



Lamont-Doherty
Earth Observatory
of Columbia University

P.O. BOX 1000 / RT 9W / PALISADES, NY 10964-8000 USA / 914-359-2900

April 22, 1997

Dr. Joseph Kravitz, Program Officer
Office of Naval Research - Code 322GG
Department of the Navy
Ballston Centre Tower One
800 N. Quincy St.
Arlington, VA 22217-5660

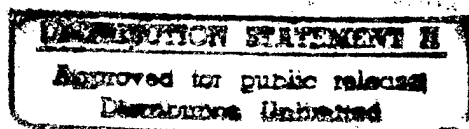
Re: PERFORMANCE/FINAL TECHNICAL REPORT for -
Enhancing Shallow Seismic Reflection Profiles using
Nonlinear Correlation: Applications to the New Jersey Margin
Grant No. NOOO14-95-1-0057

Dear Joe:

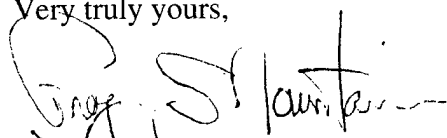
We enclose our Performance/Final Technical Report concerning the above-mentioned grant. Copies have also been sent to the individuals listed below, as outlined in the Grant Schedule.

If you require any further information, please do not hesitate to contact me at 914-365-8540, or via email: mountain@ldeo.columbia.edu.

We thank the Office of Naval Research for this award.



Very truly yours,


Gregory S. Mountain
Senior Research Scientist

enclosures

cc: Ms. Angela Potter, Resident Rep., Boston, MA
Director - Naval Research Lab, Washington, DC
✓ Defense Technical Information Center, Ft. Belvoir, VA
Mr. William F. McCarthy, ONR OOCC1, Arlington, VA
Ms. V. Murray, Columbia University - Office of Projects & Grants
Ms. P. Stambaugh - Sr. Contracts Officer, Lamont-Doherty

DTIC QUALITY INSPECTED 1

ONR Grant No. NO0014-95--1-0057
R & T Project : 22ga244---01

Performance/Final Technical Report

**Enhancing Shallow Seismic Reflection Profiles using
Nonlinear Correlation: Applications to the New Jersey Margin**

Gregory S. Mountain, Peter Buhl

The upper 200 m of the sedimentary section of the New Jersey Margin are poorly resolved on older multichannel seismic (MCS) images; in particular, on MCS data collected during Cruise 9009 of *R/V Maurice Ewing*. The object of this survey was to image deeply buried stratigraphic sequences (200 - 1000 m below the sea floor) which record the history of Oligocene to Miocene sea level changes. To insure adequate signal-to-noise ratio during the rough weather encountered, a large initial offset (200 m) was used between the airgun source and the initial hydrophone receiver group. In the shallow water of the continental shelf (~100 m and less) this initial offset meant that reflecting rays from the upper 200 m arrived at large angles from the vertical. The positive velocity gradient in the sediments exaggerated the convergence of the reflections from various depths, and caused these reflections to cross one another at or shortly after the near-offset channel.

To properly image the sedimentary structure, the MCS technique depends on the ability to correct the traveltime of all reflections to zero offset, in a process called the normal moveout (NMO) correction. Due to severe reflector convergence that occurs in large-offset, shallow-water operations, this correction results in extreme stretching and distortion of the part of the near-channel recording that contains shallow reflections. This contributed further to the poor images of the upper 200 m.

Nonlinear Correlation techniques have proven useful in interpolating seismic traces, (Martinson and Hopper, 1992). These techniques allow a mapping of two distinct time series, one of which has had its time scale variably stretched and/or compressed throughout its length. The mapping function provides a rigorous interpolation of intermediate examples of the two-time series. For nearby seismic traces this mapping function is very exact, as the traces are quite similar. Difficulties arise, however, when this method is used for extrapolation, since extrapolation is much less well constrained than is interpolation. Extrapolating sequences of traces to zero offset is what is required to generate the proper seismic image. However, our analysis showed that the particular velocity-depth function of the NJ Margin produces reflector crossovers near the initial offset trace. Coupled with the trace stretch, we found that extrapolation produces poor images. It became clear

19970428 221

that despite our efforts, nonlinear correlation technique **cannot** be used to enhance images of the shallow sedimentary section from the EW-9009 MCS data.

The required solution to this shallow imaging problem is to shorten the initial offset to approximately one-half the water depth. This was done for the data collected in 1995 during *Oceanus Cruise 270* in support of the Strataform Project. These new data show excellent images of the upper 200 m, confirming this conclusion.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
<small>Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.</small>				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE		3. REPORT TYPE AND DATES COVERED
4. TITLE AND SUBTITLE Enhancing shallow Seismic Reflection Profiles using Nonlinear Correlation: Applications to the New Jersey Margin			5. FUNDING NUMBERS Grant No. N00014-95-1-0057	
6. AUTHOR(S) Gregory S. Mountain				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) The Trustees of Columbia University in the City of NY 1210 Amsterdam Avenue - MC 2205 New York, NY 10027			8. PERFORMING ORGANIZATION REPORT NUMBER #5-21627	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research (Dr. Joseph H. Kravitz, Scientific Officer) Ballston Tower One 800 No. Quincy St. Arlington, VA 22217-5660			10. SPONSORING/MONITORING AGENCY REPORT NUMBER R & T Project: 22ga244---01	
11. SUPPLEMENTARY NOTES The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Some older Multichannel Seismic data recorded on the shallow continental shelf do not properly image the upper few 100 m. This is due to a large (approx. 200 m) minimum source-receiver offset. Nonlinear Correlation, used successfully for other seismic processing was not able to correct the data. The use of a short (Approx. 30 m) minimum source-receiver offset produces excellent seismic images of the upper sediments.				
14. SUBJECT TERMS Nonlinear Correlation - Application to New Jersey Margin			15. NUMBER OF PAGES	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UL	