Navy Integrated Tactical Environment System IIR – Data Gathering

Data Gathering Requirements and Interim Database for NITES IIR

Prepared By:
Paul Acacia
31 Millbrook Avenue
Dartmouth, Nova Scotia
B2V 0A2
General Dynamics Canada
Contractor's Document Number: 741284
Contract Project Manager: Heather Larmer, 613-596-7435
PWGSC Contract Number: W7714-115155/002/SV
CSA: Mark Ball, DRDC CORA IM ORT, 613-992-4539

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Abstract

Canadian Forces (CF) personnel are required to make assessments of the effects of meteorological, oceanographic, and/or ice conditions (hereafter referred to as “Met Effects”), on the operation of CF equipment. The current methods of assessing Met Effects for the CF rely on a suite of standard NATO criteria and manual or semi-automated processes. More sophisticated systems exist that offer improved estimates through automated software applications.

One such system, Navy Integrated Tactical Environmental System, Variant II Redesign (NITES IIR or N2R), is a sophisticated Met Effects assessment application with performance degradation predictions for known capabilities. For each specific piece of equipment, the N2R application forms an assessment based on certain aspects of the equipment's operating characteristics and technical specifications and how they react to varying meteorological, oceanographic, or ice conditions. These characteristics and specifications are provided to the application in the form of descriptive data that are formatted according to the equipment category. Algorithms of the type used by this application can significantly improve the equipment performance information available to Canadian commanders to make decisions on the tactical use of that equipment.

One problem with using systems such as N2R is that in order to assess Met Effects on CF assets, the associated databases must be populated with data specific to each piece of equipment to be assessed.

The purpose of this report is to identify the data requirements for assessing Met Effects on military equipment using an automated software application such as N2R. It also provides an evaluation of the data sources and availability, along with preliminary data collection and data collection formatting activities.

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Executive summary

Navy Integrated Tactical Environment System IIR – Data Requirements: Data gathering requirements and interim database for NITES2R

Introduction or background: Canadian Forces (CF) personnel are required to make assessment of the effects of meteorological, oceanographic, and/or ice condition on CF equipment. A more automated process is available through software systems such as the Navy Integrated Tactical Environmental System, Variant II Redesign (NITES IIR or N2R).

Results: This contract evaluates the required data to support an automated software system, and assesses the availability of the data and its various data sources. It reports on the preliminary assessment and provides the catalogued data collected so far.

Significance: To accurately model the impact of Met Effects on CF electronic sensor capabilities, a great deal of already-known and measured data needs to be collected to fully characterize the platforms.

Future plans: To achieve a high-level of proficiency in employing N2R for predictions, a continued effort is required to build a comprehensive platform database of all Canadian naval, airborne and land systems. As more electronic sensor subsystems are uncovered they should be added to the existing platform database.

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1 Introduction

1.1 Background

The primary purpose of this project is to determine the data requirements for assessing meteorological, oceanographic, and/or ice effects ("met effects") on Canadian Forces equipment using an automated software application.

The RFP refers specifically to the Navy Integrated Tactical Environmental System, Variant II Redesign (NITES II R or N2R) as the "reference" automated software application for performing met effects assessment. The Government of Canada is in the process of acquiring the N2R application for use by CF personnel. N2R will be used to support the planning and execution of operations, helping CF Commanders adjust tactics to meteorological, oceanographic, and ice conditions.

The N2R application provides a powerful and sophisticated toolset for evaluating met effects on military platforms, weapons, radios, and sensors. However, this toolset requires externally-supplied data about those assets. This data on available platforms, weapons, sensors, and radios is generally implemented by N2R as a Platform-Sensor Database (PSDB). The PSDB is an integral component of the N2R Threat Force Data software segment.

Inputting Canadian Forces equipment data into the PSDB will involve a multi-step process requiring coordination of several CF agencies and, ultimately, with other nations and equipment vendors. This project marks the initial step in this process.

1.2 Aim

This document has been prepared by GD Canada to comply with the remaining deliverables for contract "Data Gathering" W7714-115155/002/SV, Task 2. This includes Data Requirements, a Canadian Forces Equipment list, Data Availability, Data Collection and Contact Development.

In accordance with the SOW, the data identified should be considered preliminary given that limited information has been provided by DND, and that full and timely access to the CSNI network was not available throughout the execution of this task. This was due, in part, to the extensive renovation occurring in building D201 which rendered the CSNI unavailable to even the MetOc staff. The sources listed below are publically available and generic in nature; the actual document numbers describing precise and complete system specifications are not available at this time.

The team executing this contract includes individuals employed by General Dynamics Information Technology (GD-IT) that developed the N2R application. Detailed information provided by GD-IT has been used to identify a complete set of data, including the data types, units and valid range of values that are required for the N2R application.

Additionally, our GD-IT resources strongly advised that the N2R Data Editor be used to populate and build the PSDB. The initial expected delivery of the N2R application was spring of 2013, but at the time of this report the expected delivery is anticipated to be spring of 2014. Therefore, the current strategy it to collect all available data into an interim database. When the N2R is finally received and installed, this interim data will be ported into the PSDB. This strategy will enable a

more rapid ramp up to a fully functional N2R deployment when it is finally received. After this point, all new information will be incorporated directly into the "live" PSDB.

1.3 Layout of the Report

The following chapter will discuss the data collection process in more detail. Section 2.1 ("Data Requirements") will examine the generic nature of each subsystem. Section 2.2 ("Incorporation into the N2R Application") examines the way in which one builds a complete and detailed set of capabilities for one individual platform. This knowledge will dictate how the data is to be collected and organized.

Section 2.3 ("CF Equipment List") presents list of current Canadian Forces naval vessels, airborne platforms, and land vehicles. Section 2.4 (Data Availability) discusses the availability and reliability of sources for collecting data described in the previous section.

Section 2.5 ("Data Sources and Contact Development") lists the data sources in categorized groups, and rates the reliability of each group. Completeness of the full set of the characterization data is also touched on.

2 Data Requirements and Data Gathering

2.1 Data Requirements

At a high level, the raw platform data can be broken down in to a number of general categories. Sensor hardware interacts with the environment in either a passive or active way. For example, sonar transducer arrays can either passively collect incoming acoustic signals received underwater, or actively "ping" and process the echo returns. The raw data input to N2R for the various CF sonars allow it to calculate the receiver's general characteristics. The environmental impact of different ocean sound velocity profiles will also profoundly impact the performance of a sonar system.

Examples of input data required for a sonar transducer are the array geometry (cylindrical, spherical, planar, conformal, linear, or single hydrophone); its length, width, height; the number of staves and the stave spacing; the array depth; and finally the array's directivity index for its various operational frequencies.

Associated with any sonar transducer is the electronic processing of the incoming data. Since the incoming raw data can be processed in various ways to produce different acoustical displays, the N2R interface separates the acoustic sensor characteristics from the acoustic processor characteristics.

Acoustic processing falls into two broad categories, active and passive. To calculate the environmental impact on an active sonar system, N2R needs the active transmit frequencies, declination angles, the transmit source levels, the set of available pulse parameters, system loss, and the various system beam widths (transmit/receive, horizontal/vertical). For passive systems the primary concern is the frequencies used to produce the final displays, as well as their noise recognition differentials.

Similar information is required for other electronic sensors, such as communication systems, radar systems, and Electronic Support Measures (ESM) systems. In these cases the antenna type needs to be known (omni-directional, Sin(x)/X, Gauss, etc...), along with other system parameters such as polarization, peak power, antenna gain, sensitivity and the various pulse lengths and frequencies.

The platform itself needs to be specified in terms of the antenna height reference, the platform speed, its aspect, and whether a snorkel or prairie/masker system is on. The platform's emitted narrow band frequencies and broad band sound pressure levels need to be specified for all platform speeds and aspects. Finally the target strength (for sonar echo data) and the radar cross sections are required for all possible frequencies, aspects, and polarization (for radar only).

The entire list of input parameters, along with their data types and valid range is quite extensive. All the required information has been packaged in a set of subsystem specification Word documents by GD-IT which is delivered as part of this contract report. The intent of these forms is to precisely identify and collect the listed data for input to N2R. There are a total of 45 separate forms that specify various platforms, sensors, and processors. An example of the Word template document is given below:

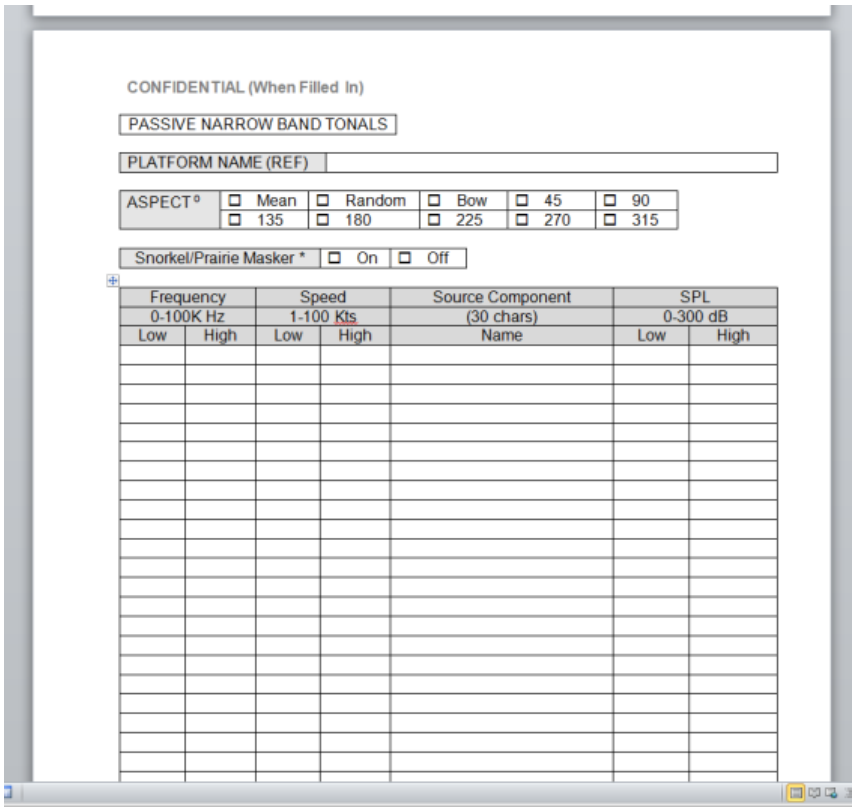

Figure 1 Sample blank N2R Word document data input form

The first recommendation to build the CF equipment database was to fill in the word documents for each CF equipment platform and each electronic subsystem. Note that as more information about a specific platform is accumulated, this stack of forms can quickly grow quite large. For example, a platform's radar cross section is fully defined by the cross-sectional area for all aspect angles, and for all incoming radar frequencies, and for all polarizations (vertical, horizontal, and circular).

Due to the highly sensitive nature of most of the raw data, this procedure would quickly become untenable. This method may work if N2R was currently available. A completed form could be used to transfer data into the PSDB and then the form would be disposed of immediately. But without N2R, to collect a complete and detailed set for each CF platform would be unwieldy and involve significant security risk.

Another avenue explored for the interim database was to build a Microsoft Excel workbook with all the required data explicitly listed. This application was determined to be widely available at all DND workstations, and involves little or no training.

The array of input forms are grouped by sensor types into separate worksheets. The data can be entered directly into the various cells, and existing data can be review and edited. In addition, there is a "NOTES" section at the bottom of each worksheet that can be used for detailed notes and even live URL links to external document locations.

To make the data entry process automated, graphical User Forms were developed to display and group the data in a user-friendly interface. These were developed with Excel's embedded Visual Basic for Applications (VBA) tool that comes with standard installations of Excel. One example of a more basic form is given below:

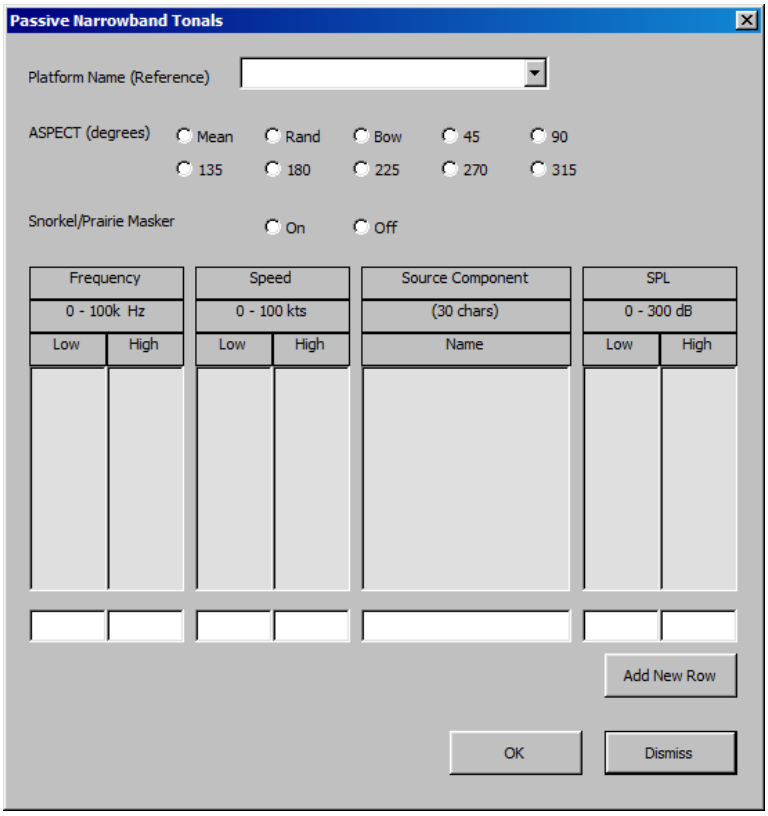

Figure 2 Sample of a blank Excel VBA data input User Form

These forms are all patterned after the GD-IT forms, giving 45 in total. One obvious advantage in using this electronic form of data collection is that the document can remain on the high-side of the network (i.e. on the CSNI) and can be easily passed from user to user.

Further advantages are that basic checks can be performed automatically to prevent minor errors in data entry. In some forms (not all) the platform name or the sensor name needs to be associated with a known platform or sensor. In these cases the VBA code scans all the existing platform or sensor lists and offers it to the operator in the form of a drop-down combo box. A populated combo box is depicted below:

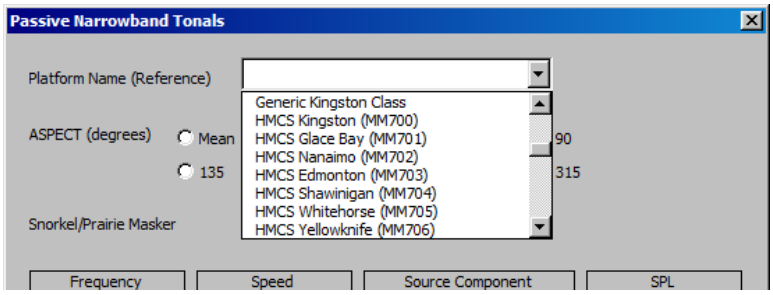

Figure 3 Sample of a Combo Box showing user-entered platform names

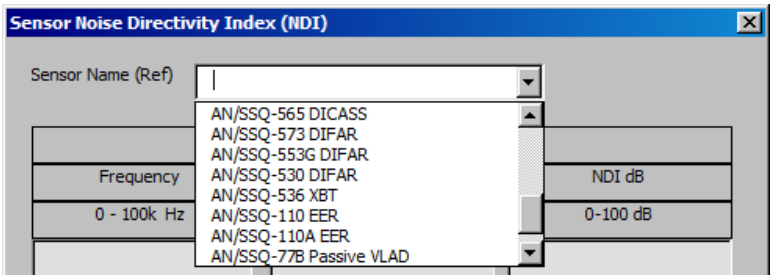

Figure 4 Sample of a Combo Box showing user-entered sensor names

In other cases the data selection can only be one of a limited set. Common radio buttons are used in this situation. Examples can be seen in Figure 2 above for the Aspect angle option, or the Snorkel/Prairie Masker on/off option.

More importantly, all the numerical data required by N2R has a specific range of validity. When a user inputs the data the VBA code checks if the input data has exceeded either the upper or lower limit of the valid range. If so, the data is simply clipped to the maximum or minimum range value. (Due to the limited time available, a more elaborate error handling could not be implemented.)

Not all input forms are as elementary as the platform Passive Narrowband Tonals (Figure 2) illustrated above. The following is a more involved input data User Form for a radar subsystem:

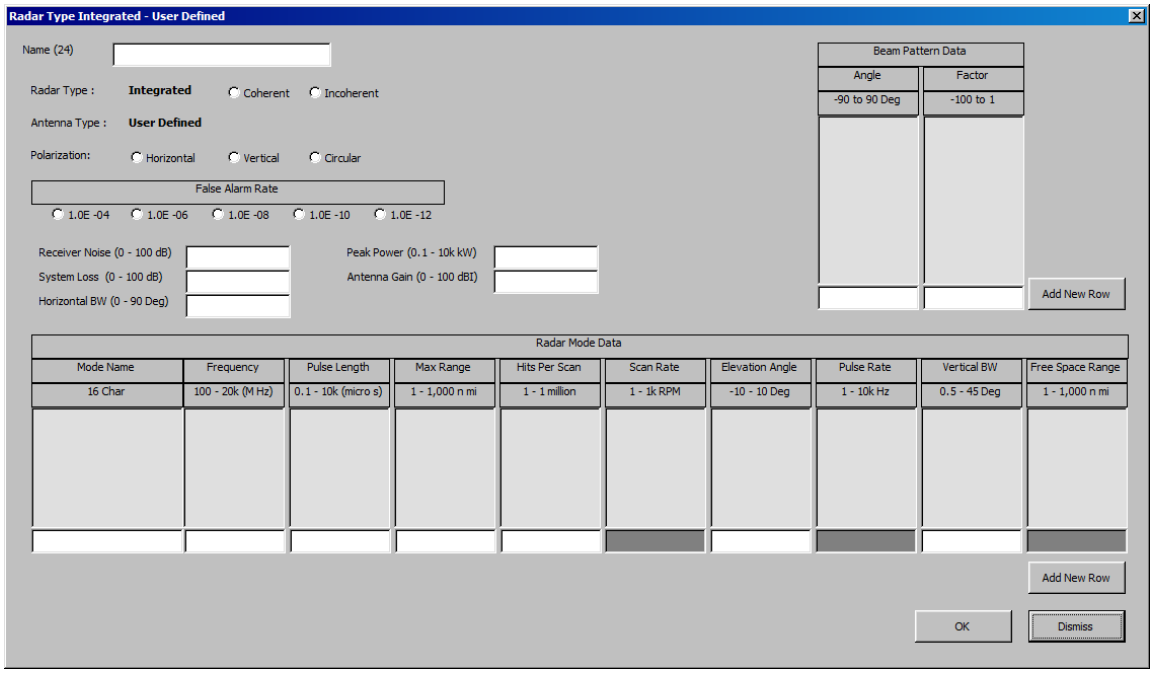

Figure 5 Sample of a more complex data entry form

Figure 5 illustrates the number of system parameters that are required to fully define a radar system to the N2R application. A full 360 degree set of beam pattern data needs to be defined. Many radar systems have a number of operational modes; this data set can be entered as a list. As can be seen by the data types, many of the parameters can be difficult to find in public resources.

While the allotted time didn't allow for further development, there exists a possibility to extend the Excel workbook into a full-fledged interactive database. This may be required if there are further delays in DND receiving and standing up the N2R application.

Another possibility that was explored briefly was to export all the accumulated data in an XML format. This may be a fruitful approach in the future, since our GD-IT contacts have demonstrated the N2R Platform Import/Export feature. With this tool, a set of platform data can be shared between N2R installations. A sample export file was generated from the Excel workbook for just the first five platform data forms.

The ultimate goal would be to export all captured CF platform and equipment data from the workbook database, and then import it directly into the N2R application. This activity is outside the scope of this current contract.

2.2 Incorporation Of Data Into The N2R Application

The process in which data is brought into the N2R application sheds light on the extent of the effort, and it identifies a strategy in collecting this data. At a high level, the process to populate the PSDB is to build a platform (e.g. a Halifax-class ship) by attaching various acoustic sensors, acoustic processors and electromagnetic (EM) sensors.

This means that the first step in the process is to identify individual CF sensor subsystems, such as the AN/ARC-210 V/UHF radio, and then to obtain the required data for all of that individual

sensor's characteristics. In the above example, the required data fields are listed in the Excel "Comms" worksheet.

Once all the sensor subsystems and acoustic processors are identified, then they can be associated with a particular platform (such as a Sea King).

This building process is supported by the primary N2R user task "Manage Platform Functions" which uses a graphical Data Editor user interface. This task is a central part of the workflow in the N2R application, and it allows the user to view, create, and edit platforms, underwater acoustic sensors, and EM sensors.

The advised strategy is to create one generic platform of a certain class (e.g. a Halifax-class patrol frigate), then define all the platform characteristics, and then attach all common sensors for that class. This "generic" platform can then be copied and tailored to be specific instances of that class (e.g. HMCS Fredericton).

In the case of underwater acoustic sensors, the sensor subsystem is separated from the processor subsystem. This is because one sensor (e.g. a hull-mounted transducer array) may have its raw data processed in several different ways (e.g. to produce active sector scan displays, or narrow band and broad band gram displays). This fact results in separate and distinct worksheets for the acoustic sensors and acoustic processors, which somewhat simplifies the task in fully defining acoustic systems.

2.3 CF Equipment List

The list of current Royal Canadian Navy vessels in operational use is given in the table below. Individual vessels are identified to allow tailoring of the exact subsystems to that hull number. Some ships may not be primary war fighting equipment, such as HMCS Oriole. But they have been included in the list since they have at least one electronic sensor, such as navigation radar.

Vessel Name (class/hull number)	***Classification code***
CFAV Black Duck (YAG660)	YAG
CFAV Albatross (YAG661)	YAG
CFAV Gemini (YAG650)	YAG
CFAV Pegasus (YAG651)	YAG
CFAV Pelican (YAG4)	YAG
Unnamed (YTD11)	YDT
CFAV Granby (YTD12)	YDT
Generic Sechelt Class	YDT
CFAV Sechelt (YTD610)	YDT
CFAV Sikanni (YTP611)	YPT
CFAV Sooke (YTD612)	YDT
CFAV Stikine (YTP613)	YPT
Generic Diving Support Craft	YDT
Fortune	YDT
Abalone	YDT

Resolute	YDT
Dungeness	YDT
Tonnerre	YDT
Sculpin	YDT
CFAV Oriole (KC480)	AXS
CFAV Orca (PCT55)	AXL
CFAV Raven (PCT56)	AXL
CFAV Caribou (PCT57)	AXL
CFAV Renard (PCT58)	AXL
CFAV Wolf (PCT59)	AXL
CFAV Grizzly (PCT60)	AXL
CFAV Cougar (PCT61)	AXL
CFAV Moose (PCT62)	AXL
CFAV Lawrenceville (YTL590)	YTL
CFAV Parksville (YTL591)	YTL
CFAV Listerville (YTL592)	YTL
CFAV Merrickville (YTL593)	YTL
CFAV Granville (YTL594)	YTL
CFAV Tillicum (YTM555)	YTM
CFAV Glendyne (YTB640)	YTB
CFAV Glendale (YTB641)	YTB
CFAV Glenevis (YTB642)	YTB
CFAV Glenbrook (YTB643)	YTB
CFAV Glenside (YTB644)	YTB
CFAV Firebrand (YTR562)	YTR
CFAV Quest (AGOR172)	AGORH
CFAV Firebird (YTR561)	YTR
HMCS Kingston (MM700)	MM
HMCS Glace Bay (MM701)	MM
HMCS Nanaimo (MM702)	MM
HMCS Edmonton (MM703)	MM
HMCS Shawinigan (MM704)	MM
HMCS Whitehorse (MM705)	MM
HMCS Yellowknife (MM706)	MM
HMCS Goose Bay (MM707)	MM
HMCS Moncton (MM708)	MM
HMCS Saskatoon (MM709)	MM
HMCS Brandon (MM710)	MM
HMCS Summerside (MM711)	MM
HMCS Protecteur (AOR509)	AORH
HMCS Preserver (AOR510)	AORH
HMCS Victoria (SSK876)	SSK
HMCS Windsor (SSK877)	SSK
HMCS Corner Brook (SSK878)	SSK
HMCS Chicoutimi (SSK879)	SSK
HMCS Halifax (FFH330)	FFGHM
HMCS Vancouver (FFH331)	FFGHM

HMCS Ville de Quebec (FFH332)	FFGHM
HMCS Toronto (FFH333)	FFGHM
HMCS Regina (FFH334)	FFGHM
HMCS Calgary (FFH335)	FFGHM
HMCS Montreal (FFH336)	FFGHM
HMCS Fredericton (FFH337)	FFGHM
HMCS Winnipeg (FFH338)	FFGHM
HMCS Charlottetown (FFH339)	FFGHM
HMCS St. John's (FFH340)	FFGHM
HMCS Ottawa (FFH341)	FFGHM
HMCS Iroquois (DDG 280)	DDGH
HMCS Athabaskan (DDG 282)	DDGH
HMCS Algonquin (DDG 283)	DDGH

Table 1 Canadian Forces Naval Vessels

The list of the current operational Royal Canadian Air Force airborne platforms is given below.

Model Name of Aircraft	***Canadian Designation***
Generic Airbus CC-150 Polaris	CC-150
Generic BAe CT-155 Hawk	CT-155
Generic Boeing CC-177 Globemaster III	CC-177
Generic Bombardier CC-144 Challenger	CC-144
Generic Canadair CT-114 Tutor	CT-114
Generic DHC CC-115 Buffalo	CC-115
Generic DHC CC-138 Twin Otter	CC-138
Generic DHC CT-142 Dash 8	CT-142
Generic Lockheed C-130E Hercules	CC-130E
Generic Lockheed C-130H Hercules	CC-130H
Generic Lockheed C-130H-30 Hercules	CC-130H-30
Generic Lockheed C-130T Hercules	CC-130T
Generic Lockheed C-130 Super Hercules	CC-130J-30
Generic Lockheed CP-140 Aurora Block I	CP-140
Generic Lockheed CP-140 Aurora Block II	CP-140
Generic Lockheed CP-140 Aurora Block III	CP-140
Generic Lockheed CP-140A Arcturus	CP-140A
Generic Lockheed Martin CC-130J Super Hercules	CC-130J
Generic McDonnell Douglass CF-18A Hornet	CF-188A
Generic McDonnell Douglass CF-18B Hornet	CF-188B
Generic Raytheon CT-156 Harvard II	CT-156
Generic Bell CH-139 JetRanger	CH-139
Generic Bell CH-146 Griffon	CH-146
Generic Sikorsky CH-124A ASW Sea King	CH-124A
Generic Sikorsky CH-124B Utility Sea King	CH-124B
Generic AgustaWestland CH-149 Cormorant	CH-149

Generic Sikorsky CH-148 Cyclone	CH-148
Generic Boeing CH-147D Chinook	CH-147D
Generic Boeing CH-147F Chinook	CH-147F
Generic Boeing ScanEagle	SUAV
Generic Maveric UAS	MUAV
Generic IAI CU-170 Heron	CU-170
Generic MMIST CQ-10A SnowGoose	CQ-10A
Generic MMIST CA-10B SnowGoose	CQ-10B

Table 2 Canadian Forces Airborne Platforms

The list of the current operational Canadian Army platforms is given below. Some of the equipment listed may be of a basic type (e.g. utility vehicle) but they may be used in conjunction with electronic systems, such as the Combat Net Radio.

Vehicle Model	***Vehicle Type***
Generic Grizzly AVGP Armoured Personnel Carrier	AVGP
Generic Cougar WFSV	WFSV
Generic Cougar H Joint EOD Rapid Response Vehicle	JERRV
Generic Buffalo A2 Mine Protected Vehicle	Buffalo MPV
Generic Buffalo 3 M Armoured Recovery Vehicle	Buffalo AVGP
Generic Aardvark Joint Service Flail Unit	Aardvark JSFU
Generic Husky Vehicle Mounted Mine Detector	Husky VMMD
Generic Husky Armoured Vehicle General Purpose	Husky AVGP
Generic LAV 25	LAV 25
Generic Bison Armoured Personnel Carrier	Bison
Generic Coyote Armoured Reconnaissance	Coyote
Generic LAV III	LAV III
Generic Stryker	Stryker
Generic ADATS	ADATS
Generic Leopard C2 Main Battle Tank	Leopard C2 MBT
Generic Leopard 2A4+ Main Battle Tank	Leopard 2A4+ MBT
Generic Leopard 2A6 Main Battle Tank	Leopard 2A6 MBT
Generic Leopard 2A6M Main Battle Tank	Leopard 2A6M MBT
Generic LUVW G-Wagon	LUVW
Generic M113A3 Armoured Personnel Carrier	M113A3
Generic RG-31 Nyala	RG-31
Generic Textron TAPV Armoured Personnel Carrier	Textron TAPV
Generic Mamba Armoured Personnel Carrier	Mamba APC
Badger Armoured Engineering Vehicle	Badger AEV
Generic Beaver Armoured Bridge-Laying Vehicle	Beaver AVLB
Generic Taurus Armoured Recovery Vehicle	Taurus ARV
Generic MILCOTS Silverado Light Utility Vehicle	Silverado LUV
Generic Iveco Light Support Utility Vehicle	Iveco LSVW
Generic M35 Medium Logistic Vehicle	M35 MLVW
Generic Navistar 7000 Series Medium Logistic Vehicle	Navistar MSVS

Generic Steyr Heavy Logistic Vehicle	Steyr HLVW
Generic Bandvagn 206 Tracked Utility Vehicle	Bv206 TUV
Generic Mercedes Armoured Heavy Support Vehicle Systems	Mercedes AHSVS
Generic Tropco XF95 Heavy Equipment Tractor	Tropco HET
Generic Bison-Chassis Battlefield Radar	TRILS
Generic Bison-Chassis Electronic Warfare Evaluation	AERIES

Table 3 Canadian Forces Land Systems Platforms

The following is a summary of CF electronic subsystem equipment, sorted by N2R category. For each subsystem, a search was made in original equipment manufacturer specifications and public resources. All relevant characteristics have been recorded in the database accompanying this report.

Subsystem	***Type***
Type 2041 MicroPUFFS	Acoustic Sensor
Type 2040 Bow	Acoustic Sensor
Type 2019 Intercept	Acoustic Sensor
AN/SQS-510 HMS MF	Acoustic Sensor
Type 2007 Flank Array	Acoustic Sensor
HELRAS DS-100	Acoustic Sensor
AN/SSQ-36 XBT	Acoustic Sensor
AN/SSQ-41B LOFAR (Jezebel)	Acoustic Sensor
AN/SSQ-53B DIFAR	Acoustic Sensor
AN/SSQ-53C DIFAR	Acoustic Sensor
AN/SSQ-53D DIFAR	Acoustic Sensor
AN/SSQ-53E DIFAR	Acoustic Sensor
AN/SSQ-53F DIFAR GPS	Acoustic Sensor
AN/SSQ-57B LOFAR	Acoustic Sensor
AN/SSQ-62B DICASS	Acoustic Sensor
AN/SSQ-62C DICASS	Acoustic Sensor
AN/SSQ-62D DICASS	Acoustic Sensor
AN/SSQ-62E DICASS	Acoustic Sensor
AN/SSQ-565 DICASS	Acoustic Sensor
AN/SSQ-573 DIFAR	Acoustic Sensor
AN/SSQ-553G DIFAR	Acoustic Sensor
AN/SSQ-530 DIFAR	Acoustic Sensor
AN/SSQ-536 XBT	Acoustic Sensor
AN/SSQ-110 EER	Acoustic Sensor
AN/SSQ-110A EER	Acoustic Sensor
AN/SSQ-77B Passive VLAD	Acoustic Sensor
AN/SQS-510 VDS MF	Acoustic Sensor
AN/AQS-502 Dipping Sonar	Acoustic Sensor
Thales Type 2046 VLF	Acoustic Sensor
AN/SQR-501 CANTASS	Acoustic Sensor

AN/UYS-501 HMS processor - Active	Acoustic Processor
AN/UYS-501 VDS processor - Active	Acoustic Processor
AN/UYS-503 SBY processor - Active	Acoustic Processor
AN/UYS-504 SBY processor - Active	Acoustic Processor
OL 5004 SBY processor - Active	Acoustic Processor
AN/UYS-501 HMS processor - Passive BB	Acoustic Processor
AN/UYS-501 VDS processor - Passive BB	Acoustic Processor
AN/UYS-501 CANTASS processor - Passive BB	Acoustic Processor
AN/UYS-503 SBY processor - Passive BB	Acoustic Processor
AN/UYS-504 SBY processor - Passive BB	Acoustic Processor
AN/AYK-502 SBY processor - Passive BB	Acoustic Processor
OL 5004 SBY processor - Passive BB	Acoustic Processor
AN/UYS-501 HMS processor - Passive NB	Acoustic Processor
AN/UYS-501 VDS processor - Passive NB	Acoustic Processor
AN/UYS-501 CANTASS processor - Passive NB	Acoustic Processor
AN/UYS-503 SBY processor - Passive NB	Acoustic Processor
AN/UYS-504 SBY processor - Passive NB	Acoustic Processor
AN/AYK-502 SBY processor - Passive NB	Acoustic Processor
OL 5004 SBY processor - Passive NB	Acoustic Processor
AN/ARC-210 V/UHF	EM – Comms
AN/ARR-502B SBY RX	EM – Comms
AN/ARC-243	EM – Comms
SATCOM	EM – Comms
AN/ARS-501 SBY Ref Sys	EM – Comms
AN/APX-502 IFF	EM – Comms
AN/ARC-511	EM – Comms
EPLRS	EM – Comms
AN/SLQ-501 intercept (Canews)	EM – ESM
AN/SLQ-503 (Ramses) jammer	EM – ESM
AN/SLQ-504 Racal Kestrel	EM – ESM
AN/SLQ-505 jammer	EM – ESM
AN/ULR-501 Sea Search	EM – ESM
AN/SRD-501 HF/DF	EM – ESM
AN/SRD-502 (Telegon 4) HF/DF	EM – ESM
AN/SRD-503 HF/DF	EM – ESM
AN/SRD-504 HF/DF	EM – ESM
AN/ULQ-6 jammer	EM – ESM
AN/WLR-1C radar analyzer	EM – ESM
AN/APX-72 MKXII IFF	EM – ESM
AN/SRN-504	EM – ESM
AN/URN-25 TACAN	EM – ESM
AN/ALQ-210	EM – ESM
AN/ALQ-217	EM – ESM
AN/APX-502 IFF	EM – ESM
Sea Giraffe 150 HC	EM – Radar
AN/APS-143B(V)3	EM – Radar
AN/SPQ-501 (DA08) E/F	EM – Radar

AN/SPQ-502 (LW08) D	EM – Radar
AN/APS-503	EM – Radar
AN/APS-506	EM – Radar
AN/APS-507	EM – Radar
AN/APS-508	EM – Radar
AN/SPS-49(V)5	EM – Radar
Kelvin Hughes Type 1007	EM – Radar

Table 4 List of CF Subsystem Equipment

The above list is not complete. As more sensor subsystems are uncovered the database should be extended to include new subsystems from the CF inventory.

2.4 Data Availability

Much of the high-level information about subsystems in naval and airborne platforms can be found in a variety of publicly available documents. These sources identify what electronic systems are integrated into each platform. Also, the capabilities are described in broad terms, and some specific parameters are listed.

As an example, for a particular airborne asset the operational speed, service ceiling and range are listed. More detail is given in listings of the electronic systems such as the radars (such as specifying the precise model numbers or AN Designation numbers), electronic support measure systems (giving model numbers or AN Designation numbers), communication systems, and acoustic processor systems (giving model numbers or AN Designation numbers).

Using a number of defense industry publication catalogues such as those by Jane's Information Group (which specializes in military and aerospace subject matter), more information and data can be found that is of direct use in data gathering for N2R data input.

A variety of online resources also offer data that can be used for N2R data input, and for corroboration. In some cases additional data can be found to extend the data coverage. The online resources comprise original equipment manufacturers, trade studies, and encyclopedia sites.

The trustworthiness of information pertaining to the identified subsystems is high, since original publication of the data is a result of the tendering process. But this is for the high-level data only (i.e. subsystem identification) and data regarding a sensor system's performance or precise operational modes is much less well known.

When precise data is required for a sensor's characteristics, this data is much less reliable and occasionally contradictory values have been found. Further, we found that no publicly available resource could identify all the sensor characteristics as a complete set as required by the N2R data sheets. System specifications would show only a handful of the needed data items.

Platform narrow band and broad band tonal spectrum could not be found in any public resources. Also, acoustic target strength and radar cross sectional data for CF equipment was not found.

Antenna and sonar beam pattern data was not found. This information is deemed to be highly sensitive, especially for war fighting assets.

Data that was found to be trustworthy was included in the current N2R Excel database. A total of 30 acoustic sensor systems, 8 communication system, 17 ESM, and 14 radar systems were identified.

It is clear that a full and complete set of reliable sensor characteristics must come from technical documents delivered with the original equipment subsystems, or from research performed by DND (as in the case of acoustic signatures and radar cross sections).

2.5 Data Collection and Contact Development

All data information collected has been assembled within the appropriate worksheets of the aforementioned Excel database. This database is named "N2R_CA_Platforms" and is delivered along with this report.

Primary resources used in this work were:

- Jane's Fighting Ships 2009-2010,

  Ed. Cdre Stephen Saunders RN, IHS Jane's (Global) Limited, UK

- Jane's Radar and Electronic Warfare Systems 2009-2010,

  Ed. Martin Streetly, IHS Jane's (Global) Limited, Surrey, UK

- Naval Institute Guide to World Naval Weapon Systems,

  Ed. Norman Friedman, U.S. Naval Institute, Annapolis, Maryland, USA

- Naval Institute Guide to the Ships and Aircraft of the U.S. Fleet,

  Ed. Norman Polmar, U.S. Naval Institute, Annapolis, Maryland, USA

This collection of books forms a backbone of platform, sensor and weapon data for many nations. The resources are updated with the latest technical data that is available and unclassified. The information contained within is considered to be reliable. The coverage of data required for N2R is not complete.

Original equipment manufacturer online resources used were:

- MacDonald, Dettwiller and Associates Ltd., (radar systems)

  http://is.mdacorporation.com

- Saab AB, (radar systems)

  http://www.saabgroup.com

- Telephonics Corporation, (radar systems)

  http://www.telephonics.com

- Thales Nederland B.V. (radar systems)

  http://www.thalesgroup.com

- Southwest Research Institute, (radar systems)

  http://www.swri.org

- NavCom Defense Electronics Inc. (transponders)

  http://www.navcom.com

- Rockwell-Collins Inc. (communications and network radios)

  http://www.rockwellcollins.com

- DPD Productions Inc. (military radios)

  http://dpdproductions.com

- Ultra Electronics Inc. (sonobuoy systems)

  http://www.ultra-fei.com

- Iridium Communications Inc. (communication devices)

  http://www.iridium.com

- L3 Ocean Systems, L-3 Communications Holdings, Inc. (sonar systems)

  http://l-3mps.com

- General Dynamics Canada Ltd. (sonar systems)

  http://gdcanada.com

The above original equipment manufacturers have some brief technical data listed in their various product specifications. The data listed is considered to be reliable, but the coverage of data required for N2R is not complete. All sensitive and classified data will not be listed.

Other online resources are more varied, but considered to be less reliable. Some of the sites are:

- Wikipedia – This internet resource has a large collection of Canadian military information in the form of an encyclopedia. But since the data presented can be changed or mis-managed by anyone, it is considered to be less than reliable.

  It can be a good source for external Reference links to more rigorous information and original sources.

  http://www.wikipedia.org

- Jerry Proc – Research papers published by Jerry Proc and collected data regarding the history of Canadian military and naval communications. He has expended a large effort to collect detailed data about subsystems for current and retired Canadian platforms.

  http://jproc.ca

- Federation of American Scientists – This organization works to provide science-based analysis and information to the public and government. It is a non-profit organization that was founded in 1945 by many of the original Manhattan Project scientists. Currently, it is staffed with professionals in the field of biology, biochemistry, chemistry, environmental science, nuclear engineering, physics and political science. More than 65 Nobel laureates have endorsed FAS.

  http://www.fas.org

- Defense Industry Daily – An online defense industry publication dedicated to military equipment acquisition and programs.

  http://www.defenseindustrydaily.com

- Global Security – A private national security company that is a leading source of background information related to acquisition of defense, space, intelligence and homeland security systems. It is not associated with any military, public, or private organization. The director is a member of FAS.

  http://www.globalsecurity.org

More detailed information, including specific web page links, are stored in the N2R_CA_Platforms database. These are grouped by electronic sensor systems on individual worksheets. The list can be found below the sensor data in a section entitled "NOTES". More relevant notes can be stored here as data gathering work progresses.

Finally, reliable information of a more general nature can be found at the Canadian Armed Forces web pages. Using the search function, one is able to find basic overview and some generic technical specifications for various platforms (such as transport aircraft currently in use).

- http://www.forces.gc.ca

A related resource that is more specific to the Canadian Army's land forces equipment. Once again, the pages offer broad descriptions that also include some technical details. The site can be found at:

- http://army.ca

These government resources can be considered to be reliable, although the data is only at a fairly high level. A complete and comprehensive set of required N2R data cannot found be in these locations.

During the execution of this task it was understood that network access to the CSNI would be available soon. The core of the problem was that extensive renovations were underway on building D201. We and the MetOc project staff were lead to believe that the renovations would be completed at some point soon. As a result, some time was spent on building the N2R database into a practical tool that is open to the user, and in collecting as much publicly available data as time would allow.

Discussions with the MetOc Centre staff suggested that much of the classified data for airborne platforms can be found in the Aircraft Operating Instructions (for example, the CP-140 Aircraft Operating Instructions). It is not certain that all of the N2R required data will be found therein, such as the various radar cross sections for all aspects, all frequencies, and all polarization.

Other sources of detailed information regarding electronic sensor systems will be typically found in CFTO technical documentation in use with the RCN and RCAF. Acoustic and array towing data may likely be found at the Maritime Warfare Centre. These measurements are typically made on sound ranges such as the AUTEC range in the Bahamas. Radar cross section data is measured on FORACS ranges, and the information could be held by the Maritime Warfare Centre or DRDC-Valcartier.

Key people who have offered their assistance to obtaining more data and platform characteristics are:

- Major N. Scantland,

Senior Staff Officer Meteorology and Oceanography,

NORM.SCANTLAND@forces.gc.ca

Major Scantland has a background with the Royal Canadian Air Force, and can provide information on where to obtain further data on aircraft and aircraft subsystems.

- PO2 S. Hopper

  Meteorology and Oceanography Centre, Trinity

  William.Hopper@forces.gc.ca

  Petty Officer 2nd Class Hopper works with the naval acoustic data and would be a prime resource to obtain the relevant acoustical characteristics of the Canadian naval vessels.

- Dugald Thomson

  Underwater Acoustics Research Officer at ADAC

  Dugald.Thomson@forces.gc.ca

  Officer Thomson works at the Acoustic Data Analysis Centre and would be a prime resource to obtain underwater acoustical and target strength characteristic data for Canadian naval vessels.

Two more valuable resources that may be able to fill the gaps in the required N2R are listed below. There was not enough time remaining to fully explore these leads.

- Canadian Forces Aerospace Warfare Centre,

  Located within CFB Trenton, Ontario

  This centre is designated to become the Canadian centre of excellence for aerospace power.

- Joint Meteorological Centre,

  Located within CFB Gagetown, New Brunswick

  This new centre will incorporate the former Army Meteorological Centre and interconnect with the MetOc Centres at CFB Halifax and CFB Esquimalt.

References

W7714-115155/002/SV	Contract entitled “Data Gathering” awarded 2013-02-20.
CANADA_PSDB.zip	Set of Word document data collection templates.
N2R_CA_PLATFORMS.xlsm	Excel workbook containing acquired N2R data for CF platforms.

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List of acronyms

ADAC	Acoustic Data Analysis Centre
AOI	Aircraft Operating Instructions
AUTEC	Atlantic Undersea Test and Evaluation Center
CF	Canadian Forces
CFTO	Canadian Forces Technical Order
CSNI	Canadian Secret Network Infrastructure
DND	Department of National Defence
DRDC	Defence Research & Development Canada
DRDKIM	Director Research and Development Knowledge and Information Management
EM	Electro Magnetic
ESM	Electronic Support Measures
GD-IT	General Dynamics Information Technology
NITES IIR or N2R	Navy Integrated Tactical Environmental System Variant II Redesign
PSDB	Platform-Sensor Database
R&D	Research & Development
SOW	Statement of Work
URL	Uniform Resource Locator
USN	United States Navy