [3]). The Supplier may negotiate extending the license agreement period beyond the end date of the Contract. In the system engineering activities outlined in Annex D, the proposed division of labour between the Supplier and DRDC is shown in Figure 2. Some activities require joint effort. The Contractor would be given an initial planning phase.

DRDC is the technical authority and is responsible for activities 1, 2, 7, 11 and 13.

The Supplier is the design authority, system developer, integrator and tester, and provides a trials / field support. The Supplier is responsible for activities 3, 4, 6, 8, 9, 10. The Supplier will support activities 5, 12, 14, 15, 16 and 17.

Intellectual Property (Strategy B)

Since the foreground Intellectual Property (IP) arising from this project will build upon significant background IP instantiated in the DRDC System Test Bed (STB), the Supplier is expected to license the STB from the Crown exclusively for this Contract. Any proprietary background technology that is incorporated into the solution by the Contractor must be "wrapped" in code with a releasable software interface which can be made available to other users of the STB including Crown, allied nations and third-party licenses. Any company proprietary background IP brought to work must be explicitly identified to and approved by the Crown.

Canada owns the intellectual property (IP) rights on the STB version supplied as the core of the solution for the following reasons:

- To avoid fragmented ownership and facilitate systems integration;
- The IP is part of a defence technology which is of strategic importance to DRDC and the Department

No foreign-owned IP that is subject to ITAR or other trade/use restrictions is to be incorporated into the design without the express written consent of the Crown.

Limitation of Expenditure (Strategy B)

The overall limitation of expenditure is:

$2,500,000.00 (applicable taxes extra) with preliminary cash phasing by fiscal year as follows:
FY 13/14 $1,000,000.00
FY 14/15 $1,000,000.00
FY 15/16 $500,000.00
Follow on option: unfunded

There is some flexibility to how the cash phasing is structured prior to the completion of solicitation documents. The distribution of FY cash phasing will ultimately be based upon actual contract award date.

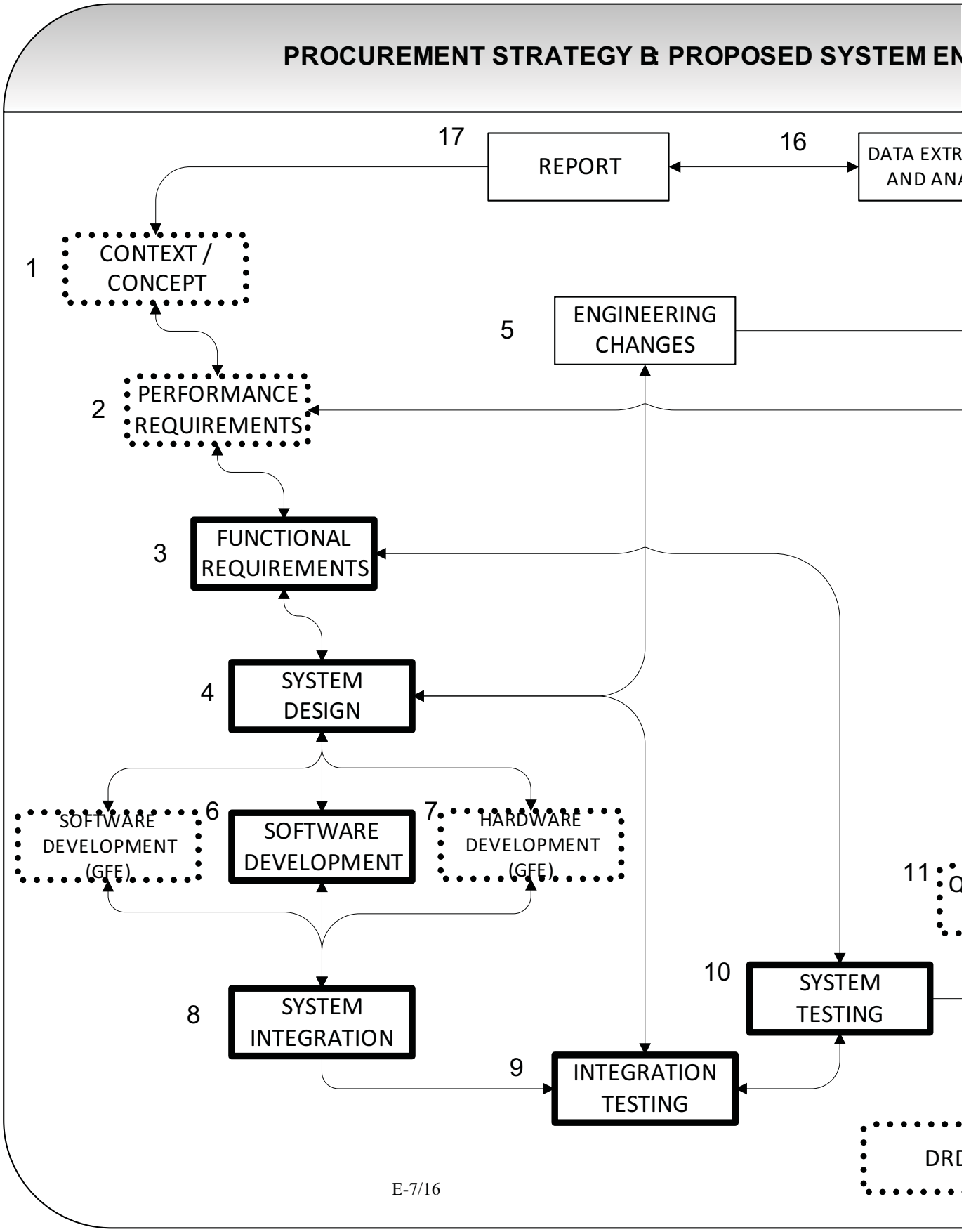
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Figure 2. *Proposed division of labour of system engineering activities for procurement strategy 'B'.*

Procurement Strategy C

This approach utilizes a Contractor-defined R&D effort to deliver the solution. The Contractor is the technical authority, design authority, system developer, integrator and tester, and provides trials / field support. The Contractor will be given an initial phase to define the requirements of the Contract program of work based on the Crown-supplied context / concept (subject of current work) and project constraints. One caveat on this solution is that interfaces to DRDC IP will have to be integrated and tested at DRDC. In the system engineering activities outlined in Annex D, the proposed division of labour between the Supplier and DRDC is shown in Figure 3. Some activities require joint effort.

DRDC is responsible for activities 1 and 7.

The Supplier is the design authority, system developer, integrator and tester, and provides a degree of trials / field support. The Supplier is responsible for activities 2, 3, 4, 6, 8, 9, 10, 11, 12, 14. The Supplier will support activities 5, 13, 15, 16, and 17.

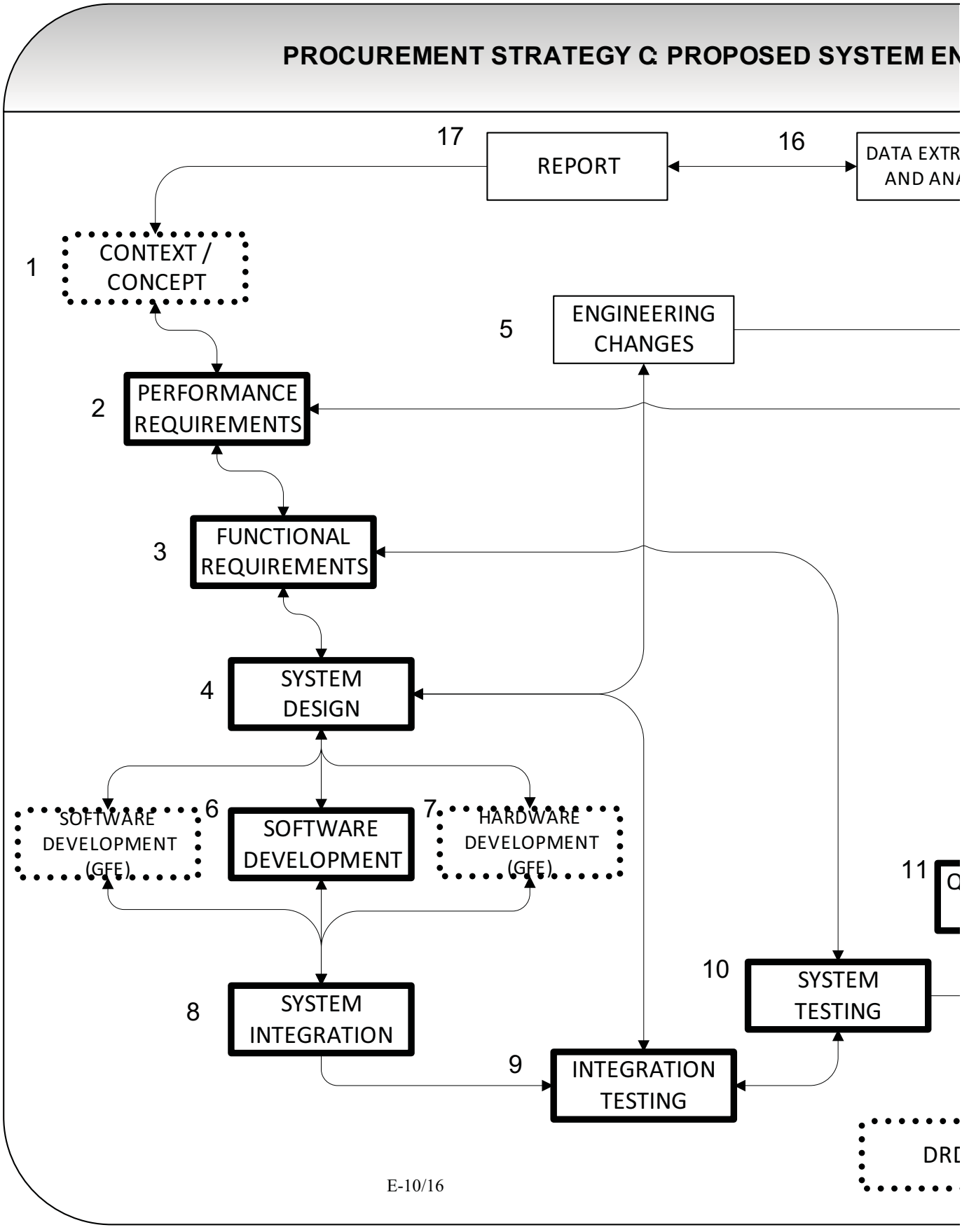
Intellectual Property (Strategy C)

Unless DRDC IP is specified as the core of the solution, the Contractor shall own the intellectual property (IP) rights in all foreground information arising from this requirement. No foreign-owned IP that is subject to ITAR or other trade/use restrictions is to be incorporated into the design without the express written consent of the Crown.

Limitation of Expenditure (Strategy C)

The overall limitation of expenditure is $3,250,000.00 (applicable taxes extra) with preliminary cash phasing by fiscal year as follows:
FY 13/14 $1,200,000.00
FY 14/15 $1,250,000.00
FY 15/16 $800,000.00
Follow on option: unfunded

There is some flexibility to how the cash phasing is structured prior to the completion of solicitation documents. The distribution of FY cash phasing will ultimately be based upon actual contract award date.


PROCUREMENT STRATEGY C: PROPOSED SYSTEM EN
17
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(GFE)
SOFTWARE
DEVELOPMENT
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HARDWARE
DEVELOPMENT
(GFE)
11
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SYSTEM
TESTING
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SYSTEM
INTEGRATION
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Figure 3. *Proposed division of labour of system engineering activities for procurement strategy 'C'.*

COMMON TO ALL PROCUREMENT STRATEGIES

The following sections covers draft solicitation information which may be generally applicable to all procurement strategies previously described.

Security

In order to provide the required services, Contractor personnel will require access toclassified information and will therefore require a security clearance of SECRET – Canadian Eyes Only provided by Canadian International Industrial Security Division (CIISD), Public Works and Government Services Canada (PWGSC).

Controlled Goods

The work requires access to Canadian Controlled Goods. Therefore, the Contractor must hold a valid Canadian Controlled Goods registration. The resulting deliverables will be reviewed for controlled goods content.

Time Schedule

- Start: upon contract award (Spring 2013)
- Definition Phase (if applicable): Completed Spring / Summer 2013
- First Development and Trials Phase: Completed Jan 2014
- Second Development and Trials Phase: Completed Jan 2015
- Third Development and Trials Phase: Completed Jan 2016
- Close-out Phase: Completed Mar. 2016

Contract Phases – Overview

This requirement covers the design, construction, integration and testing of a multi-platform, multistatic active-sonar demonstrator system using an option-based (phased) approach which reduces the risk of late delivery and provides off-ramps in the event of unsatisfactory progress or quality, or as directed by the Senior Review Board (SRB). It is intended to partition the contract into distinct development and trial phases, which allows for testing and problem resolution before continuing on to the next phase, while also providing opportunities for re-scoping based on incremental and iterative system integration. DRDC Atlantic and the Contractor team accepts that they are working on an inherently risky project, with the overall aim to reduce risk through iteratively building, testing and improving system maturity, and by continuously reviewing risk and implementing risk-mitigation strategies. At each end-of-phase review the Project Authority may decide to:

a. Exercise the option to proceed to the next phase;
b. Direct/adapt/alter development plans to implement corrective actions necessary to complete the phase, in negotiation with the Contractor and Crown Contracting Authority;
c. Terminate – follow on phases will not be pursued.

The requirement consists of phases sequenced as follows:

a. Definition Phase
b. Option 1: Development and Trials Phase 1
c. Option 2: Development and Trials Phase 2
d. Option 3: Development and Trials Phase 3
e. Option 4: Close-out Phase
f. Option 5: Exploitation Support (currently unfunded)

The options may be exercised subject to the following conditions:

Option 1: The Contractor has successfully completed all work elements identified for definition and provides an acceptable detailed Work Breakdown Structure (WBS), a Project Implementation Plan (PIP), schedule and budget.

Option 2: The Contractor has successfully completed all work elements identified in the previous phase.

Option 3: The Contractor has successfully completed all work elements identified in the previous phase.

Option 4: The Contractor has successfully completed the development and trials phases and the Major demonstration is complete.

Option 5: Funding is available to accelerate the exploitation of technology and concepts developed under this requirement.

Draft Milestones

Event	Planned Date / Period*	FY	Cash Phasing**	
			By Phase	By FY
Initial Requirement – Contractor's Definition Phase	Upon contract award (Apr-Jun 2013)	13/14	Initial [A] $300K [B] $400K [C] $480K	FY13/14 Limitation [A] $750K [B] $1000K [C] $1200K
Kick-off Meeting	Within three (3) weeks of contract award.	13/14		
Start of development and design	Upon contract award	13/14		
Contractor's PIP approval meeting	Within five (5) weeks of contract award	13/14		
Preliminary design review meeting: deliver preliminary design	Within eight (8) weeks of contract award	13/14		
Final design review meeting: deliver design, WBS, PIP and testing requirements	Within twelve (12) weeks of contract award	13/14		
Option 1 - Development and Trials Phase 1	Jul 2013-Jan 2014	13/14	Option 1 [A] $450K [B] $600K [C] $720K	
Deliver System Integration Test trial procedures for HALIFAX-Class, KINGSTON-Class, QUEST, CONVAIR and trial communications infrastructure	Aug 2013	13/14		
Deliver Integrated System build for the Phase 1 Trial	Sep 2013	13/14		
Support System Integration Trial at sea	Oct 2013	13/14		
Support Trial data extraction, analysis and reporting	Nov-Jan 2013	13/14		
Deliver Sea Trial 1 Report	Dec-Jan 2014	13/14		
Deliver End of Phase 1 Report	Jan 2014	13/14		
Phase 1 Review (Option, Re-scope, Terminate)	Jan-Mar 2014	13/14		
Option 2 - Development and Trials Phase 2	Mar 2014-Dec 2014	14/15	Option 2 [A]$850K [B] $1000K	FY13/14 Limitation [A] $850K [B] $1000K
Update specification of demonstration system	Apr 2014	14/15		

Event	Planned Date / Period*	FY	Cash Phasing**	
			By Phase	By FY
Deliver System Integration Test trial procedures for HALIFAX-Class, KINGSTON-Class, QUEST, CONVAIR, MPA and trial communications infrastructure.	Aug 2014	14/15	[C] $1250K	[C] $1250K
Deliver Integrated System build for the Phase 2 Trial	Sep 2014	14/15		
Support System Integration Trial at sea	Oct 2014	14/15		
Support Trial data extraction, analysis and reporting	Nov-Jan 2015	14/15		
Deliver Sea Trial 2 Report	Dec-Jan 2015	14/15		
Deliver End of Phase 2 Report	Jan 2015	14/15		
Phase 2 Review (Option, Re-scope, Terminate)	Jan-Mar 2015	14/15		
Option 3 – Development and Trials Phase 3	Mar 2015-Dec 2015	15/16	Option 3 [A] $300K [B] $375K [C] $600K	FY13/14 Limitation [A] $400K [B] $500K [C] $800K
Update specification of demonstration system	Apr 2016	15/16		
Deliver System Integration Test trial procedures for HALIFAX-Class, KINGSTON-Class, QUEST, CONVAIR, MPA, DRDC reach back and trials communication infrastructure.	Aug 2013	15/16		
Deliver Integrated System build for the Phase 2 Trial	Sep 2013	15/16		
Support System Integration Trial at sea	Oct 2013	15/16		
Support Trial data extraction, analysis and reporting	Nov-Jan 2013	15/16		
Deliver Sea Trial 2 Report	Dec-Jan 2014	15/16		
Deliver End of Phase 3 Report	Jan 2016	15/16		
Phase 3 Review (Option, Re-scope, Terminate)	Jan 2016	15/16		
Option 4 (Close-out)		15/16	Option 4 [A] $100K [B] $125K [C] $200K	
Draft Contractor's Completion Report	Early Feb 2016	15/16		
Contractor's Project Completion Report	Early Mar 2016	15/16		
Administrative closure and return of GFE / Crown documentation (IP audit, licensing terms)	Prior to 31 March 2016	15/16		

Event	Planned Date / Period*	FY	Cash Phasing**	
			By Phase	By FY
Option 5 Exploitation	Follow-on support	16/17+	N/A	N/A

*Assuming contract award by 31 Mar 2013.

** The distribution of FY cash phasing will ultimately be based upon the funds allocated by the Senior Review Board.

Deliverables

In addition to the return of all non-expended items (equipment, software, books, etc.) acquired by the Contractor in support of this requirement and claimed for against the contract, the deliverables shall be:

General

a. All software documentation and manuscripts generated under this contract;
b. Contractor's Work Implementation Plan for the Contractor's Program of Work (project management plan, work breakdown structure, cost and schedule, etc.);
c. All user and programming guides generated under this Contract;
d. Original data collected under the Contract;
e. Monthly progress reports;
f. Any interim report generated;
g. Phase completion report;
h. Contractor's project completion report;
i. Overall test plan including system integration trial test procedures and sea trial test procedures;
j. Contractor trial results and lessons learned;
k. Contractor trial and engineering log books; and,
l. All study reports conducted under the contract.
m. All hardware generated under this contract.

STB software version control and STB software development will need to conform to the configuration management and methodology mandated at DRDC Atlantic.

Contractor's Monthly Progress Reports

The Contractor shall report on the progress of the work on a monthly basis. All reports shall be delivered electronically in Microsoft Word with a paper copy to follow. As a minimum, the following shall be included:

a. Financial report actual vs. forecasted expenditure
b. Cost tracking and control
c. Summary of work completed
d. Risk monitoring and controlling

e. Problem reporting and change control
f. Actions taken/required to address any problems/issues
g. Results of any testing conducted
h. Copies of correspondence which affects direction of the work
i. Interim technical reports and results of investigations, studies, etc.
j. Milestones achieved

Contractor's End of Phase and Project Completion Report

The Contractor is responsible to produce an end of Phase Completion Report for each phase and follow-on phase selected, and a Contractor Project Completion report upon completion of the overall requirement. Each phase completion report and the project completion report shall contain an executive summary of the work performed including conclusions and recommendations. The executive summary shall be aimed at a senior level audience. The report itself shall capture the essence of the work for a general DND audience. The report shall provide an overview of the system plus a summary of the developmental process, results and recommendations for future work. It shall also provide a comprehensive list referring to associated supporting documentation (reports, manuals, drawings, etc.)

User Guides

In order to ensure that the technical staff at DRDC Atlantic can utilize the completed software without assistance, the Contractor shall provide user and programming guides for all completed software components. These documents shall be considered as formal technical reports, and as such, a draft copy shall be submitted to the Technical Authority for review and approval. The documents should clearly guide novice users in the use of the component, including configuration, required inputs, and available output.

Source Code Packages

Source code shall be provided for all custom software, with one copy being available on hard drive and one copy burned to CD-ROM media. Source code shall be internally documented to at least the level of detail required to understand the intent. Full instructions shall be provided to build executable versions of the code along with licenses to use any proprietary software libraries required to build the code. Source code development shall follow the DRDC Atlantic configuration management process. Source code shall be deemed to be "delivered" when:

a. A tagged version of the source code is checked into the STB repository; and
b. An executable version has been built by DRDC Atlantic personnel on an in-house platform.

Trials

The Contractor shall provide support during and after the trials to perform the test procedures, operate and maintain the AMASE systems, collect data, conduct analysis, and report on the results.

Trial Preparation

The Contractor shall deliver appropriate trials and demonstrations test procedures for the AMASE system prior to the specific trial or demonstration.

The Contractor shall deliver an integrated AMASE system for the major demonstration aboard the platform prior to the demonstration.

The Contractor shall provide support during and after the major demonstration to perform the test procedures, operate and maintain the AMASE systems, collect data, conduct analysis, and report on the results.

Trial Logistics
DRDC Atlantic is responsible for providing the detailed cruise plan, trial co-ordination, and the majority of the logistics efforts necessary to conduct the trial. The Contractor shall provide appropriate personnel to support, operate, and maintain equipment, perform system integration tests in the trial, collect data, and analyze results.

GFE
DRDC shall provide equipment necessary to support the trial.

Additional GFE Sonar Equipment
During this project, existing operational or experimental sonar equipment may become available for use in development and trials. Any such equipment utilization shall be at the discretion of the Project Authority.

Meetings
Required meetings include: Kick-off meeting, Contractor's Work Implementation Plan Approval meeting, Preliminary Design Review meeting, Final Design Review meeting, Progress Review Meeting, and integrated project team meetings and End of Phase Review meetings, and a project close-out meeting. Additional meetings may be called by the Project Authority or requested by the Contractor, as required.

Meeting Location
Unless otherwise specified, all meetings shall be held at DRDC Atlantic, Dartmouth Nova Scotia.

Meeting Agenda
The Contractor shall provide an agenda to the Project Authority in advance of each meeting with DRDC Atlantic. The agenda shall identify purpose, location, date, duration, discussion items and reference information to be reviewed before the meeting.

Meeting Minutes
The Contractor shall provide minutes of all meetings. Contractor generated documents shall be submitted to the Project Authority for approval within ten (10) working days of the date of the meeting.

Kick-off Meeting
The DRDC and Contractor team shall meet within three (3) weeks of contract award for briefing on current status of the AMASE TDP project, to clarify objectives, to identify DRDC Atlantic

and Contractor Integrated Project Team (IPT) members, review the Contractor's initial management plan, and to discuss the work plans for all phases of the contract.

Progress Review Meeting (PRMs)
Monitoring of Progress shall be through regular consultation between the Contractor and the Project Authority. The Contractor shall provide monthly progress reports to the Project Authority detailing progress toward the objectives of each phase, and billing toward the project. Monthly progress reports shall be reviewed at regularly held Progress Review Meetings called between the Contractor and the Crown. A PRM shall be held at least once per phase with additional meetings as required at the call of the Project Authority. The Contractor shall keep the Project Authority fully informed of any changes in circumstances that might delay the receipt of a deliverable.

Integrated Project Team (IPT) Meetings
The AMASE TDP shall employ the Integrated Project Team (IPT) concept and process ensuring that all stakeholders are consulted and have a voice in the direction of the project. The IPT shall meet as required to assess and discuss engineering and technical matters, propose technical recommendations to the Technical Authority. Stakeholders will consists of DRDC, CF/DND and Contractor members as appropriate. It is not intended that all IPT members attend each IPT meeting, but the appropriate representatives of each stakeholder be available. The meetings shall be called by the Project Authority or requested by the Contractor on an as-required basis.

Phase End Review Meetings
A phase end review meeting shall be conducted for each phase. The Phase End review meeting is used as a decision point to review whereby the Project Authority may decide to:

a. Exercise the option to proceed to the next phase;
b. Direct/adapt/alter development plans to implement corrective actions necessary to complete the phase, in negotiation with the Contractor and Crown Contracting Authority.
c. Terminate – follow on phases will not be pursued.

Quality Assurance

The engineering design and development phases of the Contract shall be conducted under a Quality Assurance program that meets software management and documentation processes acceptable to the Crown. At the discretion of the Technical Authority, Crown representatives shall witness some or all of the testing of the deliverable software through demonstrations of the testbed capabilities under a variety of tests or simulations if applicable. The completion of each phase shall include such demonstrations of the completed components.

Software quality assurance is managed through documentation, configuration management and testing, where the Contractor shall, in context of the STB (if selected as the basis of the solution):

a. Develop a software-testing plan that addresses new capabilities created and developed under this Contract;
b. Define an initial snapshot of STB software to be used in the implementation of this Contract;

c. Check-out and test revised code to confirm that the code continues to function as expected;
d. Test and demonstrate to the satisfaction of the Technical Authority new software capabilities as per item (a) and document the results;
e. Conform to DRDC Atlantic software configuration management procedures and practices; and
f. Advise on and maintain Intellectual Property (IP) tracking and audit as part of the software development process.

Equipment Purchases

Requirements for additional hardware and software may arise and any such hardware/software purchase request shall be made to the Project Authority and if approved may be purchased by DRDC Atlantic. All such hardware/software shall remain the property of the Crown and shall be returned upon completion of the contract.

Travel and Living

The Contractor shall be required to travel in support of at least three (3) planned sea trials and various project meetings and engineering tests as required. Travel and living expenses shall be billed to the Contract in accordance with PWGSC and Treasury Board polices. All other billable travel required in support of the requirement shall be approved in advance by the Project Authority. The Crown reserves the right to refuse to reimburse travel expenses that have not been approved in advance by the Project Authority. The Crown shall not pay travel *per diems* when the Crown is providing "hotel" facilities for Contractor personnel (e.g. aboard ship during sea trials).

Basis of Selection

It is requested that Contractor selection be on the basis of *highest technical proposal within the stated budget.* Suggested Evaluation Criteria is to be developed.

Industrial in-kind contributions may be evaluated as point rated criteria if acceptable to the contracting authority at PWGSC.

Government Furnished Equipment (GFE)

Software components and an instantiation that represent the current state of development of the System Test Bed (STB) are available at DRDC Atlantic for solutions specifying use of STB as the basis of the multi-platform system demonstrator.

DRDC Atlantic Support, Facilities and Responsibilities

The Contractor shall be provided access to computing facilities and laboratory space at DRDC Atlantic.

As some of the data analysis will require close interaction with DRDC staff, the Contractor shall be required to perform data/performance analysis at the DRDC Atlantic secure computing facilities.

For procurement strategies A and B, given the equipment required in meeting the requirements of the contract it will be necessary for the Contractor to perform the majority of the development work under the contract on-site at DRDC Atlantic in Dartmouth, Nova Scotia.

Meals and accommodations will be provided for Contractor personnel on the same basis they are provided for DRDC Atlantic personnel while aboard CFAV QUEST and Canadian Forces vessels for sea trials.

Policy for Connecting Non-DND Computers to DRDC Atlantic Networks

The policy for connecting non-DND computers to DRDC Atlantic Networks will be in effect if required for portions of the work.

Basis of Payment

Basis of payment may consist of a blend of progress (monthly) and milestone payments. Milestone payments would be aligned with the successful completion of a phase.

Available Documentation

As deemed appropriate by the Project Authority, DRDC Atlantic library reports and textbooks requested by the Contractor shall be made available. These shall be returned before the completion of the Contract. It is recommended that the Contractor apply for an account at the CANnadian Defence Information Database (CANDID) http://candid.drdc-rddc.gc.ca to access DRDC publications.

Approval Prior To Publication

All manuscripts for publication in scientific journals or the like, abstracts of oral presentations and any releases that describe portions of the contract work or related information shall be submitted to the Project Authority for approval of release. If the inadvertent presence of either defence classified or proprietary material is determined, the Project Authority will consult with the Contractor to redraft the relevant sections to their joint satisfaction to produce an unclassified text or theme without sensitive information. Review of manuscripts and releases will be completed within two months after receipt. Review of abstracts and any other releases will proceed rapidly and approval of release will follow without delay.

ANNEX F: POTENTIAL FOR IN-KIND CONTRIBUTIONS

Preamble

DRDC is seeking ways to maximize the project's impact for the CF by identifying opportunities for "sharing the costs" associated with performing the project. Discussed in the table below are potential areas where such "cost off-setting" or "cost sharing" may be possible by identifying potential in-kind industrial contributions. These contributions may add value or mitigate potential insufficiencies with the DRDC options either proposed or constrained by the funding limitations of the project. Industry may benefit from a partnership that offers incentives in return such as access to Crown data, access to CF exercises and unique licensing terms that may be negotiated with the Crown.

Several areas/issues that are potentially good candidates for industrial in-kind contributions are presented in column (A). The current or prospective DRDC options for these areas/issues are presented in column (B) and potential industrial in-kind suggestions are presented in column (C). The Supplier may consider commenting on applicable areas as part of a response to this RFI or in a follow-on "Industry Day" in support of the AMASE procurement strategy. These do not cover all in-kind options and industry may comment upon or suggest other areas/options that are not covered here.

Following the table, an overview of available government furnished equipment (GFE) is provided.

Table: Preliminary identification of potential industrial in-kind contributions

No.	(A) AREA / ISSUE DESCRIPTION	(B) DRDC OPTIONS	(C) POTENTIAL INDUSTRIAL IN-KIND OPTIONS
1	**Towed Array** Reliable access to and scheduling control of a towed array optimized for multistatic operations with high dynamic range and directional sensors.	(1) Overhaul the TIAPS Directional Acoustic Sensor Module (DASM) to provide a high dynamic range, directional, active receive towed array. (2) Use the AN/SQR-19 towed array. The multistatic demonstrations and experiments will be constrained. (3) Submit funding request for a COTS high dynamic range towed array in a separate DRDC equipment re-capitalization project which is underway. This will not deliver a system until 2015.	(1) Specify contribution of "loaner" or "leased" systems for a COTS towed array with high dynamic range and directional sensors. **Incentive** • **Equipment is employed during CF exercises** • **Access to data**

No.	(A) AREA / ISSUE DESCRIPTION	(B) DRDC OPTIONS	(C) POTENTIAL INDUSTRIAL IN-KIND OPTIONS
2	**Towed Low Frequency Active sonar source** A towed lowed frequency active sonar source for conducting multistatic active sonar experimentation and trials.	(1) Overhaul the TIAPS towed low frequency vertical projector array with two free flooded rings (FFR) to provide a high power towable source. The system is referred to as the VP2.	(1) Specify contribution of "loaner" or "leased" systems for a COTS towed low frequency source. **Incentive** • **Equipment is employed during CF exercises** • **Access to data**
3	**Sonar System Baseline & Algorithm development and data analysis** The majority of developmental costs will likely be associated with signal processing and displays for shipboard and airborne multistatic active sonar systems. With available personnel resourcing, work may progress too slowly in realizing advanced multistatic signal processing and display capability (waveform selection, target-tracking algorithms, etc).	(1) Start with basic multistatic processing capability within the DRDC Atlantic STB and develop for shipboard and airborne systems. (2) Exploit in house expertise for signal processing, displays and algorithm development.	(1) Start with a mature baseline. Exploit to the extent possible previously developed sonar processing systems within industry, if systems can be "opened" for adjunct or developmental processing / displays. (2) Exploit to the extent possible previously developed algorithms developed within industry. (3) Co-development with DRDC -discounted labour rates. **Incentive** • **Co-development** • **Licensing terms** • **Insertion of DRDC developed signal processing and algorithms** • **Access to data**
4	**Operator Availability** Lack of availability of CF operators to support development and participate in trials.	(1) Engage MPEU, HOTEF, ADAC(A) and CFMWC to involve subject matter experts. (2) Plan trials to align with existing CF operations and exercises and identify these requirements early.	(1) Industry personnel with CF operational experience could offset lack of operators for development and trials. **Incentive** • **Access to CF exercises**
5	**Planning Aids and Performance Prediction** With available resourcing, real time multistatic planning aids and performance prediction tools will be difficult to implement.	(1) Use non-real time tools (2) Exploit to the extent possible previously developed planning aids and performance prediction tools in the R&D community (NATO CMRE, TTCP, and DRDC).	(1) Industry to offer COTS available systems. **Incentive** • **Equipment is employed during CF exercises.** • **Co-development**

Closing Comments

This section intends to stimulate responses and follow-on dialogue to identify and investigate potential industrial partnering and in-kind contributions.

ACRONYM / TERM	DESCRIPTION
ADAC(A)	Acoustic Data Analysis Centre (Atlantic)
A-CASS	A-size Coherent Active Source Sonobuoy (AN/SSQ-565)
AIMP	Aurora Incremental Modernization Project
AMASE	Advancing Multistatic Active Sonar Employment
AMASE TDP	AMASE Technology Demonstration Project
AN/ARR-502B	The in-service sonobuoy receiver system.
AN/SQR-19	The in-service tactical towed array on the HALFIAX-Class frigate providing passive acoustic detection of submarines and surface ships.
AN/SQS-510	The in-service hull mounted sonar system on the Halifax-Class frigate.
AN/SSQ-53	The in-service DIFAR passive sonobuoy optimized for low frequency detection.
AN/SSQ-565	A developmental low frequency active source sonobuoy with receive capability. It is compatible with aircraft commanding in-service AN/SSQ-62 DICASS sonobuoys..
AN/SSQ-573	A developmental DIFAR passive sonobuoy which may be used to receive active sonar signals for multistatic operations.
AN/SSQ-62	The in-service active directional sonobuoy optimized for mid frequency detection, classification and localization.
ASW	Antisubmarine Warfare
BUSTER	A towed echo-repeater compatible with low-frequency sources such as the AN/SSQ-565 sonobuoy.
CANDID	CANadian Defence Information Database
CANTASS	Canadian Towed Array Sonar System (AN/SQR-501). The passive towed array component of the CANTASS is the AN/SQR-19.
CAS	Continuous Active Sonar
CCS	Command and Control System
CD-ROM	Compact Disc – Read Only Memory
CEO	Canadian Eyes Only
CF	Canadian Forces
CFAV	Canadian Forces Auxiliary Vessel
CFB	Canadian Forces Base
CFMETR	Canadian Forces Maritime Experimental and Test Ranges
CFMWC	Canadian Forces Maritime Warfare Centre
CIISD	Canadian International Industrial Security Department
CMA	Canadian Multi-Mission Aircraft
CMRE	Centre for Maritime Research and Experimentation
Convair 580	The Convair 580 aircraft is part of the facilities of the National Research Council (NRC) Institute for Aerospace Research. It is a twin engine medium size pressurized aircraft capable of long distance operation carrying several racks of instrumentation and up to a dozen research crew members. It is a multi-purpose flying laboratory supporting various research projects and was leased by DRDC Atlantic during the NUW TDP and used as an aircraft node within the NUW network concept to act as a surrogate MPA. IMPACT and network communications equipment were installed on the Convair 580 during the NUW

ACRONYM / TERM	DESCRIPTION
	TDP trial.
COTS	Commercial-off-the-shelf
CPF	Canadian Patrol Frigate (see FFH, HAL)
CSC	Canadian Surface Combatant
CVAR	Conduction-cooled VME Acoustic Processor/Receiver
CW	Continuous wave
DARB	Dynamic Active Retrievable Buoy. The DARB is a recoverable active buoy configured with a double barrel-stave projector and pre-loaded active pulses. The passive DARB is a recoverable passive buoy that provides a means for recording both underwater radiated noise and man-made acoustic transmissions. The DARBs are deployed directly from QUEST (or other vessel), and allowed to drift freely during daily trials.
DASM	Directional Acoustic Sensor Module. DASM is a high-dynamic range directional active receive sonar array that was developed for the TIAPS Technology Demonstration project, designed to explore the potential development of a next-generation sonar system. The receiver consists of a horizontal line array of 96 Combined Omni-directional and Resolved Dipole Sensors (CORDS). Each CORDS has two co-located sensors, an omni-directional hydrophone group and a dipole accelerometer hydrophone, with a roll resolve sensor.
DEVAL	Developmental Evaluation
DGSTO	Director General Science and Technology Operations
DICASS	Directional Command-Activated Sonobuoy System (AN/SSQ-62)
DIFAR	Directional Frequency Analysis and Recording (AN/SSQ-53)
DMRS	Director Maritime Requirements Sea
DMSS	Director Maritime Ship Support
DND	Department of National Defence
DRDC	Defence Research and Development Canada. An agency of the Canadian Department of National Defence that responds to the scientific and technological needs of the Canadian Forces.
DRDC Atlantic	Defence R&D Canada – Atlantic. DRDC Atlantic has expertise in antisubmarine warfare, mine and torpedo defence, air and naval platform technology, the modelling and simulation of ship and combat systems, shipboard command and control, maritime information and knowledge management, emerging materials, power sources, and signature management.
EC	Engineering Change
ECP	Engineering Change Package
EMATT	Expendable Mobile ASW Training Target
FFH	Canadian multi-role patrol frigate (see CPF, HAL)
FLEETEX	Fleet Exercise
FM	Frequency modulation, or frequency modulated
FY	Fiscal Year
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GST	Goods and Services Tax

ACRONYM / TERM	DESCRIPTION
GUI	Graphic User Interface
HAL	Halifax-Class frigate (see CPF,FFH)
HELO	Helicopter
HELRAS	Helicopter Long Range Active Sonar
HF	High-frequency
HMS	Hull Mounted Sonar (AN/SQS-510)
HOTEF	The Helicopter Operational Evaluation and Test Facility
IMPACT	Integrated Multistatic Passive / Active Concept Testbed. IMPACT is a real-time sonar processor that is flyable on fixed-wing aircraft and was the basis for the sonobuoy-processor specification for both the CP-140 Aurora and CH-148 aircraft. DRDC Atlantic has been improving multistatics software in IMPACT and is currently upgrading (i.e. modernizing) the hardware. Software that exploits the new hardware is being implemented using the System Test Bed (STB). It simultaneously processes four multistatic active data streams from a field of up to 16 sonobuoys, providing operator tools for localization and other tasks. Development of IMPACT began in the 1990's and was funded through a series of R&D projects.
IP (1)	Intellectual Property
IP (2)	Internet Protocol
IPT	Integrated Project Team
ISO	International Organization for Standardization
ITAR	International Traffic of Arms Regulations
KIN	KINGSTON-Class (see MCDV)
Level of Effort	Level of Effort (LOE) as defined in the Project Management Body of Knowledge Guide Third Edition 2004 Glossary: Support type activity which does not produce definitive end products. It is generally characterized by a uniform rate of work performance over a period of time determined by the activities supported.
LF	Low-frequency
LFA	Low-frequency Active
MAPS	Maritime Acoustic Processing System. An application of the DRDC system test bed (STB) which may be developed for shipboard multistatic sonar processing. Current MAPS capability includes shipboard processing and display for sonobuoy information, and is capable of receiving data from any of the 99 sonobuoy channels. The system provides Narrowband, and Transient acoustic processing, acoustic range prediction processing, and a chart display that receives information from NavDDS (AIS, GPS data, and Weather/Met), CCS Bus Sniffer (track and sonobuoy reporting data), and MK8 (F) bathy interface (XBT temperature profile data).
MARLANT	Maritime Forces Atlantic
MCDV	Maritime Coastal Defence Vessel (see KIN)
ME	Maritime Evaluation
MF	Medium frequency, or mid-frequency
MH	Maritime Helicopter (CH-148 Cyclone)
MOE	Measures of Effectiveness
MOP	Measures of Performance

ACRONYM / TERM	DESCRIPTION
MPA	Maritime Patrol Aircraft (CP-140 AIMP Block III)
MPEU	Maritime Proving and Evaluation Unit
MSTDCL TDP	Multi-Sensor Torpedo Detection, Classification and Localization (MSTDCL) TDP. The MSTDCL TDP created PLEIADES to demonstrate automated multi-sensor Torpedo detection, classification and localization (DCL) tailored to the existing sensors and systems on-board the Halifax-Class frigate. PLEIADES is an instantiation of the DRDC system test bed (STB). The MSTDCL TDP was implemented over 2005-2009.
MVASP	Modular VME Acoustic Signal Processor. The MVASP system is an integrated active/passive and multistatic active sonobuoy processing and display system for airborne use on the CP-140 Aurora. The MVASP trials kit which DRDC is familiar consists of the following: MVASP operator workstation, AN/ARR 502(B)v4 sonobuoy receiver, and the DMS emulator.
NATO	North Atlantic Treaty Organization
NRC	National Research Council
NUW TDP	Networked Underwater Warfare TDP. The NUW TDP demonstrated that the underwater portion of the common operating picture (COM) can be developed more quickly and more accurately when tactical information is shared among platforms / sensors. Using software components derived from the DRDC system test bed (STB), the NUW TDP created a Network Enabled Combat System (NECS) containing sonar processing, display and information management in a collaborative environment. The communications network used to pass information between the different platforms at sea was a sub-net relay (SNR) over UHF radio. A communication capability over satellite was used to connect one of the platforms at sea to a shore-based reach back cell. The NUW TDP was implemented in the middle part of decade 2000-2010.
OMI	Operator/machine interface
PLEIADES	Not an acronym. Advanced sonar processing demonstration system which integrates Halifax-Class ship's sonar, towed array, sonobuoy receiver and command and control system bus. PLEIADES was developed through the MSTDCL TDP. It is one of the most visible applications developed from the DRDC Atlantic System Test Bed (STB).
PRM	Progress Review Meeting
PWGSC	Public Works and Government Services Canada
QUEST	CFAV QUEST is based in Halifax, Nova Scotia and is an oceanographic and acoustic research vessel used by DRDC and the Royal Canadian Navy.
R&D	Research and Development
RF	Radio Frequency
RFE	Request for Effect
RFI	Request for Information
RFP	Request for Proposal
RHIB	Rigid Hull Inflatable boat
SNR (1)	Signal-to-noise ratio
SNR (2)	Sub-net relay
SOR	Statement of Requirement

ACRONYM / TERM	DESCRIPTION
SOW	Statement of Work
SPSS	Sonobuoy processor sub-system (on CH-148)
SRB	Senior Review Board (internal to the DND / DRDC TDP program) The SRB is responsible for: a. Advising the Project Leader (Director General S&T Operations) on the management of the project from planning through to implementation; b. Providing the project team with sufficient guidance, staff assistance and delegated authority for the proper conduct of the project; c. Considering and recommending options presented by the project team; d. Reviewing all recommended proposals to change the project scope; e. Ensuring that contingency funds are used for activities within the scope of the project; f. Monitoring and reviewing project progress, including issues of finance, personnel, and contracting; g. Providing guidance in the development of the Exploitation Plan; and h. Ensuring that the project team complies with the policies and procedures imposed by higher authority. An SRB meeting will be held at least every year during the conduct of a TDP. The status of all activities will be reviewed, problems or concerns discussed, and the status of cost and schedule reported. The SRB will be asked to recommend approval of the plan for the coming year, including any changes to scope, deliverables, schedule or budget.
SRCL	Security Requirements Check List
SSK	Submerged ship conventional - a diesel-electric powered attack submarine (see VCS)
STB	System Test Bed (in recent times - also referred to as System Tool Box, in the past - also referred to as Sonar Test Bed). The STB is a collection of software components that provide active and passive sonar processing and display functionality for sensor, feature, contact, track and environmental data. The development and evolution of the STB began in the mid 1990's to support various sonar system development projects at Defence Research and Development Canada (DRDC) Atlantic. The STB has been designed to provide flexible, portable, reusable, scalable components for a wide variety of sonar applications. System integrators assemble only the components needed to provide the desired capability. Third party application integration is readily supported through mainstream commercial interface protocols.
TARM	Total Air Resource Management
TBD	To be determined
TD	Technology Demonstration
TDA	Tactical Decision Aid
TDP	Technology Demonstration Project
Technology Refresh	The process of updating components (especially hardware) as a way to sustain a system to address obsolescence. Technology Refresh maintains but does not add increment capability.
Technology Insertion	Insertion of new capabilities into a system as part of a regular update process.
TEMP EC	Temporary Engineering Change
TGEX	Task Group Exercise

ACRONYM / TERM	DESCRIPTION
TIAPS TDP	Towed Integrated Active and Passive Sonar System TDP. TIAPS demonstrated towed low-frequency active-sonar, improved towed arrays and dry-end processing and display capabilities on a single research platform. The TIAPS dry-end was built using the STB to integrate the active and passive sonar systems. TIAPS was implemented over the mid 1990's to mid 2000's.
TTCP	The Technical Cooperation Program
UHF	Ultra-high Frequency
VCS	VICTORIA-Class Submarine (see SSK)
V-FIN	A tow-body equipped with an ITC-2010 free flooding ring projector designed for broadband, high efficiency transmission at low//medium frequencies.
VHF	Very-high frequency
VME	Versa Module Eurocard (a type of system bus)
VP2	Vertical Projector 2. The VP2 system is a towed acoustic source consisting of two Free Flooded Ring (FFR) projectors mounted on a tow body together with the associated tow cable, amplifiers and system monitoring hardware.
WAN	Wide Area Network