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ANALYSIS AT TECHNOLOGY

TASSRAP II OB
SYSTEM TEST

Analysis & Technology, Inc.
Report No. P-339-4-77

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1.0 INTRODUCTION

Following the TASSRAP II development, extensive tests will be conducted on the finalized computer program. Included in these tests will be all modules and data files as they relate to the various predictions output by the program. It should be noted that obtaining a prediction based upon the various independent parameters is difficult. As a result, the best to be hoped is that the prediction is a "good" one. Good predictions, as common sense dictates, is one which is "close" to the parameter being predicted. More precisely, the quality of the prediction is to be evaluated in terms of unbiasedness, consistency, efficiency, and sufficiency.

A prediction is unbiased if its expected value is identical with the parameter being predicted. If the probability for a prediction to approach the parameter being predicted is one as the population of the parameter approaches infinity, the prediction is consistent. One prediction is more efficient than another if the variance of the first is less than that of the second. The concept of sufficiency entails an accurate intuitive meaning. A prediction is sufficient if it conveys as much information as possible about the parameter being predicted, so that little additional information will be supplied by any other predictor.

Unbiasedness, consistency, efficiency, and sufficiency form the basic criteria for all the tests described in the succeeding pages. More quantitative criteria are applied to specific tests as necessary.

The main objective of the in-house testing is to establish whether the model will produce valid outputs for various inputs for purposes of attaining a specific objective.

Validation of the model will be defined as an attempt to show consistency between results observed in at-sea exercises and outputs produced in a computer simulation of this same exercise. The overall purpose of this validation is to discover any flaws in the predictive model and correct them before the model is tested at sea. The performance of these tests will aid in avoiding the pitfalls which eventually lead to the demise of the original TASSRAP system.

2.0 AT-SHORE TEST

The following test describes the evaluation program proposed to show the operational serviceability of the TASSRAP II based on in-house testing. This plan is divided into seven major tests with the objective, procedure, criteria, and modules tested described in each test.

2.1 TOW DEPTH AND SEARCH FREQUENCY

Objective - This test will be to determine if the recommended tow depth and frequencies are consistent with the acoustic environment.

Procedure - The TASSRAP II program will be exercised for areas throughout the world where the acoustical and environmental conditions are well known. Recommended tow depths and search frequencies output by the program will be examined to determine if the criteria are satisfied. When the criteria are satisfied, no further testing is required. In the event the output fails to meet the criteria, further detailed testing will be necessary. Detailed testing will entail inputting various depths and frequencies to determine if there is an error in the program. Modifications to the program will be made as necessary.

Criteria

1. Are the recommended tow depths possible for the particular array.

2. Do the output tow depths and frequencies follow the standards published in the:
   Fleet Introduction Plan for the AN/SQR-15 Towed Array Surveillance Plan and Submarine Search Manual (NWP-73).

3. If 2. is not satisfied, the difference is explainable and correct according to the MOE utilized by TASSRAP II.

Modules tested:

Input
FACT
Transmission Loss Driver
Sonar File
Noise File

2.2 EXPECTED DETECTION RANGE/COVERAGE

Objective - To determine if the TASSRAP II range predictions are congruent with actual at-sea results obtained during both operational deployments and fleet exercises.

Procedure - This test requires inputting the necessary parameters in order to duplicate the deployments and/or exercises as closely as possible. TASSRAP II will be run for the various data bases in order to determine if the criteria are satisfied. No further testing is necessary once the criteria are met. Should the output fail to fulfill the standards, the inputs will be varied within the range of the uncertainties (e.g., target source levels for operations are not known precisely and, therefore, have an associated sigma). If the criteria are still unsatisfied, modifications will be necessary.

Criteria

1. Does the data base show detection where TASSRAP II predicts detection.

2. No detections occurred where the predictions indicate no detections should occur.

Listed below are the areas and related exercises/ operations from which the data base will be formed.

A. Mediterranean Sea
   1. TASSRAP 72
   2. Mediterranean ASW Augmentation Program (74)
   3. ASW Squadron (76)

B. Atlantic
   1. LANTREADEX
   2. SAI
   3. TEAMWORK
   4. CLEANSWEEP

C. Norwegian Sea
   1. STASS Deployments

D. Pacific
   1. RIMPAC 73
   2. COMTUEX 75
   3. KENT BEACON

Modules tested:

Input
FACT
Executive
Interactive
Sonar File
Displays
Transmission Loss Driver
Detection

2.3 TONAL VERSUS LEVEL/TONAL SIGNAL EXCESS VERSUS RANGE

Objective - To ascertain if TASSRAP II predicted tonal levels and signal excess are concordant with available exercise data.

Procedure - This test parallels that for detection with the addition that all historical target levels will be inspected.

Criteria

1. Target levels must be equal to the average level as reported in the Submarine Acoustic Data Manual (NWP 76-2).

2. Differences between predicted and historical curves must fall within the combined standard deviations of the parameters involved.

Modules tested:

Input
Target File
Sonar File
FACT

2.4 PROPAGATION LOSS

Objective - To resolve whether or not the mini-FACT propagation loss is consistent with the NAVOCEANO standard FACT test.

Procedure - The standard NAVOCEANO FACT test package complete with input data and output will be obtained from NAVOCEANO. The TASSRAP mini-FACT will be exercised utilizing the required input data. Results from the various runs will be compared with the test data results to determine if the criteria are satisfied.

Criteria

The criteria for this test will be a one-to-one comparison of the TASSRAP II calculated propagation loss with that calculated by the FACT model. If they are with 0.5 dB, the results will be considered to be in agreement. If only a few points exceed the 0.5 dB, a value judgment will be made whether to further analyze the problem or accept it as being in agreement. If the difference consistently exceeds 0.5 dB, then the problem will be rectified.

Modules tested:

Input
Environmental Files
Propagation Loss

2.5 PREDICTED BEAM NOISE

Objective - To ascertain if the TASSRAP II predicted noise level is in accordance with historical data and exhibits known characteristics for towed array noise.

Procedure - When employing measured data, the conditions prevailing during the measurements will be duplicated as nearly as possible. Predicted beam noise data will be compared with the measured data to determine if the criteria are satisfied. Tests will also be made to determine if wind speed, tow speed, and cable scope affect the predicted noise values as indicated in the criteria.

Criteria

1. Predicted data consistencly fall within one standard deviation of historical data.

2. Noise increases with an increase in tow speed.

3. Noise increases with increased wind speed at frequencies over 250 Hz under low to moderate shipping conditions except when the array is below a sharp negative gradient.

4. Noise received on forward beams decreases with increased cablescope.

Modules tested:

Input
Sonar File
FACT
Noise File

2.6 BATHYTHERMOGRAPH DATA FILE

Objective - To determine if abnormalities exist in selected BT files.

Procedure - The TASSRAP II program will be exercised for randomly selected areas throughout the world with the retrieved BT and calculated SVP compared with historical FNWC data. If any abnormalities are found, NORDA will be requested to reconcile any differences.

Criteria

Temperatures must agree with 0.5°C at and below the main thermocline depth.

Modules tested:

Input
Environmental Data

2.7 OPERABILITY TEST

Objective - Operability tests will be conducted to evaluate the TASSRAP II system in terms of man/machine performance. The purpose of these tests will be to show the relationship between the design purpose of the system and the ability of the operator to use the system to obtain maximum performance.

Procedure - Operability tests will be conducted concurrent with other tests and will also be run as separate tests. For the separate test, two Navy sonar operators with a level commensurate with that of the expected at-sea operators will be provided a TASSRAP II operating guidelines manual and a series of input data. Each will be requested to operate the program. All comments and recommendations made by the operators will be reviewed with the intent towards improving the utility of TASSRAP II.

Criteria

If either operator is unable to complete a run, the program or instructions will be modified.

Modules tested:

Executive
Input
Environmental File
Sonar File
FACT Propagation
Noise File

Modules tested: (con't)

Interactive
Displays
Transmission Loss

3.0 SCHEDULE

The TASSRAP II computer system is anticipated to be delivered to Analysis & Technology, Inc., North Stonington, Connecticut in August 1977. The in-house test and evaluation will get underway immediately and will require six (6) weeks to completely satisfy the requirement that the modules perform to expectation, and the overall program satisfies all requirements. During this effort, some time has been allocated to incorporate some minor modifications. It is not anticipated there will be a requirement for major model changes, and the six weeks time period does not allow for any major changes.

Figure 1 shows a detailed schedule for this phase of the program.

EVALUATION SCHEDULE

	Time Weeks 0	1	2	3	4	5	6
1. Delivery of TASSRAP II System	Δ						
2. Set Up and Check Out Hardware		Δ					
3. Tow Depth/Frequency Test			Δ				
4. Detection Range/Coverage Test				Δ			
5. Tonal Versus Level/S/E Versus Range					Δ		
6. Propagation Loss						Δ	
7. Predicted Beam Noise							Δ
8. Environmental Data File							
9. Operability							
10. Incorporate Required Changes							

Figure 1

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IN REPLY REFER TO:

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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.

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Declassified LRAPP Documents

Report Number	Personal Author	Title	Publication Source (Originator)	Pub. Date	Current Availability	Class.
DASC 012-C-77	Unavailable	LRAPP PACIFIC DYNAMIC ARCHIVE (U) SEPTEMBER 1976	Daniel Analytical Services Corporation	770201	NS; ND	U
SAI-78-527-WA	Spofford, C. W.	NELANT DATA ASSESSMENT APPENDIX III-MODELING REPORT	Science Applications, Inc.	770225	ND ADA047680	U
PSI TR 036049	Barnes, A. E., et al.	OCEAN ROUTE ENVELOPES	Planning Systems Inc.	770419	ND	U
Unavailable	Unavailable	TAP II BEAMFORMING SYSTEM SOFTWARE FINAL REPORT	Bunker-Ramo Corp. Electronic Systems Division	770501	ADC011789	U
S01037C8	Unavailable	TAP 2 PROCESSING SYSTEM FINAL REPORT HARDWARE DOCUMENTATION (U)	Bunker-Ramo Corp. Electronic Systems Division	770501	ADC011790; NS; ND	U
Unavailable	Weinberg, H.	GENERIC FACT	Naval Underwater Systems Center	770601	ADB019907	U
Unavailable	Unavailable	TASSRAP II OB SYSTEM TEST	Analysis and Technology, Inc.	770614	ADA955352	U
Unavailable	Unavailable	LRAPP TECHNICAL SUPPORT	Texas Instruments, Inc.	770624	ND	U
Unavailable	Bessette, R. J., et al.	TASSRAP INPUT MODULE	Analysis and Technology, Inc.	770729	ADA955340	U
Unavailable	Unavailable	TAP-II PHASE II FINAL REPORT	Bunker-Ramo Corp. Electronic Systems Division	770901	ADC011791	U
Unavailable	Unavailable	LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP)	Xonics, Inc.	770930	ADA076269	U
SAI78696WA	Unavailable ADA055728	REVIEW OF MODELS OF BEAM-NOISE STATISTICS (U)	Science Applications Inc.	771101	NS; ND	U
TRACORT77RV109 C	Unavailable	FINAL REPORT FOR CONTRACT N00014-76-C-0066 (U)	Tracor Sciences and Systems	771130	ADC012607; NS; ND	U
Unavailable	Unavailable	LONG RANGE ACOUSTIC PROPAGATION PROJECT (LRAPP)	Xonics, Inc.	771231	ADB041703	U
Unavailable	Homer, C. I.	SUS SOURCE LEVEL ERROR ANALYSIS ADA055660	Underwater Systems, Inc.	780120	ND	U
Unavailable	Fitzgerald, R. M.	LOW-FREQUENCY LIMITATION OF FACT	Naval Research Laboratory	780131	ADA054371	U
Unavailable	Unavailable	MIDWATER ACOUSTIC MEASUREMENT SYSTEM - PAR AND ACODAC	Texas Instruments, Inc.	780228	ADB039924	U
ORI TR 1245	Moses, E. J.	OPTIONS, REQUIREMENTS, AND RECOMMENDATIONS FOR AN LRAPP ACOUSTIC ARRAY PERFORMANCE MODEL	ORI, Inc.	780331	ND	U
Unavailable	Hosmer, R. F., et al.	COMBINED ACOUSTIC PROPAGATION IN EASTPAC REGION (EXERCISE CAPER): INITIAL ACOUSTIC ANALYSIS	Naval Ocean Systems Center	780601	ADB032496	U
LRAPPRC78023	Watrous, B. A.	LRAPP EXERCISE ENVIRONMENTAL DATA INVENTORY, JUNE 1978 (U)	Naval Ocean R&D Activity	780601	NS; ND	U
TR052085	Solomon, L. P., et al.	HISTORICAL TEMPORAL SHIPPING (U)	Planning Systems Inc.	780628	NS; ND	U

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