AD NUMBER

ADB091119

NEW LIMITATION CHANGE

TO

Approved for public release, distribution unlimited

FROM

Distribution authorized to DoD and DoD contractors only; Critical Technology; 01 APR 1985. Other requests shall be referred to Naval Ocean Research and Development Activity, AEAS Program, Code 201, NSTL Station, MS 39529.

AUTHORITY

ONR ltr, 31 Jan 2006

FINAL TECHNICAL REPORT

SEAS SUPPORT

Contract N00014-80-C-0911

SYSTEMS INTEGRATED

No. SD850-115-901

FINAL TECHNICAL REPORT

SEAS SUPPORT

Contract N00014-80-C-0911

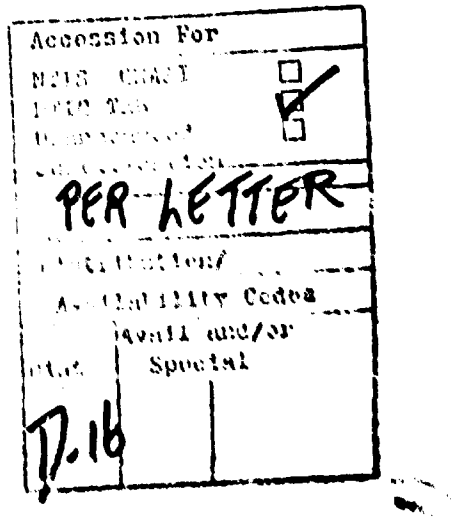
29 FEBRUARY 1984

by

Systems Integrated
7394 Trade Street
San Diego, CA 92121

Foreward

This report is submitted by Systems Integrated in accordance with Exhibit Line Item Number A002, DD Form 1423 of Contract N00014-80-C-0911.



I. INTRODUCTION

This final report presents the results of the work accomplished by Systems Integrated under Contract N00014-80-C-0911 and the associated amendments/modifications to the subject contract. There were, in total, ten (10) modifications. Hence, although the contract was effective 1 August 1980, the final date for the completion of the contract with its modifications was not until 29 February 1984.

The work performed by Systems Integrated (SI) under the contract covered a variety of tasks which included:

- Support for the SEAS WESTLANT 80 exercise,
- Acoustic data analysis,
- Inventory of SEAS measurement hardware
- Installation, maintenance, and operations of the MFA System,
- Repair of the TAPP III beamformer and the SEAS Batch Processing System,
- Installation and upgrading of TAPP III for an on-board processing system,
- Procurement of a computer to run ASEPS software,
- Provide support for AMES
- Support for OUTPOST CREOLE, BIG DIPPER and MFA

First, a summary of the tasks as delineated in the contract and subsequent modifications are presented. Then the work accomplished is discussed. Every effort has been made to relate the results of the work to a specific tasl assignment and/or modification.

II. SUMMARY OF TASKS

The following summarizes the tasks that were to be performed by the contractor (Systems Integrated) in accordance with Contract N00014-80-C-0911 and associated amendments/modifications.

As stated in terms of the original contract, the contractor shall provide FY80 support for the Surveillance Environmental Acoustic Support Program (SEAS) WESTLANT 80 exercise. Specifically, the contractor will repair and provide maintenance of the TAPP III beamformer system and Batch Processing System. In addition, the contractor will provide at-sea support during WESTLANT 80 by furnishing senior technical personnel who have a thorough knowledge in the following SEAS systems: Mid-Frequency Array collection system (MFA), Batch Processing System (BATCH), Non-Acoustic Data Subsystems (NADS) and Satellite Navigation System (SATNAV). The contractor will also provide training for other SEAS personnel on the above systems.

Under the terms of Modification P00001, the contractor shall provide technical support to the SEAS Measurements Program in the area of data analysis and processing systems. Specifically, the contractor will perform the following tasks:

Task 1: SEAS Processing System Maintenance - The contractor will continue to house, maintain and operate the SEAS at-sea processing hardware during FY81. In addition, the contractor will provide instruction to SEAS sponsored users on an "as required" basis.

Task 2: MFA Processing for Data Analysis - The contractor will provide a systems engineer to support the reinstallation of the MFA processing hardware at NOSC. In addition, the contractor will provide an engineer/scientist to support the BIG DIPPER data processing activities at NOSC.

Task 3: SEAS Inventory - The contractor will make a comprehensive inventory of all the SEAS Measurement Program's hardware at the end of WESTLANT. Equipment to be inventoried includes all that of NOSC, NORDA, APL/JH and ARL/UT. The inventory records will be placed on the SEAS batch processor at Systems Integrated, San Diego. Deliverable is computer printouts of SEAS inventory by 15 March 1980.

Under the terms of Modification P00002, the contractor shall perform the following tasks:

Task 1: Technical assistance during system performance tests. The contractor shall support SEAS in operational performance tests for the TAPP III beamformer system.

Task 2: Repair and maintenance of the TAPP III beamformer system.

Task 3: Repair and maintenance of the SEAS BATCH processing system.

Under the terms of Modification P00003, the contractor shall perform the following task:

On-Board Processing System Support - The contractor shall house and provide maintenance for the SEAS on-board processing hardware. Also, the contractor shall support integration of the hardware into the Mid-Frequency Array (MFA) van prior to OUTPOST CREOLE and shall provide maintenance in the field as needed.

The contractor shall also perform the following tasks:

a. On-Board Processing Upgrade - The Towed Array Performance Prediction (TAPP) III system hardware will be upgraded and modified to support analysis of data from a surveillance towed array. Specifically, the TAPP system will be interfaced to the MFA beamformer and programmed to provide 64 channels of spectrum analysis. In addition, the batch processor software from MFA and TAPP shall be assembled on the SEAS batch processor.

b. MFA Beamformer - Digital Filter Diagnostic - The contractor shall provide a software package to display data in real time from the MFA beamformer. The display must permit a user to detect beamformer or filter malfunction by comparing data collected with expected data.

c. HP 5420 Interface - The contractor shall develop the software to interface the HP 5420A Digital Signal Analyzer to the MFA Beamformer Controller. The software must permit the user to exercise all the HP 5420A functions from the computer terminal and to store data for plotting in post-exercise analysis.

Under the terms of Modification P00004, the contractor shall purchase a computer system for the Surveillance Environmental Acoustic Support (SEAS) Program. The Automatic Signal Excess Prediction System (ASEPS) software will be installed on this compu.er. The powerful ASEPS modeling system is currently useable only in the confines of the laboratory. The need exists to operate this system efficiently and effectively in the field. Therefore, to support the Fleet, it is imperative to find a suitable mini-computer system to fulfil: this te.* A Hewlett Packard System (as set forth in Attachment Number 1) is recommended in order to maintain consistency with the current SEAS hardware and software. This will allow useable software already developed on the SEAS systems to be installed.

Under the terms of Modification P00005, the contractor shall operate and provide support for the Surveillance Environmental Acoustic Support (SEAS) processor during Exercise OUTPOST CREOLE Cruise 3. Specifically, the contractor shall perform the following tasks:

Task 1: The contractor shall provide for the testing of various subsystems at Dallas, Texas, and for system integration in Great Britain.

Task 2: The contractor shall operate and maintain the SEAS processor from 10 September 1982 to 24 November 1982 at-sea and ashore.

Task 3: The contractor shall maintain the SEAS DSP equipment as required intermittently from 1 September 1982 to 24 November 1982.

Under the terms of Modification P00006, the contractor shall assemble the required data processing and collection systems and furnish oceanographic services for the duration of the SEAS environmental acoustics measurements exercise. Such work shall be in general accordance with Section 1.2, page 1-2 of the contractor's proposal, entitled "Technical Proposal to Provide Systems Support for SEAS Array Processor", dated 11 August 1982, which section is incorporated herein by reference.

Under the terms of Modification P00007, the contractor shall expand the present effort to include the following tasks:

Task 1: AMES Software Execution - Provide software support for the Acoustic Measurement and Evaluation Systems (AMES) by developing the PASCAL source code, compiling on the UNIVAC 1100/80, handling of device drivers, program debugging, and other functions, as necessary, to handle all system functions using applications software.

Task 2: Data Analysis Using AMES - Provide personnel with knowledge of the AMES and with scientific and report preparation experience. Using these qualified personnel, use the AMES to perform signal processing, interactive displays, echo measurements, processor emulation, reverberation measurements, non-isotropic measurements, and appropriate environmental measurements. Enter data via magnetic tape, store and process as directed by supervising scientist, and organize in a format suitable for reporting purposes.

Task 3: Provide Software Support - Provide personnel to install the HP 1000 software into the AMES.

Task 4: Data Collection and Processing - Operate the HP 1000 system in conjunction with the AMES to provide greater processing capacity and failure backup.

Task 5: Hardware Support - Maintain the HP system by performing preventive maintenance and unscheduled repairs.

Such work shall be in general accordance with Pages 2-1 through 6-1 of the contractor's Proposal Number 821-014-100, entitled "Proposal to Provide Support for the Acoustic Measurement and Evaluation System", dated 14 October 1982.

Modification P00008 amended the cost of the contract. No tasks were involved.

Under the terms of Modification P00009, the contractor shall thoroughly analyze acoustic and non-acoustic data collected during FY82/83 at-sea exercises. These data were collected by using the Digital Signal Processing (DSP) beamformer, the SEAS Array Processor (SAP), and the

Non-Acoustic Data Subsystem (NADS). During the at-sea exercises, data were analyzed on a first look basis only. It is now necessary to thoroughly analyze the data to examine specific areas and times of interest. Also, the contractor shall support the post-processing area. This shall be accomplished by configuring a post-processing computer system and installing the SEAS analysis software. The contractor shall then provide personnel to play back High Digital Density Recorder (HDDR) tapes through the SAP system and the processing system. All personnel shall be systems experts capable of maintaining and operating the SEAS collection and processing systems. These services shall be in general accordance with Pages 1-1 through 3-1 of the contractor's Proposal No. 830-203-001, entitled "Technical Proposal to Provide Post-Processing Support for OUTPOST CREOLE Data", dated 3 February 1983, which pages are incorporated herein by reference.

Under the terms of Modification P00010, the contractor shall provide additional assistance in processing of recorded data from the AMES System and maintain and operate the analysis system.

III. DISCUSSION OF WORK ACCOMPLISHED

In accordance with the assigned tasks under the original contract, Systems Integrated provided support to NORDA during the WESTLANT 80 at-sea exercises. The period of performance was from 20 August 1980 to 31 December 1980. The support provided by Systems Integrated was to take on the responsibility of operating and maintaining the following systems during the tests:

a) TAPP Beamformer System

b) Batch Processing System

c) Digital Filter System

d) Non-Acoustic Data Subsystems

e) Satellite Navigation System

Briefly, the primary data collection system (which accepted data from the above systems) used during WESTLANT 80 was the Mid-Frequency Acoustics (MFA) collection system. The MFA system took hydrophone and beam data from a beamformer and provided 48 channels of selectable data to digital filters. The resulting output data from the filters covered 4 separate frequency bands with a total output of 384 channels. These 384 channels are routed to a Hewlett Packard 1000 series computer and processed. The results are then stored on magnetic tape.

For WESTLANT 80, SI developed the necessary hardware interfaces and software to process and collect data from the digital filters. The software developed was a system driver that took control signals from the digital filters and outputted the resultant data to a 9-track magnetic tape. The majority of the software was written in HP assembly language and the remainder in FORTRAN. The collection system performed well during the tests.

During the at-sea exercises, SI personnel operated the MFA processing system and performed data reduction and analysis. The analysis consisted of running software to perform beam and hydrophone noise statistics, noise directionality, and array signal gain. The results were displayed in graphic form and tabular listings.

Systems Integrated also operated and maintained the satellite navigation system (SATNAV) during the exercise. The SATNAV consisted of a Magnavox 702 satellite receiver, a LORAN-C receiver, and a HP 1000 series computer. SI was responsible for setting up the proper parameters to produce dead reckoning positions, as well as ship's position via a satellite. The major parameters were the ship's heading, speed, antenna height, sail-line, date, and time. The SATNAV system dead reckoning did not perform well due to noisy LORAN-C signals. The SATNAV receiver

functioned properly and provided an accurate position when called upon approximately once every hour during the at-sea tests.

In short, SI successfully configured, maintained and operated the designated systems under the contract. An experienced SI engineer was aboard the research ship during all at-sea operations. SI technicians were available in ports-of-call, as required.

Under Modification P00001 to the contract, SI provided support to SEAS in the area of data analysis and processing systems between January 1981 and September 1981. This support was provided by senior level technical personnel from SI who were aboard the research ship during all of WESTLANT 80. At the end of the exercise, SI assisted in the demobilization of the MFA processing system for shipment to NOSC, San Diego, California. Upon arrival of the processing system at NOSC, SI engineers reconfigured the equipment to allow principal investigators the capability to analyze the data collected during WESTLANT 80. Assistance provided to principal investigators during the data reduction period consisted of operating the system, maintaining the equipment, and providing spare parts, as needed.

During this same period, SI completed an inventory of the SEAS measurement hardware which were located at NOSC, NORDA, APL/JHU, and ARL/UT. SI personnel visited all the sites and upon completion of the inventory, forwarded a master list of equipment to the SEAS program office. The completed inventory list is currently maintained at SI on a HP 9816 computer.

From September 1981 through June 1982, SI supported the SEAS measurement program in operational performance analysis of the TAPP III beamformer system. The TAPP III system had been used by SEAS during several at-sea exercises which included CHURCH STROKE I, II, and III. Several hundred High Density Digital Recorder (HDDR) tapes were generated by the TAPP III system during the exercises. However, before these tapes could be analyzed, a method of calibrating the TAPP III system was required. SI engineers reconfigured the TAPP III system to allow principal investigators from the CHURCH STROKE exercises to perform the required calibrations of the system during playback of the HDDR tapes.

During this period of data analysis by the principal investigators, SI provided personnel on a 24-hour basis to maintain the TAPP III system, the batch processing system, and the HDDR recorders.

From June 1982 through December 1982, SI provided support for the BIG DIPPER exercise under Modification P00003 to the contract. The SEAS on-board processing hardware was integrated/interfaced by SI (wherever applicable) with the Mid-Frequency Array (MFA) data collection system for the BIG DIPPER exercise. The only part of the SEAS on-board equipment that could not be readily integrated into the MFA system was the TAPP III. It was determined that upgrading the TAPP III would not be feasible nor cost effective. The exclusion of the TAPP III did not cause any problems since the MFA system already had a beamformer which had been procured from

Rockwell International.

A software package was written for the HP 2100 computer (which was part of the MFA system) to allow operators to observe, in real time on a display, the data received on the MFA beamformer and digital filters. Additionally, a program was written to interface a HP 5420 digital signal analyzer to the MFA beamformer which permitted the operator to store data for plotting during post-exercise data analysis.

SI assisted NOSC personnel to install the MFA data collection system in portable vans in San Diego prior to the at-sea exercise and provided engineers to operate the data collection system during the exercise from July through September 1982.

Concurrent with the work performed during this time period, SI procured a computer for SEAS. The SEAS modeling program office was in need of a portable computer system to run the Automatic Excess Predictions System (ASEPS) model in the field. SI performed an in-depth study of the ASEPS model to determine the feasibility of implementing the model on a microcomputer. The study took into consideration the following:

a) Is there a microcomputer based system designed to provide a secure, on-site, and predictive capability for ASEPS?

b) Can the system be utilized by SOSUS, SURTASS, RDSS, and future elements of the Integrated Undersea Surveillance System (IUSS)?

The major concern of the study was to determine if the proposed system had the capability to incorporate measured real-time data taken from the surveillance network (i.e., beam noise, measured array beam patterns, response, etc.) with measured on-site environmental data (sea temperature, wind speed, wave height, surface shipping, etc.)

The study indicated that the ASEPS software could, indeed, be handled by a microprocessor system. The system selected was the HP 1000. This system was chosen because of the compatibility between it and the rest of the SEAS systems, such as the beamformer control system, non-acoustic data subsystem (NADS), the SATNAV, the batch processor, and array processor.

The equipment purchased is listed in Table 1. Upon receipt of the equipment, the system was checked and then forwarded to COSL, Pearl Harbor, Hawaii.

HP 1000 PURCHASE EQUIPMENT LIST

Item	No.	Part No.	Description
1		2177C	HP 1000 Model 45 system
		014	Delete Memory
		019	Delete disc and console
2		12788E	512K Byte High Perf. Memory
3		12992D	Magtape Loader Rom
4		2648A	Graphics Terminal
		032	Interface
		007	Dual Cartridge Tapes
5		7925H	120m Byte Disc
6		12821A	Disc Interface
7		13356A	Disc Pack
8		7970E	1600 BPI Magnetic Tape
		236	Subsystem
9	2 ea.	59310B	GPIB Interface
10		2635B	Printing Terminal
		051	RS232 Edge Connector
11		26097A	Pedestal for Printing Terminal
12	2 ea.	12966A	RS232 Interface
		001	Cable for 2635B
		002	Cable for Modem (9845)
14	2 ea.	31389C	HPIB Cable; 4m
15		9872T	8 Pen Graphics Plotter

Table 1

HP 9845C PURCHASE EQUIPMENT LIST

Item	Part No.	Description
1	9845C	Color Desktop Computer
	250	187K Bytes; Fast Processor
	800	ASCII Keyboard
	060	ASCII Printer
2	98412A	I/O Rom
3	98417A	Data Com Rom
4	98034B	HPIB Interface
	445	Use with 9845
5	98046B	Data Com 35/45
	001	Male Connector
6	98035A	Real Time Clock
	001	U S Date Format
	045	Use with 9845
7	987776A	RGB Interface

Table 1 (Cont'd)

The basic contract was continued under Modification P00005 to 31 January 1983, in order for SI to provide support to SEAS for the OUTPOST CREOLE III exercise which followed immediately after the BIG DIPPER exercise.

OUTPOST CREOLE III required, however, a data processing and collection system that could do more than the system used on previous SEAS measurement programs. The system used in BIG DIPPER as well as WESTLANT 80 had some major deficiencies which had to be corrected before it could be used again in OUTPOST CREOLE III. First, there was no method of indicating to the user of the MFA digital filters used during BIG DIPPER and WESTLANT 80 when, and if, the filters were not functioning properly. Second, the throughput of the TAPP III beamformer was very low and indications from users were that the system was becoming obsolete from a hardware standpoint. Third, there was no real-time display associated with the data collection hardware.

Therefore, SI designed and implemented a new hardware suite to alleviate the above mentioned problems. The suite consisted of a beamformer controller, a redesigned TAPP system renamed SEAS Array Processor (SAP), and new SEAS processing system. The beamformer controller was designed to download parameters into the MFA beamformer (see Figure 1). These parameters included the number of hydrophones, number of beams, hydrophone spacing, cosine weighting, sample rate, SCU gain, array type, etc. The beamformer output provided beam and hydrophone data to the new SAP system.

SAP was designed to eliminate some of the problems associated with the TAPP system. Figure 2 shows a block diagram of the SAP. Briefly, the SAP system receives data from the MFA beamformer at a sample rate of 2048 per channel. The data is then "decimated" and "corner turned" by the HP E-series computer. The "corner turned" data is then sent to an A-series computer, which, in turn, sends it to the AD120B (with floating point capability). The AD120B performs complex FFTs and calculates power spectrums. The results are then sent back to the A-series computer which stores the data onto a 9-track magnetic tape. The output data is divided into 0.75 Hz bands with a .01 or .08 Hz resolution. The maximum number of channels allowed is 64 with the option of collecting either beam or hydrophone data. The minimum throughput of the SAP is 80%.

The SEAS processing system (see Figure 3) was developed to process the data tapes generated by the SAP. This system provides principal investigators with a tool (i.e., using the processing suite) to look at data in real time with the HP 5423 digital signal analyzer and/or to perform more complex calculations using a software package developed by SI. This package allows the user to perform the following functions:

1) General Statistics

BEAMFORMER CONTROLLER

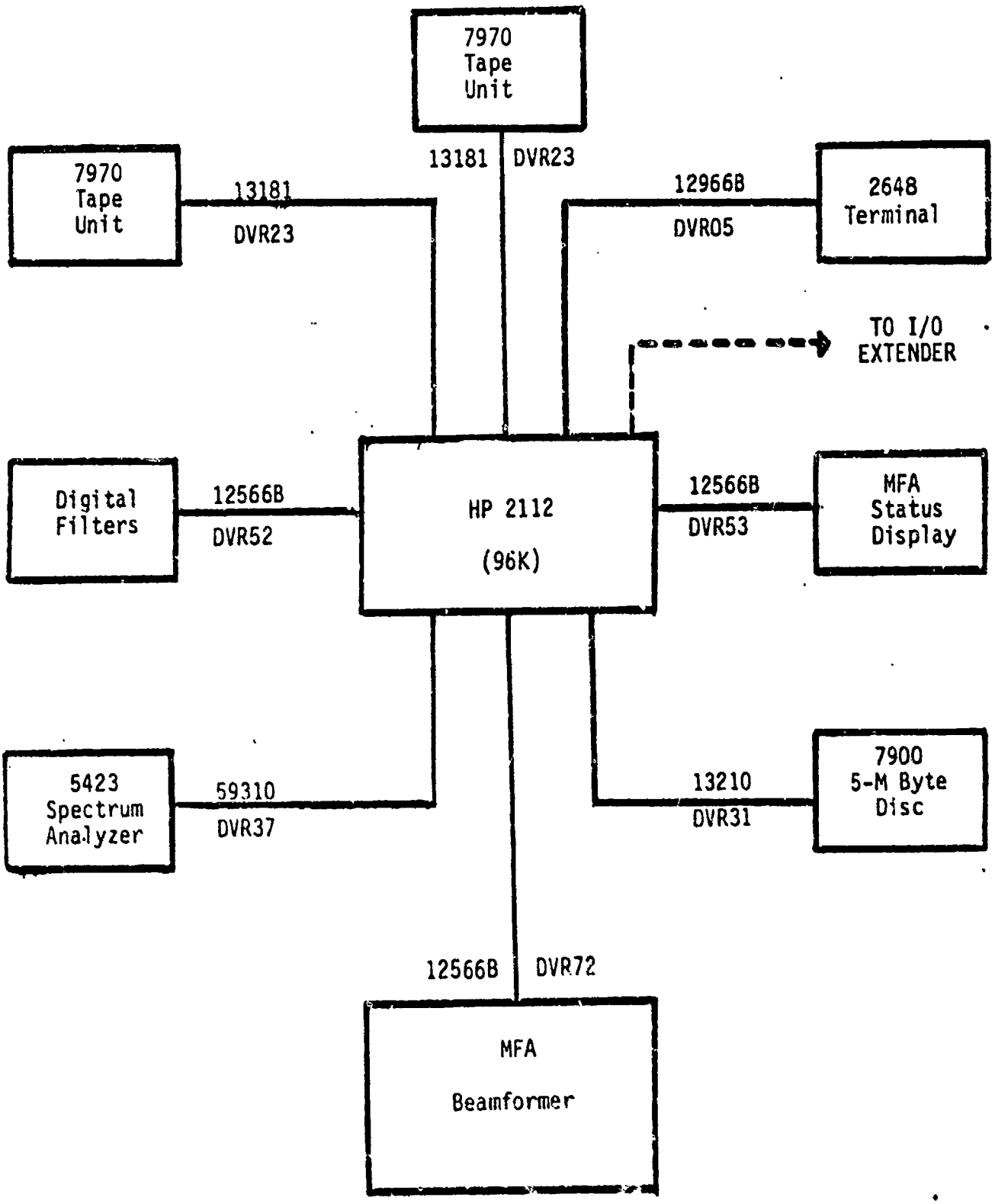


FIGURE 1

SEAS ARRAY PROCESSOR

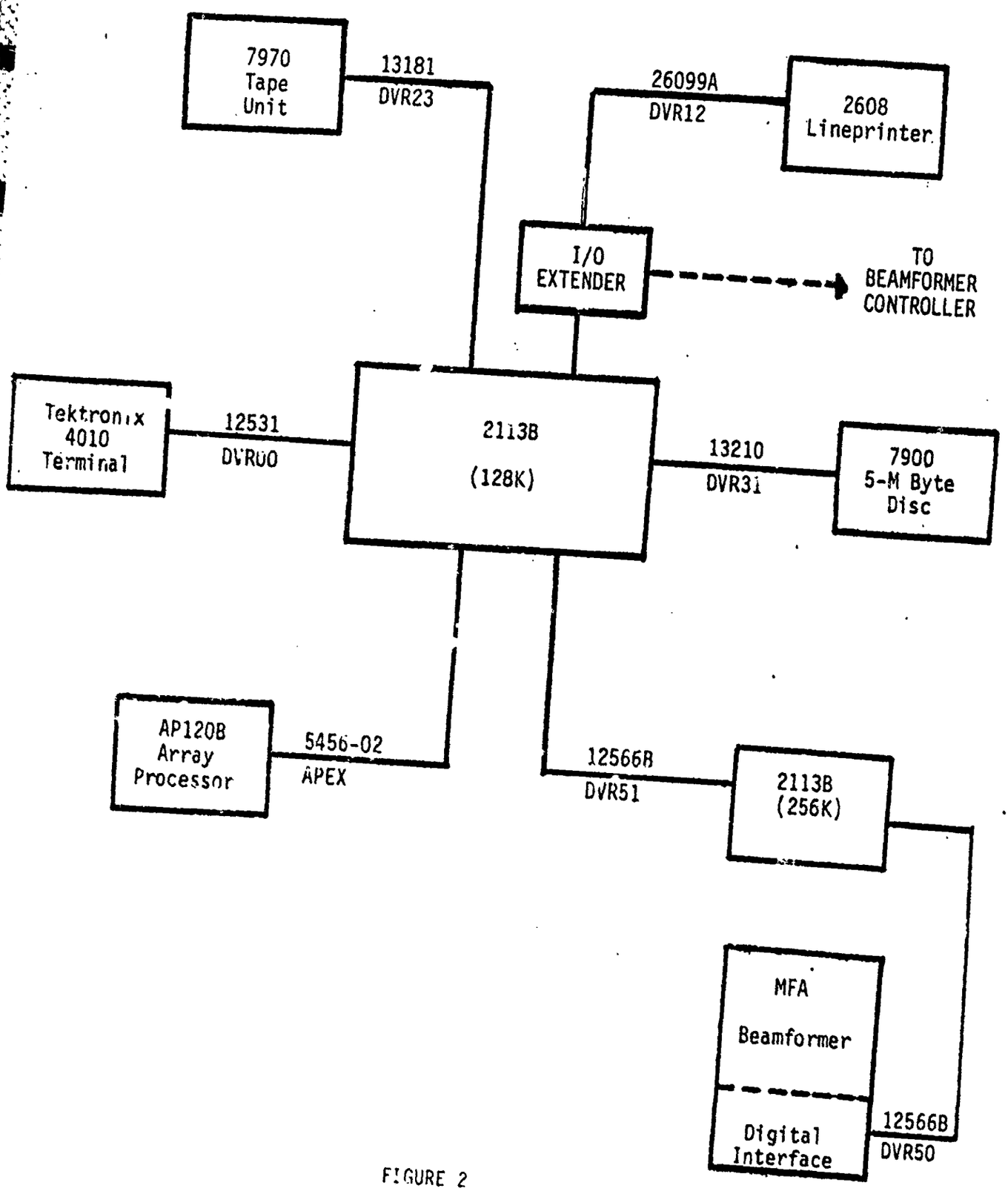


FIGURE 2

BATCH PROCESSOR

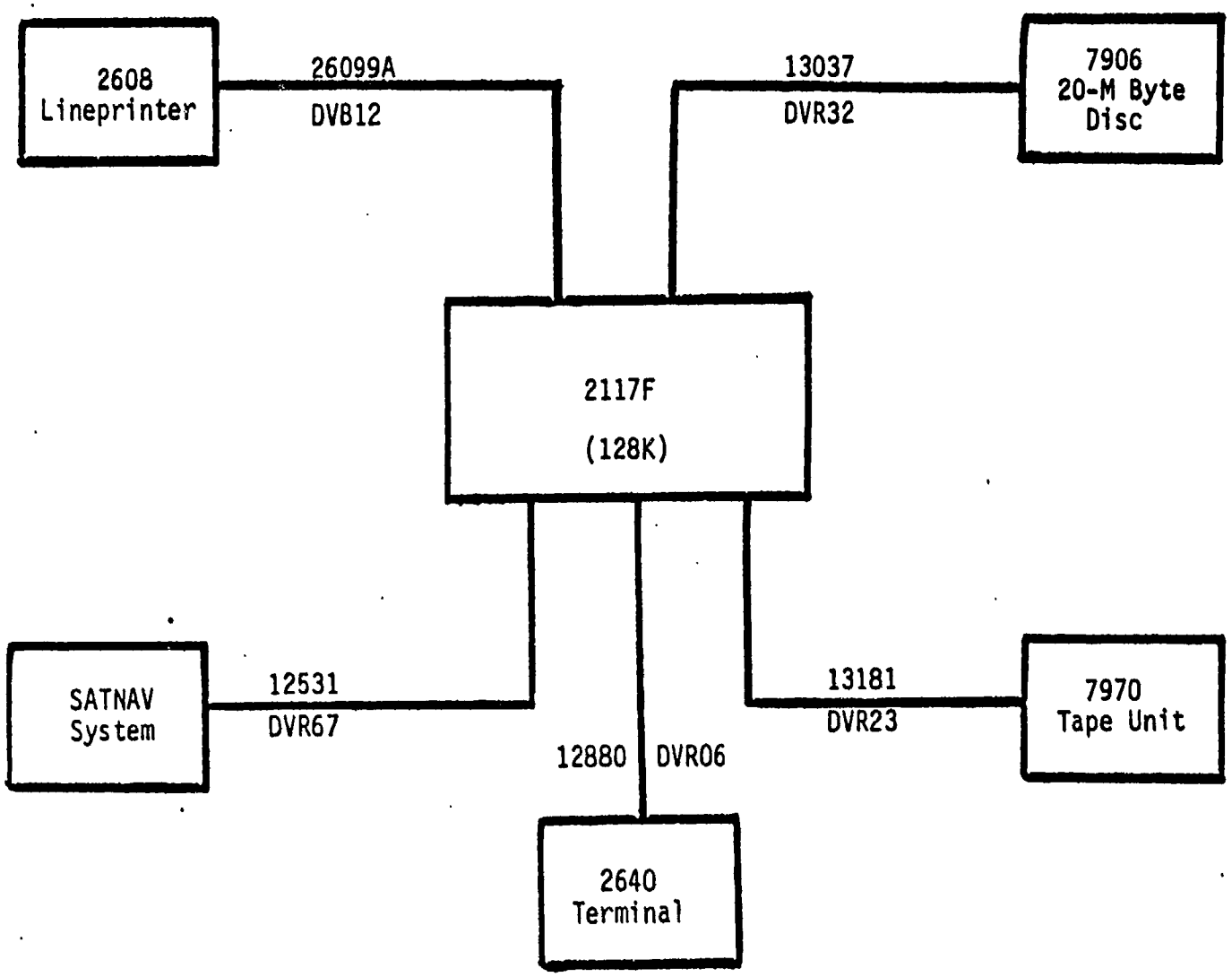


FIGURE 3

2) Beam/Hydrophone Level vs. Time

3) Beam/Hydrophone Level vs. Channel

4) Beam/Hydrophone Level vs. Frequency

5) Array Signal Gain (ASG)

6) Cumulative Distribution Function (CDF)

7) Scatter Diagrams/Plots

The above mentioned improvements to the SEAS measurement suite was completed in time for the OUTPOST CREOLE III at-sea exercise. Prior to the exercise, SI engineers accompanied the equipment vans to HydroScience, Inc., in Dallas, Texas, to perform checkouts and testing of the processing system interface with the towed array system that was used during the exercise.

SI personnel assisted in mobilizing the system onboard the exercise tow ship and then operated and maintained the system for the entire period of the OUTPOST CREOLE III exercise.

Under Modification P00006, SI assembled the required data processing and collection systems and furnished oceanographic services for the duration of OUTPOST CREOLE III. During the exercise, SI maintained and operated the SEAS Array Processor (SAP) which was the primary data collection system for the exercise. At the conclusion of the exercise, SI personnel performed postprocessing of the data onboard the research vessel right up to the time the ship returned to port and the equipment demobilized for shipment back to NOSC, San Diego.

SI personnel worked on a 24-hour basis during this postprocessing phase. The primary functions were to analyze the HDDR recordings using the digital filter and power spectrum routines which were part of the SAP software. The SAP tapes were then analyzed to provide principal investigators aboard with a "quick look" of the results.

In addition to processing the HDDR tapes, SI maintained the equipment and logged data processing procedures. The final task performed under Modification P00006 was to monitor the demobilizing of the HDDR, DSP beamformer, and the SAP. This task was necessary to make sure the collection system could be remobilized ashore at NOSC without damage to the equipment during shipment to San Diego.

For the period December 1983 through February 1984, SI performed (under Modification P00007) AMES software and hardware support. Acoustic Measurement and Evaluation System (AMES) is an acoustic processing system which accepts sonar data as well as ocean temperature and depth, and other ship operational data. AMES processes the data to provide intermediate

results such as interactive displays, echo measurements, environmental measurements, and integrated target strengths. The final outputs of AMES are time signatures, correlation functions, power spectrums, velocity profiles, ray-trace diagrams, histograms, range doppler maps, and various environmental acoustic descriptors.

SI provided software support for AMES in two areas; 1) supporting the Perkins-Elmer system at NOSC, and 2) expanding the capabilities of AMES by adding signal processing software that was operational on a HP 1000 system.

First, SI added a high speed display system to the AMES that had resided in the Perkins-Elmer system. The display system was manufactured by LEXIDATA. SI then improved the Perkins-Elmer system by upgrading the operating system to UNIX. The upgrading required the purchase of a hard disc, interfacing new devices to the mainframe, installing the UNIX operating system, and writing a custom driver program to interface the LEXIDATA display. When the system was reconfigured correctly, the AMES software was loaded onto the system and tested. (The AMES software was "debugged" by SI to eliminate differences in its operating system and UNIX.)

The upgrading of the Perkins-Elmer system allowed the loading to it of a signal processing software package from the HP 1000. The HP 1000 had a digital signal processing package entitled "DIGET". This package was operated as a backup to the Perkins-Elmer system during developmental phases. With the incorporation of the "DIGET" software into AMES, scientists can now use both sets of software on the same system.

During the OUTPOST CREOLE exercise in FY83, Systems Integrated provided engineers to maintain and operate the Digital Signal Processing (DSP) beamformer, the SEAS Array Processor (SAP), and the non-acoustic data subsystem (NADS). The output of the SAP system were digital 9-track magnetic tapes. These magnetic tapes contained averaged power spectrum data over three 4-Hz bands with 0.08 Hz resolution. However, the processing of the data, which was accomplished during the exercise, was on a "quick look" basis only. Modification P00009 tasked SI to perform a more complete reduction/analysis of the data utilizing the SAP system when the system would be back at NOSC.

Upon return of the OUTPOST CREOLE system to NOSC, personnel were provided by SI to reconfigure the system and to checkout all the equipment. SI then processed data for time periods of the exercise that were selected by NOSC principal investigators. The data was processed by taking the hydrophone data from the HDDR and inputting it into the DSP beamformer. The beamformer was set up to form beams that would look in the direction of a specified area of interest which had been determined by a reconstruction of the exercise. The output from the beamformer was 64 channels of beam and hydrophone signal levels which were input to the SAP system. The SAP system was programmed to utilize the optimum averaging period and frequency bands. The SAP generated a new 9-track magnetic tape with averaged spectrum data. This tape was then processed and produced the following

results that could be selected by investigators:

1) Statistics

2) Beam/Hydrophone Level vs. Time Plots

3) Beam/Hydrophone Level vs. Channel Plots

4) Beam/Hydrophone Level vs. Frequency Plots

5) Array Signal Gain (ASG) Calculation Listings

6) Cumulative Distribution Function (CDF) Listings

7) Scatter Plots of ASG vs. Signal-to-Noise Ratios (SNR)

The above results were either listed or plotted on a HP printer and bounded into notebooks for further analysis by principal investigators. The task was completed by 1 March 1984.

The final modification to the contract expanded the scope of Modification P00007 to provide additional assistance in processing data from the AMES system. SI provided the assistance with personnel, as needed and required, to operate and maintain the AMES hardware and software.

IV. CONCLUSION

It is believed that the work performed by Systems Integrated, and the accomplishments reported herein, has fully met the requirements and needs of the SEAS Program Office for the tasks as stated in ONR Contract N00014-80-C-0911 and related modifications. Systems Integrated is pleased to have been able to provide the support to SEAS under this contract that will further the technological data base of the U.S. Navy in undersea surveillance and ocean acoustics.

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
875 NORTH RANDOLPH STREET
SUITE 1425
ARLINGTON VA 22203-1995

IN REPLY REFER TO:

5510/1
Ser 321OA/011/06
31 Jan 06

MEMORANDUM FOR DISTRIBUTION LIST

Subj: DECLASSIFICATION OF LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP) DOCUMENTS

Ref: (a) SECNAVINST 5510.36

Encl: (1) List of DECLASSIFIED LRAPP Documents

1. In accordance with reference (a), a declassification review has been conducted on a number of classified LRAPP documents.

2. The LRAPP documents listed in enclosure (1) have been downgraded to UNCLASSIFIED and have been approved for public release. These documents should be remarked as follows:

   Classification changed to UNCLASSIFIED by authority of the Chief of Naval Operations (N772) letter N772A/6U875630, 20 January 2006.

   DISTRIBUTION STATEMENT A: Approved for Public Release; Distribution is unlimited.

3. Questions may be directed to the undersigned on (703) 696-4619, DSN 426-4619.

BRIAN LINK
By direction

Subj: DECLASSIFICATION OF LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP) DOCUMENTS

DISTRIBUTION LIST:

NAVOCEANO (Code N121LC – Jaime Ratliff)
NRL Washington (Code 5596.3 – Mary Templeman)
PEO LMW Det San Diego (PMS 181)
DTIC-OCQ (Larry Downing)
ARL, U of Texas
Blue Sea Corporation (Dr.Roy Gaul)
ONR 32B (CAPT Paul Stewart)
ONR 321OA (Dr. Ellen Livingston)
APL, U of Washington
APL, Johns Hopkins University
ARL, Penn State University
MPL of Scripps Institution of Oceanography
WHOI
NAVSEA
NAVAIR
NUWC
SAIC

Declassified LRAPP Documents

Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
NORDA35VOL.1BK 2OF3	Lauer, R.B.	THE ACOUSTIC MODEL EVALUATION COMMITTEE (AMEC) REPORTS, VOL. 2- APPENDICES A-D- EVALUATION OF THE FACT PL9D TRANSMISSION LOSS MODEL	Naval Ocean R&D Activity	810901	ND ADC034017	U
NORDA36VOL.3BK 2OF3	Lauer, R.B., et al.	THE ACOUSTIC MODEL EVALUATION COMMITTEE (AMEC) REPORTS, VOL. 3- APPENDICES A-D- EVALUATION OF THE RAYMODE X PROPAGATION LOSS MODEL (U)	Naval Ocean R&D Activity	810901	ND ADC034022	U
Unavailable	Hooper, M. W., et al.	MEASUREMENTS AND ANALYSIS OF ACOUSTIC BOTTOM INTERACTION IN THE NORTHWESTERN MEXICAN BASIN	University of Texas, Applied Research Laboratories	811005	ADA107551	U
Unavailable	Kirby, W. D.	FINAL REPORT FOR CONTRACT NUMBER N00014-78-C-0862	Science Applications Inc.	820201	ADA111000	U
Unavailable	Brunson, B. A., et al.	PHYSICAL SEDIMENT MODEL FOR THE PREDICTION OF SEAFLOOR GEOACOUSTIC PROPERTIES	Planning Systems Inc.	820701	ADA119445	U
Unavailable	Cavanagh, R. C., et al.	NORDA PARABOLIC EQUATION WORKSHOP, 31 MARCH - 3 APRIL 1981	Naval Ocean R&D Activity	820901	ADA121932	U
NORDA34VOL.1A	Martin, R. L., et al.	THE ACOUSTIC MODEL EVALUATION COMMITTEE (AMEC) REPORTS, VOL. 1A- SUMMARY OF RANGE INDEPENDENT ENVIRONMENT ACOUSTIC PROPAGATION DATA SETS	Naval Ocean R&D Activity	820901	ADC034017; ND	U
Unavailable	Bartberger, C. L., et al.	THE ACOUSTIC MODEL EVALUATION COMMITTEE (AMEC) REPORTS, VOLUME 2. THE EVALUATION OF	Naval Ocean R&D Activity	820901	ADC034019	U
Unavailable	Deavenport, R., et al.	THE ACOUSTIC MODEL EVALUATION COMMITTEE (AMEC) REPORTS, VOLUME 3. EVALUATION OF THE RAYMODE X PROPAGATION LOSS MODEL. BOOK 2. APPENDICES A-D	Naval Ocean R&D Activity	820901	ADC034022	U
Unavailable	Unavailable	1975-1982 SUMMARY REPORT	Analysis and Technology, Inc.	821217	ADA192591	U
Unavailable	DeChico, D.	ACOUSTIC EVALUATION OF SANDERS ASSOCIATES ACODAC SENSORS	Naval Air Development Center	830301	ADB073873	U
NRL-FR-8695; NRL-8695	Palmer, L. B., et al.	TRANSVERSE HORIZONTAL COHERENCE AND LOW-FREQUENCY ARRAY GAIN LIMITS IN THE DEEP OCEAN	Naval Research Laboratory	830809	ND ADA131916	U
Unavailable	Unavailable	ENGINEERING SUPPORT FOR ACOUSTIC AND ANALYSIS SYSTEM	Systems Integrated	840101	ADB091112	U
Unavailable	Unavailable	SEAS (SURVEILLANCE ENVIRONMENTAL ACOUSTIC SUPPORT PROGRAM) SUPPORT	Systems Integrated	840229	ADB091119	U