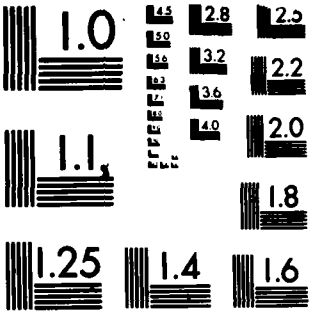
AD-A141 872 TECHNICAL ASSISTANCE IN THE DESIGN OF SONAR TRANSDUCER 1/1
ARRAYS(U) OPTIMAL METHODS INC AUSTIN TX
LASDON ET AL. 31 DEC 83 N00014-83-C-0437

UNCLASSIFIED F/G 17/1 NL



FINAL REPORT

Contract N00014-83-C-0437

"TECHNICAL ASSISTANCE IN THE DESIGN OF SONAR TRANSDUCER ARRAYS "

From: Optimal Methods, Inc.
4700 Downridge Cove
Austin, Tx. 78731

Covering period: 4/15/83 - 12/31/83

1. INTRODUCTION

This report summarizes work performed over the period 4/15/83 - 12/31/83 by Drs Lasdon and Waren and Mr. Plummer. It also summarizes progress since our last report, which covered the month ending 11/15/83.

2. ACCOMPLISHMENTS

A. Overall Accomplishments

During the contract period, we have improved our optimal design algorithms and codes so that they now comprise a practical design tool. We have added the following capabilities:

1. Incorporation of a constraint on the number of effective elements. This ensures that designs produced by the system are not overly sensitive to random errors and that the signal to noise ratio is acceptable.
2. Ability to restrict sensor weights to be real. Designs with real weights are easier to implement.
3. Combining subarrays. The weights for sensors in each subarray are determined and fixed. Each subarray is then treated as a single "macroelement", and weights for these macroelements are determined to yeild as low sidelobes as possible subject to MRA and efficiency constraints. This capability has received only preliminary testing, but appears to function properly.

4. A much cleaner and easier to use system. Its features include: dynamic storage allocation, a free-format input command file with easily understood keywords, and improved output features. These include the creation of a summary log for viewing the progress of a run at the terminal, and an output weights file which can be examined while the run is still in progress. Since this systems input routines are table driven, new options are easily incorporated by adding elements to a few tables.

This system has been used to solve problems with up to 391 sensors. Such runs take several hours on a Vax 11/780. However, we believe that a combination of (a) a faster machine with more fast memory and (b) improvements to the algorithm (e.g. early termination of subproblems with long "tails") can reduce this by an order of magnitude. We have proposed such enhancements in a recent proposal.

In summary, with the aid of Dr. Buehler, Mrs. Maciejewski, and Mr. Ahmed at NUSC, and Dr. Harry Cox, we have provided NUSC with a design tool capable of helping to solve the difficult design problems faced by ACSAS. A paper describing work to date is under preparation, for the Journal "Mathematical Programming". It will be complete by Jan. 1984.

R. Progress since 11/15/83

A tape and user guide for the improved system described above was mailed to NUSC in early December, and is now installed on their system. This system is now being tested. We will continue to aid NUSC personnel on a gratis basis after 1/1/84 to insure that any bugs in the system are corrected, and to note any improvements that are desired.

Some more subarray problems were examined over this period. These were test runs in which a 391 element (endcap) array was divided into 12 subarrays. The 391 element problem was solved, and its optimal weights were used as the fixed subarray weights. One would then expect the optimal subarray weights to be unity. Using tight optimality tolerances, all but a few of the 12 subarray weights did turn out to be close to unity. Deviations are, in our opinion, explained by the fact that solutions produced are only within 2 to 4 db of minimax optimality, and many different sets of weights can get this close. In fact, there was a small db improvement over the results of the 391 element run. Hence the subarray capability seems to function correctly. However, further testing is needed to be sure of this and to assess its value to ACSAS.