Evaluation of the AN/SSQ-573 as a Multistatic Receiver

Contractor Report

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Abstract

The Canadian Forces are updating the acoustic processing capability on the CP-140 Aurora Aircraft. Included in this effort is the delivery of the MVASP (Modular VME Acoustic Signal Processor) system to replace the older OL-5004/AYS acoustic processor. MVASP includes the capability to process fields of sonobuoys as an integrated Multistatic Active Sonar. An upgraded DIFAR (Directional Frequency Analysis and Recording) buoy (AN/SSQ-573) with multistatic performance enhancements is being developed. DAEPM (M) requested that DRDC Atlantic investigate the bearing performance of the AN/SSQ-573 sonobuoy.

A contract was awarded to compare the performance of the AN/SSQ-573 DIFAR sonobuoy relative to two production DIFAR sonobuoy models (AN/SSQ-53D(3) and AN/SSQ-53F). Detection performance and bearing accuracy were examined for medium- to low-SNR simulated echoes at the Canadian Forces Maritime Experimental and Test Ranges. The contract was successful in that it provided insight into the relative performance, though some questions were raised, related to bearing bias, which could not be fully investigated within the scope of this work. This report summarizes the contracted work performed while the results were provided to DRDC Atlantic for further analysis and inclusion in a DRDC Atlantic Technical Memorandum.

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Executive summary

Evaluation of the AN/SSQ-573 as a Multistatic Receiver: Contractor Report

Joe Hood; Ben Bougher; May 2013.

Introduction: The Canadian Maritime Patrol Aircraft (MPA) Anti-Submarine Warfare (ASW) capability is being updated to include a sonobuoy-based multistatic active sonar capability. With the additional signal processing and information management capability, a review and update of the sensor suite is required.

In January 2010 DRDC Atlantic and Akoostix Inc. investigated the performance of three DIFAR (Directional Frequency Analysis and Recording) sonobuoy designs in multistatic scenarios at the Canadian Forces Maritime Experimental and Test Ranges (CFMETR). The sonobuoys used in the tests were: AN/SSQ-53F in DIFAR mode, AN/SSQ-53D(3), AN/SSQ-573 in LFA (low-frequency active) mode, and AN/SSQ-573 in DIFAR mode. During the experiments, simulated echoes, using frequency modulation (FM) and continuous wave (CW) pings, were transmitted with varying source levels and received by a total of 16 sonobuoys located at four posts surrounding the source.

Results: In undertaking this work, Akoostix enhanced the STAR (software tools for analysis and research) package to allow for easier analysis of this type. This document includes a description of the work elements, progress, and recommendations. The sonobuoy-analysis results are included in a separate DRDC Atlantic Technical Memorandum and show that the variance of the bearing estimates increases dramatically as SNR decreases below a threshold, which is expected.

Significance: This document describes the work required to efficiently analyze the sonobuoy data using the DRDC analysis tools. The study identifies a bias in the bearing estimates of three DIFAR sonobuoy designs. Discovery of this source of error raises the critical question, “What is the operational impact of biased bearing estimates?” As promised detection ranges increase with the introduction of operational airborne multistatic-active-sonar capabilities, the impact may be found to be larger than with traditional passive operations.

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Acknowledgements

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1 Introduction

This contractor report documents work performed under contract W7707-4500772426 for Project Authority (PA), James Theriault. The work was performed between May 2010 and September 2010.

The objectives of this contract were to study the performance of the AN/SSQ-573 DIFAR sonobuoy relative to similar in-service DIFAR models (AN/SSQ-53D(3) and AN/SSQ-53F). Performance was examined for simulated low signal-to-noise ratio (SNR) multistatic echoes. The related experiments and analysis are fully documented in a DRDC Atlantic Technical Memorandum (TM) [1]. This work is an extension of a previous effort where the same sensors were examined for performance receiving multistatic echoes shortly after reception of a loud sonar pulse (main blast) [2].

This report provides a description of the work performed for each of the tasks listed in the Statement of Requirements (SOR), and documents other important detail not captured in the related TM. The report is organized as follows:

- Section 2 details the work performed under this contract.
- Section 3 documents recommendations for future work.
- Section 4 provides configuration management (CM) information to help users understand which version of the software was used for this work.
- Section 5 summarizes the results of the project with conclusions.
- Annex A provides a brief description of the software used to support this project.

2 Technical Effort

This section provides a description of how the tasks in the Statement of Work (SOW) were achieved. Effort related to each SOW task is described in the corresponding subsection below.

Information related to this analysis is captured in the *trials09* Subversion (SVN) repository under *cfmetr_10-1/difar_test/*. The repository contains scripts, non-acoustic data (NAD), notes, and logs. A full version of the trial data was also delivered to DRDC at the end of the contract which includes larger raw and processed data files and other information that does not require version control. This repository includes the analysis notebook, containing detailed notes and figures that explain the approach used during the contract.

2.1 Analysis Planning

Analysis planning occurred early in the contract. The plan was captured in PowerPoint slides that were reviewed with the PA at the kick-off meeting and subsequently approved. This plan closely reflected the vision presented in the SOW. The kick-off slides also captured project management plans, risks, and assumptions.

In addition to the planning, the following effort was expended:

- The original trial reconstruction had not incorporated AN/SSQ-53D(3) positions, which do not provide GPS (global positioning system) position information. The buoy drop and final positions were analyzed for two of the four sensors and compared to other sensor drift. Akoostix determined that the buoys drifted in a manner similar to the AN/SSQ-573, so the drift from one of these sensors, at the same post, was translated to the AN/SSQ-53D(3) to derive an estimated position.
- The SOW required that Akoostix perform testing to validate their method of estimating SNR. This was performed using synthetic data of known SNR, showing that the STAR (software tools for analysis and research) SNR estimation algorithm was adequate.
- Akoostix obtained and reviewed a paper discussing theoretical bearing estimation performance for DIFAR sensors [3]. These theoretical results were later compared to experimental results.

2.2 Signal Quality Analysis

Under this task, the data from the CFMETR 10-1 DIFAR performance experiment were processed and the results were examined to ensure that the data was of sufficient quality for the performance analysis. Processing included DIFAR demultiplexing (DEMUX), where the DEMUX operation was monitored for quality (loss of lock). The data were then beam-formed and processed to support detection of Frequency Modulated (FM) and Continuous Wave (CW) signals. (See [1] and the processing scripts on the associated SVN repository for more detail.)

2.3 Detection Performance Analysis

Under this task, automated processing scripts used for similar work were adapted to this data set and used to perform STAR echo analyses on each time series. Several adjustments were iteratively made to improve the process and achieve better results. The analysis was performed after each adjustment to determine the impact of the change and generate ideas for the next iteration:

- The scripts were adapted to deal with DIFAR sensors (previous processing was on omni-directional sensors).
- The underlying analysis functions were enhanced to perform a broader search, over time and beam, for the best signal in the search region (near the predicted signal arrival time). Prior to this improvement the best signal within a time window on the designated beam was used, with a search conducted over each beam. After the improvement, the user has the option for a full 2D search over time and beam.
- Minor adjustments were made to the various processing parameters to obtain unbiased results. For example, adjustments were made to noise windows to avoid including neighbouring signals in noise estimates, while including as many data points as possible to average over more data. As a final quality-assurance check, regions of lost lock and RF (radio frequency) interference were manually removed from the analysis logs.

The analysis logs, produced by STAR, were used to perform the performance analysis. Data were plotted a number of ways and analyzed to infer performance. Akoostix performed an initial analysis of the results, and then met with DRDC scientists to get their interpretation of the results. More work was performed after this meeting to refine and improve the presentation of results (e.g. figures), and to refine the related analysis and discussion. The most useful analysis was used in [1], while the scripts used to perform all analysis and many other plots were captured with the trial data.

Approximately 70% of the project effort was expended on this task and related documentation.

2.4 Software Maintenance and Enhancement

Only a small amount of effort was used for software maintenance and enhancement under this contract, 17 hours. This was used to address some issues in OPD (omni passive display) that made it easier to perform overview processing on the data.

2.5 Report Generation

Effort under this task was focused on providing input and support for a DRDC Atlantic TM [1]. A small amount of effort was also used to generate this contractor report. In addition to the TM, considerable notes, analysis logs, and figures were created that are archived with the data.

3 Recommendations

Ideas for improvement of both the software and algorithms are frequently generated during a contract. This section documents those recommendations, capturing both a high-level description of the suggestion and a rough order-of-magnitude (ROM) estimate of the required effort. Each section contains a summary table itemizing the ideas and the related ROM. Often a reference to a Jira ticket (used for STAR issue tracking), where more detailed information is available, is also provided.

ROM estimates are generated after a preliminary review of the requirements and therefore could have significant variance. They are broken down into the following categories:

- Very Small is less than one (1) day of effort
- Small is between one (1) day and five (5) days of effort
- Medium is between one (1) week and two (2) weeks of effort
- Large is more than two (2) weeks of effort

Table 1 is a summary of selected issues related to this call-up. These issues are further explained in the following subsections.

Table 1: Selected issues related to this call-up

Jira ID	Type	Summary	Estimated Effort
AKSP-86 and AKOT-131	Enhancement	Generate processing for Arctan bearing calculation on ETI data	Medium to Large
AKSP-85	Enhancement	Modularize the DIFAR demultiplexor and create an SPPACS application	Medium to Large
AKSP-87	Enhancement	Compute Correlation Energy Envelope	Medium
AKOT-132	Enhancement	Better Detector for Echo Analysis	Small
See SPPACS in Jira for numerous issues	Enhancements and Defects	SPPACS Design Upgrades and Maintenance	Large

3.1 Generate processing for Arctan bearing calculation on ETI data

During this contract, the team discussed experimenting with other methods of bearing calculation. (Beam interpolation was used for this analysis.) One common method of bearing calculation is computing the arctangent from the relative phase and amplitude of the DIFAR Sine and Cosine channels. SPPACS (signal processing packages) currently has the ability to perform arctan bearing calculation on spectral data. A similar processing capability should be created for ETI (energy time integration) data in SPLIB (signal processing library) and then integrated into an SPPACS application. This would allow DRDC to compare the performance of these two methods of bearing estimation. (MVASP currently uses arctan bearing estimation for ETI data.)

The processing should be prototyped in STAR-IDL before developing the SPLIB module to ensure that the algorithm is correct. Methods for storing the data should also be considered. The SPPACS application sp_arctan currently packs the intensity and bearing data into one fixed-point 32-bit value. This avoids the requirement to synchronize two data files (one for bearing and another for intensity), and is currently used in other STAR-IDL applications. Other options could include an independent bearing file with one bearing for each time sample, and multi-beam intensity data. This change would allow users to benefit from the beamforming gain on the displays, while having access to the pre-computed bearing estimate. A new design should also consider how other bearing estimation methods might be integrated for future analysis and comparison.

Once the SPPACS application is ready, STAR-IDL should be upgraded to support use of this data type. This would require enhancement of the STAR-IDL ETI analysis application and the echo (and potentially main blast) analysis functions. There may also be a number of options on how this could be implemented to account for the new data type and future growth.

The effort estimate for this work is ROM (Medium to Large). The actual effort required would depend on the design choices selected. It may be possible to iteratively develop this capability using smaller work packages.

3.2 Modularize the DIFAR demultiplexor and create an SPPACS application

The current DIFAR demultiplexor (DEMUX) is run as a stand-alone application that cannot be connected to an SPPACS stream, as it will not accept or produce data using pipes (stdin, stdout). It is also not modularized so that it could be integrated into applications such as OPD to enable DIFAR processing. Finally, the DEMUX application requires filters be available from the current directory (i.e. directory from which the application is run). These limitations reduce the potential for reuse and batch processing efficiency.

Akoostix recommends that the DEMUX be ported into an SPLIB module, but contained in its own library to simplify control over the source code. This integration effort would allow for either static definition of filters, or an environmental variable that defines the location of the filters. This change would also allow the DEMUX to be used as an object code library with defined interfaces, which would increase its value to other users. Once this work is completed it would be straightforward to integrate the module into an application compatible with SPPACS, and to use it in other applications (e.g. GUI (graphical user interface)-based demultiplexor, OPD, etc.).

3.3 Compute Correlation Energy Envelope

The current correlation processing (sp_correlate) has the option to output raw, magnitude, or log-magnitude of a correlation process. It may also be helpful to have access to the energy envelope, which among other things could be used to simplify the data decimation process. The energy-envelope could be computed rigorously (i.e. use Hilbert transform to compute a phase-shifted version of the signal and added in quadrature, or using an approximation such as the Taeger-Kaiser Energy Operator [4]).

It may be possible to optimize the Hilbert transform as part of the filter operation by avoiding the forward FFT (fast fourier transform) if this is performed in sp_correlate. We may also need to be able to delay the energy envelope calculation to avoid losing phase information which would be required for arctan bearing calculation.

3.4 Better Detector for Echo Analysis

The current STAR-IDL echo-analysis functions for ETI and CW data detect the signal of interest by finding the maximum level within a given range of data. Performance, especially for automated processing, might be improved by using an alternate detector such as the likelihood-detector.

The small ROM estimate assumes that the selected detector is not complicated (e.g. maximum likelihood-detector).

3.5 SPPACS Design Upgrades and Maintenance

There are a growing number of minor defects and design issues in SPPACS and it has been over seven years since the last time that SPPACS has received any major design upgrades. Akoostix recommends that a block of effort be assigned to prioritize the issues and perform an upgrade to the general design, along the lines of the previous recommendations.

As much of this task could be completed in small, independent work elements the total effort required for this task is difficult to estimate. Akoostix recommends that tasks are selected and prioritized based on available budget.

4 Configuration Management

The final software deliverable for this contract was provided on the STAR release CD (compact disk) - version 6.6.4. The CD was generated and delivered on September 30st, 2010. This software release contains the original project deliverables. This section of the document describes the content of that CD.

4.1 STAR Branch and Release Information

Each logical grouping of software modules has been independently assembled on the CD. The current STAR release version is 6.6.4 and contains the following:

- OPD 2.3.1
- ACDC 2.1.5
- SPPACS 1.1.5
- Analysis Tools 6.8.1 (STAR-IDL)

The 6.6.4 release CD was generated in conjunction with other DISO (Departmental Individual Standing Offer) call-ups. Installation instructions are located in the root directory on the release CD.

4.1.1 STAR Software Documentation

Manuals, API (application program interface) documentation, and other design documents are provided with the 6.6.4 software release CD. In a normal STAR installation they can be found by opening the */usr/local/atools/star-6.6.4/documentation.html* file in a web browser. This page contains links to several sets of documentation including revision history, the IDLDoc for the analysis tools (STAR-IDL), the manual for the analysis tools, and DOxygen generated documents for OPD, ACDC (acoustic cetacean detection capability) and SPPACs.

PDF (portable data format) versions of user manuals for mature software can be found in the *manuals* directory on the root of the CD.

4.2 Issue Summary

The issue summary in Table 2 shows the current state of known defects for all of the software release candidates listed in Section 3 and 4.1 as of September 2010.

The distribution of issues is indicative of the maturity of the software. Though maturing, much of this software is composed of various evolutions of an iterative design, especially command line SPPACS applications and STAR-IDL components. This software would benefit from general design improvements and refactoring. There are no active blocker issues but there are several critical issues. These are obscure or infrequent bugs that were discovered during current work, but budget or schedule has been insufficient to address them yet. Critical issues are issues that still allow the operator to perform their function but could cause erroneous results or loss of data in those instances. These bugs should be fixed in the near future. Only Blocker issues do not have a work-around and need to be addressed before a contact can be completed successfully.

Table 2: Issue Summary (Severity vs. Status) for all software on STAR release 6.6.4

	New	Assigned	Reopened	Resolved	Verified	Closed
Blocker	0	0	0	2	0	20
Critical	4	6	1	4	0	53
Major	23	8	3	10	0	70
Normal	26	5	2	4	1	74
Minor	17	3	1	1	0	15
Trivial	7	0	0	0	0	2
Undecided	0	3	0	0	0	2

Table 3 summarizes the critical issues that remain open, but only for software relevant to this contract. None of the critical issues had any effect on the success of this contract. Resolution of these issues may increase efficiency during the execution of future call-ups or contracts.

Table 3: Known critical issues for OPD (omni passive display) and Active LAND (lagrangian ambient noise drifter) Buoy

Module	Issue ID	Summary	Description
OPD	OPDY90	OPD hangs when validating data sources	OPD tries to verify the data stream by reading as much data as required to determine the format and sensors. It stalls the system until it receives this information. An array server can be accepting connections but not sending data. This is particularly annoying since OPD connects to Northern Watch Array Server automatically as soon as a valid IP (Internet Protocol) address and port are given. Workaround: 1. The last used port is saved in the registry settings. It can be changed manually before resetting OPD; or 2. You can start the array server on the previously saved port. This will unclog it.
OPD	OPDY180	Crash with extreme processing parameters	It is still possible to crash OPD when memory limits are exceeded. The minimum amount of buffer size required to set up an extreme processing stream may still exceeds a PC's memory resources.
OPD	OPDY199	Bad combination of zero padding/overlap in the processing parameters dialog can cause a hang	If you choose something like 8192 FFT size, 8191 zero pads, and anything but a 0% overlap, you end up with (8192-8191)*(1-overlap) which for any overlap but 0% will cause an integer round to 0. This is an extreme case and it not likely to be used.

5 Summary and Conclusions

This contract was successful in that it provided insight into the performance of the AN/SSQ-573 DIFAR sonobuoy relative to two production DIFAR sonobuoy models (AN/SSQ-53D(3) and AN/SSQ-53F). Detection performance and bearing accuracy were examined for medium- to low-SNR simulated echoes in a realistic underwater environment at CFMETR.

No significant differences in performance were noted between the DIFAR models. However, a concern, related to bearing bias, was raised and further documented in [1]. The cause could not be identified, but recommendations for further experimentation and analysis were provided and included in the reference [1].

References

[1] Theriault, J.A., Collison, N.E., Mosher, D.R., Hood, J.D., Bougher, B.B., DIFAR Sonobuoy Bearing Accuracy, Comparison of An/SSQ-53D(3), AN/SSQ-53F, and AN/SSQ-573 Performance, DRDC Atlantic Technical Memorandum 2010-244. Dec 2012.

[2] Hood, J. (2009), Analysis of SSQ-573 and SSQ-565 Buoy Performance, DRDC Atlantic Contract Report 2009-145, in review.

[3] Maranda, B. (2003), The Statistical Accuracy of an Arctangent Bearing Estimator, In *Proceedings of OCEANS 2003*, 2127-2132(4), San Diego, CA: IEEE.

[4] Kandia V., Stylianou Y., and Dutoit, T. (2008), Improve the accuracy of TDOA measurement using the Teager-Kaiser Energy operator, In *Proceedings of the International Workshop on New Trends for Environmental Monitoring Using Passive Systems (PASSIVE '08)*, Hyeres, France: IEEE.

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Annex A Software Tools

This section provides background information necessary to understand the role that DRDC software played in this contract. Their relationship to the project is described below while a high-level description of the tool itself is provided in the subsections below:

- SPPACS was used to complete most of the data processing (detection processing, spectrogram generation, and beamforming) along with basic data conversion and utility tasks such as WAV to DAT file format conversion and time stamping.
- STAR-IDL was used to perform the majority of the data analysis. The existing power-spectral-analysis application was one of the primary tools, though custom scripts were also developed to prototype data displays and perform custom analysis.
- OPD was used for more detailed spectral processing and classification of signals. It was also used to visualize large segments of data and extract smaller samples for analysis in Adobe Audition where complementary time series and aural analysis was conducted. (The power-spectral-analysis application was the primary data extraction tool for this contract.)
- ACDC was as a secondary tool to examine detection results, playing only a minor role on this contract.

A.1 Signal Processing Packages (SPPACS)

SPPACS is a group of software programs that are based on the C/C++ programming languages with each application providing a specific processing or utility function. The programs are designed to run on Linux and OSX-based PCs and typically work with Defence Research Establishment Atlantic (DREA) formatted data files (DAT), though format converters are also contained in the suite. SPPACS has slowly evolved to its present day state.

The SPPACS software suite consists of two types of software. One type is runtime executables. These applications have proven to be very useful in simplifying data management and sonar processing tasks by providing a set of tools from which to build the necessary, and customized, processing streams. These streams can be run from a command line or assembled into scripts to perform batch-processing tasks allowing for large amounts of data to be automatically and incrementally processed.

The second form of the software is a group of library functions that can be used by other programs to efficiently perform standard tasks. These library functions are extensively used by the runtime software, but can also used for other applications, such as OPD. There are several types of libraries of which three are most commonly used in SPPACS:

- Utility (e.g. math, geo, filesystem, …) libraries that consist of routines for performing tasks, such as header manipulation, geospatial data representation, and command line parsing.
- Signal Processing (e.g. splib) libraries that contain modules for low-level signal processing. A new SPPACS module typically consists of one or more SPLIB modules linked together with an SPPACS user interface.

- Sonar Processing (e.g. sonlib) libraries that contain modules consisting of several SPLIB modules linked internally to create a complex sonar module, such as passive processing.

By separating the library code above from SPPACS, more generic and reusable software was created. These modules are independent of the data-header format, time-stamping method, etc., and are suitable for integration in real-time processing systems. The libraries can be built to run on a number of UNIX, OSX or Microsoft Windows platforms and on less common processors such as the ARM core and Texas Instruments (TI) DSPs (digital signal processor). Once successfully ported, the CMAKE build environment supports subsequent builds with a command line option.

The C and C++ elements of the libraries are intentionally separated to ensure that the core capability, found primarily in the C modules, can be readily moved to systems that don't support the more complex language features employed in the C++ version of the libraries. For the most part, the C++ layer consists of a wrapper on the C layer providing a more generic method of instantiating, connecting, and running modules. This capability is provided by inheritance that is, in part, the adoption of a common interface from a base class allowing parts of the system to interact with a module without knowing the details of the module. Connection of SPPACS applications using UNIX pipes provides similar functionality at the application layer.

SPPACS is also supported by a number of libraries, such as the Fastest Fourier Transform in the West (FFTW), helping to ensure that the SPPACS software runs as efficiently as possible, while providing a significant reduction in coding effort. These dependencies, and the associated licenses, are tracked for those projects that require knowledge of intellectual property.

A.2 STAR-IDL

The STAR-IDL[1] tools were developed to support general research and analysis objectives at DRDC Atlantic. The actual software goes hand-in-hand with an analysis process that is intended to help formalize a reliable and consistent research and analysis methodology. The primary objectives of the STAR-IDL tools are:

- Provide scientific grade analysis tools that allow for efficient, detailed quantitative and qualitative analysis of a data set.
- Provide scientific grade algorithm prototyping and refinement tools that can be used to quickly realize a variety of algorithm options, validate the basis of the algorithm, and determine the best approach to use for system prototypes.
- Support synergy between DRDC groups and the Department of National Defence (DND) by providing a common software base for analysis. This synergy encourages inter-group communication and simplifies user training, analysis-process development, documentation and data portability.
- Support cost and analysis efficiency by providing software reuse and common tools and data formats. Examples of efficiency would be using the output of analysis from one tool as the

[1] The STAR-IDL tools were formerly referred to as the Software Tools for Analysis and Research (STAR). The STAR Software Suite has evolved to mean the greater tool set, including OPD, ACDC, SPPACS, etc.

input for another, or using common software components to lower development cost of several custom analysis tools.

Most STAR-IDL components are currently implemented using Interactive Data Language (IDL), though the design is not restricted to IDL. For example, localization algorithms contained in C++ libraries are accessed from IDL.

Applications in the STAR-IDL tools are built using a combination of reusable and custom components that meet the requirements of each application. The layered design and common components allow for rapid and logical development of new capabilities. Though currently focused on two main areas: sonar data processing and analysis, and target localization, tracking, and multi-sensor data fusion; the tools are capable of expanding to meet other analysis and research requirements.

A.3 Omni-Passive Display (OPD)

OPD is a standalone signal processing application designed to run on UNIX, OSX, and Microsoft Windows platforms. It can be used to quickly produce sonogram, energy-time integration (ETI), and amplitude-line integration (ALI) output from DREA digital acoustic tape (.DAT/.DAT32) files, wave files, sound card, Environmental Acoustics Data AQuistion (EADAQ), Rapidly Deployable System (RDS), and Northern Watch. The following functions summarize its capability (detailed information can be found in the OPD User Manual):

- A user can quickly set up the desired signal processing by loading in a preset configuration from storage, or by simply defining the desired frequency and time resolution. A user can also define a wide range of parameters, including Fast Fourier Transform (FFT) size, zero padding, overlap, quantization range and much more.
- Annotations can be added to the data. The user can assign a category (or classification) to the annotation from a list of presets as well as provide free-form text to associate with the annotation. Previously generated annotations are displayed on screen when processing data associated with the annotation.
- Each processing result is stored in memory and can be selected for viewing and analysis. Analysis tools include a crosshair cursor for time-frequency measurements.
- The entire sonogram can be saved to an image file to capture the output for reports, etc.
- A WAV-file extraction tool allows the operator to define a region within a sonogram and clip the raw data associated with the selected bounds into a WAV file.

List of acronyms

2D	2 Dimension
ACDC	Acoustic Cetacean Detection Capability
ALI	Amplitude Line Integration
API	Application Program Interface
AS	Acoustic Subsystem
ASW	Anti-Submarine Warfare
CD	Compact Disk
CFMETR	Canadian Forces Maritime Experimental and Test Ranges
CM	Configuration Management
CW	Continuous Wave
DAEPM(M)	Director, Aerospace Equipment Program Management-Maritime
DAT	Digital Acoustic Tape
DEMUX	Demultiplexer
DIFAR	Directional Frequency Analysis and Recording
DISO	Departmental Individual Standing Offer
DND	Department of National Defence
DRDC	Defence Research & Development Canada
DRDKIM	Director Research and Development Knowledge and Information Management
DREA	Defence Research Establishment Atlantic
DSP	Digital Signal Processor
EADAQ	Environmental Acoustics Data AQuistion
ETI	Energy Time Integration
FFT	Fast Fourier Transform
FFTW	Fastest Fourier Transform in the West
FM	Frequency Modulated
GPS	Global Positioning System
GUI	Graphical User Interface
IDL	Interactive Data Language
IP	Internet Protocol

LAND	Lagrangian Ambient Noise Drifter
LFA	Low Frequency Active
MPA	Maritime Patrol Aircraft
MVASP	Modular VME Acoustic Signal Processor
NAD	Non-Acosutic Data
OPD	Omni Passive Display
PA	Project Authority
PDF	Portable Data Format
RF	Radio Frequency
R&D	Research & Development
RDS	Rapidly Deployable System
ROM	Rough Order-of-Magnitude
SNR	Signal to Noise Ratio
SOR	Statement of Requirements
SOW	Statement of Work
SPLIB	Signal Processing Library
SPPACS	Signal Processing Packages
STAR	Software Tools for Analysis and Research
TM	Technical Memorandum
VME	Virtual Machine Environment