

**REPORT DOCUMENTATION PAGE**

Form Approved

OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average one 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 the 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. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) 18-12-2002	2. REPORT DATE Final	3. DATES COVERED (FROM - TO) 12/01/92 - 09/30/01
---	-------------------------	---

4. TITLE AND SUBTITLE  Acoustic Thermometry of Ocean Climate (ATOC)	5a. CONTRACT NUMBER
	5b. GRANT NUMBER  MDA972-93-1-0003
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)  Worcester, Peter F.	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(ES)  University of California Scripps Institution of Oceanography 9500 Gilman Drive La Jolla, CA 92093-0210	8. PERFORMING ORGANIZATION REPORT NUMBER
--	--

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  Office of Naval Research Ballston Centre Tower One 800 North Quincy Street Arlington, VA 22217-5660	10. SPONSOR/MONITOR'S ACRONYM(S)  ONR
	11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT  
APPROVED FOR PUBLIC RELEASE

13. SUPPLEMENTARY NOTES

**20030225 114**

14. ABSTRACT  
The Acoustic Thermometry of Ocean Climate (ATOC) project was a feasibility study to determine 1) the precision with which acoustic methods could be used to measure large-scale changes in ocean temperature and heat content and, 2) the effects, if any, that the acoustic transmissions would have on marine mammals and other marine life. Two sound sources were installed for this project, one on Pioneer Seamount off central California and one north of Kauai. Each of the sound sources transmitted for 24 months in accordance with marine mammal study protocols. The results from the study indicated that 1) acoustic thermometry is a powerful tool for making routine measurements of large-scale ocean temperature variability and heat content, as originally hypothesized, and 2) acoustic travel times can be measured with a precision of 20-30 milliseconds at 3000-5000 ranges. During the Marine Mammal Research Programs conducted in both California and Hawaii, there were no observations of overt or obvious short-term changes in the behavior, abundance, distribution, or vocalizations of marine mammals in response to the ATOC sound source transmissions. Although some subtle effects were revealed through statistical analyses, bioacoustics experts have concluded that these effects would not adversely affect the survival of an individual whale or the status of the North Pacific humpback whale population.

15. SUBJECT TERMS  
ATOC, Low frequency sound (LFS), marine mammals, acoustics

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT ABSTRACT	18. NUMBER OF PAGES 6	19a. NAME OF RESPONSIBLE PERSON
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U			19b. TELEPHONE NUMBER (Include area code)

## ATOC – Thermometry Peer-reviewed Publications

- Abawi, A. T., Kuperman, W. A. & Collins, M. D. (1997). The coupled mode parabolic equation. *Journal of the Acoustical Society of America*, 102(1), 233-238.
- Andrew, R. K., Howe, B. M., Mercer, J. A. & Dzieciuch, M. A. (2002). Ocean ambient sound: Comparing the 1960s with the 1990s for a receiver off the California coast. *Acoustics Research Letters Online*, 3(2), 65-70.
- ATOC Consortium (A.B. Baggeroer, T. G. Birdsall, C. Clark, J.A. Colosi, B.D. Cornuelle, D. Costa, B.D. Dushaw, M. Dzieciuch, A.M.G. Forbes, C. Hill, B.M. Howe, J. Marshall, D. Menemenlis, J.A. Mercer, K. Metzger, W. Munk, R.C. Spindel, D. Stammer, P.F. Worcester and C. Wunsch). (1998). Ocean climate change: Comparison of acoustic tomography, satellite altimetry, and modeling. *Science*, 281, 1327-1332.
- ATOC Consortium (A.B. Baggeroer, T. G. Birdsall, C. Clark, J.A. Colosi, B.D. Cornuelle, D. Costa, B.D. Dushaw, M. Dzieciuch, A.M.G. Forbes, C. Hill, B.M. Howe, J. Marshall, D. Menemenlis, J.A. Mercer, K. Metzger, W. Munk, R.C. Spindel, D. Stammer, P.F. Worcester and C. Wunsch). (1999). Reply to 'Heat content changes in the Pacific Ocean' by Kelly et al. *Science*, 284, 1735a.
- Buck, J. R., Preisig, J. C. & Wage, K. E. (1998). A unified framework for mode filtering and the maximum *a posteriori* mode filter. *Journal of the Acoustical Society of America*, 103(4), 1813-1824.
- Chiu, C.-S. (1994). Downslope modal energy conversion. *Journal of the Acoustical Society of America*, 95(3), 1654-1657.
- Colosi, J. A. & the ATOC Group. (1999). A review of recent results on ocean acoustic wave propagation in random media: Basin scales. *IEEE Journal of Oceanic Engineering*, 24(2), 138-155.
- Colosi, J. A. & Flatté, S. M. (1996). Mode coupling by internal waves for multimegahertz acoustic propagation in the ocean. *Journal of the Acoustical Society of America*, 100(6), 3607-3620.
- Colosi, J. A., Scheer, E. K., Flatté, S. M., Cornuelle, B. D., Dzieciuch, M. A., Munk, W. H., Worcester, P. F., Howe, B. M., Mercer, J. A., Spindel, R. C., Metzger, K., Birdsall, T. G. & Baggeroer, A. B. (1999). Comparisons of measured and predicted acoustic fluctuations for a 3250-km propagation experiment in the eastern North Pacific Ocean. *Journal of the Acoustical Society of America*, 105(6), 3202-3218.
- Colosi, J. A., Tappert, F. & Dzieciuch, M. (2001). Further analysis of intensity fluctuations from a 3252-km acoustic propagation experiment in the eastern North Pacific Ocean. *Journal of the Acoustical Society of America*, 110(1), 163-169.

- Cornuelle, B. D. & Worcester, P. F. (1996). Ocean acoustic tomography: Integral data and ocean models. In P. Malanotte-Rizzoli (Ed.), *Modern Approaches to Data Assimilation in Ocean Modeling*, 97-115. Elsevier Science BV: Amsterdam.
- Curtis, K. R., Howe, B. M. & Mercer, J. A. (1999). Low-frequency ambient sound in the North Pacific: Long time series observations. *Journal of the Acoustical Society of America*, 106(6), 3189-3200.
- Dushaw, B. D. (1999). Inversion of multimegameter-range acoustic data for ocean temperature. *IEEE Journal of Oceanic Engineering*, 24(2), 215-223.
- Dushaw, B. D., Cornuelle, B. D., Worcester, P. F., Howe, B. M. & Luther, D. S. (1995). Barotropic and Baroclinic Tides in the Central North Pacific Ocean Determined from Long-Range Reciprocal Acoustic Transmissions. *Journal of Physical Oceanography*, 25(4), 631-647.
- Dushaw, B. D., Howe, B. M., Mercer, J. A. & Spindel, R. C. & the ATOC Group. (1999). Multimegameter-range acoustic data obtained by bottom-mounted hydrophone arrays for measurement of ocean temperature. *IEEE Journal of Oceanic Engineering*, 24(2), 202-214.
- Dzienciuch, M., Worcester, P. & Munk, W. (2001). Turning point filters: Analysis of sound propagation on a gyre-scale. *Journal of the Acoustical Society of America*, 110(1), 135-149.
- Fieguth, P., Menemenlis, D., Ho, T., Willsky, A. & Wunsch, C. (1998). Mapping Mediterranean altimeter data with a multiresolution optimal interpolation algorithm. *Journal of Atmospheric and Oceanic Technology*, 15(2), 535-546.
- Grabb, M. L., Wang, S. Z. & Birdsall, T. G. (1996). Deterministic three-dimensional analysis of long-range sound propagation through internal-wave fields. *IEEE Journal of Oceanic Engineering*, 21(3), 260-272.
- Heaney, K. D. & Kuperman, W. A. (1998). Very long-range source localization with a small vertical array. *Journal of the Acoustical Society of America*, 104(4), 2149-2159.
- Kuperman, W. A., D'Spain, G. L. & Heaney, K. D. (2001). Long range source localization from single hydrophone spectrograms. *Journal of the Acoustical Society of America*, 109(5) Pt.1, 1935-1943.
- Marshall, J., Adcroft, A., Hill, C., Perelman, L. & Heisey, C. (1997). A finite-volume, incompressible Navier Stokes model for studies of the ocean on parallel computers. *Journal of Geophysical Research-Oceans*, 102(C3), 5753-5766.
- Marshall, J., Hill, C., Perelman, L. & Adcroft, A. (1997). Hydrostatic, quasi-hydrostatic, and nonhydrostatic ocean modeling. *Journal of Geophysical Research-Oceans*, 102(C3), 5733-5752.

- Menemenlis, D. & Chechelnitsky, M. (2000). Error estimates for an ocean general circulation model from altimeter and acoustic tomography data. *Monthly Weather Review*, 128(3), 763-778.
- Menemenlis, D., Fieguth, P., Wunsch, C. & Willsky, A. (1997). Adaptation of a fast optimal interpolation algorithm to the mapping of oceanographic data. *Journal of Geophysical Research-Oceans*, 102(C5), 10573-10584.
- Menemenlis, D., Webb, T., Wunsch, C., Send, U. & Hill, C. (1997). Basin-scale ocean circulation from combined altimetric, tomographic and model data. *Nature*, 385, 618-621.
- Menemenlis, D. & Wunsch, C. (1997). Linearization of an oceanic general circulation model for data assimilation and climate studies. *Journal of Atmospheric and Oceanic Technology*, 14(6), 1420-1443.
- Mikolajewicz, U., Maier-Reimer, E. & Barnett, T. P. (1993). Acoustic detection of greenhouse-induced climate changes in the presence of slow fluctuations of the thermohaline circulation. *Journal of Physical Oceanography*, 23(6), 1099-1109.
- Shang, E. C. & Wang, Y. Y. (1999). Subarctic frontal effects on long-range acoustic propagation in the North Pacific Ocean. *Journal of the Acoustical Society of America*, 105(3), 1592-1595.
- Stammer, D. & Wunsch, C. (1996). The determination of the large-scale circulation of the Pacific Ocean from satellite altimetry using model Green's functions. *Journal of Geophysical Research-Oceans*, 101(C8), 18409-18432.
- Tindle, C. T. & Bold, G.E. (1999). ATOC and other acoustic thermometry observations in New Zealand. *Marine Technology Society Journal*, 33(1), 55-60.
- Voronovich, A. G. & Shang, E. C. (1995). A note on horizontal-refraction-modal tomography. *Journal of the Acoustical Society of America*, 98(5) Pt.1, 2708-2716.
- Worcester, P. F., Cornuelle, B. D., Dzieciuch, M. A., Munk, W. H., Howe, B. M., Mercer, J. A., Spindel, R. C., Colosi, J. A., Metzger, K., Birdsall, T. G. & Baggeroer, A. B. (1999). A test of basin-scale acoustic thermometry using a large-aperture vertical array at 3250-km range in the eastern North Pacific Ocean. *Journal of the Acoustical Society of America*, 105(6), 3185-3201.

## ATOC – Thermometry Other Publications

- ATOC Instrumentation Group: B.M. Howe, S. G. Anderson, A.B. Baggeroer, J.A. Colosi, K.R. Hardy, D. Horwitt, F.W. Karig, S. Leach, J.A. Mercer, K. Metzger, L.O. Olson, D.A. Peckham, D.A. Reddaway, R.R. Ryan, R.P. Stein, K. von der Heydt, J.D. Watson, S.L. Weslander & P.F. Worcester. (1995). Instrumentation for the Acoustic Thermometry of Ocean Climate (ATOC) prototype Pacific Ocean network. *OCEANS 95 MTS/IEEE Proceedings*, 1483-1500, San Diego, CA, October 9-12, 1995.
- Colosi, J.A. (1997) Random media effects in basin-scale acoustic transmissions. *Proceedings Áha Hulikoá Hawaiian Winter Workshop*, 157-166, Honolulu, HI, January 14-17, 1997.
- Dzieciuch, M. (1993). Numerical solution of the acoustic wave equation using Chebyshev Polynomials with application to global acoustics. *IEEE Oceans 93 Conference Proceedings*, I-267-I-271, Victoria, British Columbia, Canada, October 18-21, 1993.
- Dzieciuch, M., Worcester, P. & Munk, W. (2000). Turning point filters. *IEEE Sensor Array and Multichannel (SAM) Signal Processing Workshop Proceedings*, 121-124, Cambridge, Massachusetts, March 16-17, 2000.
- Forbes, A. (1994). Acoustic monitoring of global ocean climate. *Sea Technology*, 5, 65-67.
- Frietag, L. & Stojanovic, M. (2001). Basin-scale acoustic communication: A feasibility study using tomography m-sequences. *Oceans 2001 MTS/IEEE Conference Proceedings*, Vol. 4, 2256-2261, Honolulu, HI, November 5-8, 2001.
- Howe, B. M. (1993). Acoustic Thermometry of Ocean Climate (ATOC): Selection of California Source Site (*Technical Memorandum APL-UW 30-93*): Applied Physics Laboratory - University of Washington.
- Howe, B. M. (1996). Acoustic Thermometry of Ocean Climate (ATOC): Pioneer Seamount Source Installation (*Technical Memorandum APL-UW 3-96*): Applied Physics Laboratory - University of Washington.
- Howe, B. M. & Mercer, J. A. (1997). Cabled sources and receivers for ATOC. *JAMSTEC International Workshop on Scientific Use of Submarine Cables*. Okinawa, Japan, February 25-28, 1997.
- Howe, B. M., Leach, S. W., Mercer, J. A. & Odom, R. I. (1993). Designing the ATOC global array. *IEEE Oceans 93 Conference Proceedings*, I-258-I-262, Victoria, British Columbia, Canada, October 18-21, 1993.
- Hyde, D. W. (1993). ATOC network definition. *IEEE Oceans 93 Conference Proceedings*, I-249-I-252, Victoria, British Columbia, Canada, October 18-21, 1993.

- Menemenlis, D., Stammer, D., Wunsch C., Dushaw B.D. and the ATOC Group (A.B. Baggeroer, T.G. Birdsall, C. Clark, J.A. Colosi, B.D. Cornuelle, D. Costa, B.D. Dushaw, M. Dzieciuch, A.M.G. Forbes, B.M. Howe, D. Menemenlis, J.A. Mercer, K. Metzger, W.H. Munk, R.C. Spindel, P.F. Worcester and C. Wunsch). (1997). Preliminary estimates of North Pacific circulation from combined altimetry, acoustic tomography and a general circulation model. *International WOCE Newsletter*, 25, 7-10.
- Penrose, J., & Forbes, A. (1996). Acoustic thermometry in the Indian Ocean. (*Report C97-8*): Centre for Marine Science and Technology, Curtin University of Technology, Western Australia. Presented at Oceanology International '97, Singapore, May 12-14, 1997.
- Shang, E. C., & Wang, Y. Y. (1994). Acoustic propagation modelling for ATOC. *Proceedings of the Second European Conference on Underwater Acoustics, Vol. II*, 1025-1030, Lyngby, Denmark, July 4-8, 1994.
- Shang, E. C., & Wang, Y. Y. (1994). Ocean acoustic thermometry and vertical slice tomography. In D. Lee and M.H. Schultz (Eds.) *International Conference on Theoretical and Computational Acoustics - Vol. 2, Environmental Acoustics*, 883-898, Mystic, Connecticut, July 5-9, 1993. World Scientific: Singapore.
- Staten, R. A., Chiu, C.-S. & Semtner, A. J. (1996). A simulation study of the variability of acoustic transmissions from Hawaii to Monterey. In D. Lee, Y-H Pao, M.H. Schultz and Y-C Teng (Eds.) *Theoretical and Computational Acoustics '95*, 505-525, Honolulu, Hawaii, August 21-25, 1995. World Scientific: Singapore.
- Wage, K. E., Baggeroer, A. B. & Preisig, J. C. (2000). Modal analysis of broadband acoustic receptions at megameter ranges. *IEEE Sensor Array and Multichannel (SAM) Signal Processing Workshop Proceedings*, 102-106, Cambridge, Massachusetts, March 16-17, 2000.
- Worcester, P. F., Dushaw, B.D. and the ATOC Group (A.B. Baggeroer, T.G. Birdsall, C. Clark, J.A. Colosi, B.D. Cornuelle, D. Costa, B.D. Dushaw, M. Dzieciuch, A.M.G. Forbes, B.M. Howe, D. Menemenlis, J.A. Mercer, K. Metzger, W. Munk, R.C. Spindel, P.F. Worcester and C. Wunsch). (2000). A comparison of acoustic thermometry, satellite altimetry, and other observations of ocean temperatures in the North Pacific Ocean. *PORSEC Proceedings*, Vol. I: 1-4, Goa, India, December 5-8, 2000.
- Worcester, P. F., Hardy, K., Horwitt, D. & Peckham, D. A. (1995). A deep ocean data recovery module. *OCEANS 95 MTS/IEEE Proceedings*, 1225-1231, San Diego, CA, October 9-12, 1995.
- Worcester, P. F., Hardy, K.R., Horwitt, D. & Peckham, D. A. (1997). Deep ocean data recovery module. *Sea Technology*, 38(2) 10-15.

## ATOC – Thermometry Unpublished Reports

- Alliant Techsystems. (1993). *ATOC Very Low Frequency Projector, Jervis Test Summary*.
- APL-UW. (1995). *Technical Specification for Installation of an ATOC Acoustic Source on Pioneer Seamount and Cable to Shore*: Applied Physics Laboratory - University of Washington.
- APL-UW. (1996). *Investigation of Faulty Kauai ATOC Source Cable*: Applied Physics Laboratory - University of Washington.
- Farrell, W. E., Jump, J. & Nafarrete, S. (1993). *Build 1 Requirements and Design for the Remote Node of the ATOC Data Center*: SAIC.
- Farrell, W. E. & Kerr, A.U. (1993). *ATOC Data Center Concept and Design, version 1.0*: SAIC & Scripps Institution of Oceanography.
- Farrell, W. E. & Kerr, A. U. (1997). *ATOC Data Center Final Report*: SAIC-97/3001.
- Farrell, W. E. & Williams, D. J. (1995). *ATOC Database Schema*: SAIC-95/1040.
- Goff, R. C. (1995). *Build 3 Requirements and Design for the ATOC Time and Format Subsystem*: SAIC-95/1013.
- Howe, B. (1994). *Cruise Plan for the ATOC Kauai Source Deployment*: Applied Physics Laboratory - University of Washington.
- Howe, B. (1994). *Cruise Plan for the ATOC Kauai Source Deployment: 2*: Applied Physics Laboratory - University of Washington.
- Howe, B. (1995). *Cruise Plan: ATOC Pioneer Seamount Source Deployment*: Applied Physics Laboratory - University of Washington.
- Howe, B. (1995). *Summary Cruise Report: ATOC Pioneer Seamount Source Installation*: Applied Physics Laboratory - University of Washington.
- Howe, B. (1996). *Alternate Source Test (AST): Cruise Plan*: Applied Physics Laboratory - University of Washington.
- Howe, B. (1996). *ATOC Kauai Source Deployment: Cruise Plan*: Applied Physics Laboratory - University of Washington.
- Howe, B. (1997). *ATOC Kauai Source Repair: Cruise Plan*: Applied Physics Laboratory - University of Washington.
- Howe, B. & Worcester, P. (1994). *ATOC Acoustic Engineering Test. FLIP Experiment Plan & AVLA Experiment Plan*: Applied Physics Laboratory - University of Washington & Scripps Institution of Oceanography.

- Jump, J. M. (1995). *Build 3 Requirements and Design for the ATOC Remote Node System: SAIC-95/1014.*
- Jump, J. M., Dean, J. & Maher, K. (1994). *ATOC Data Center, Architecture and Plan for 'mst' and 'sc' Processing: SAIC and UCSD.*
- Kerr, A. U. & Farrell, W. E. (1994). *ATOC Acoustic Engineering Test Data Management and Distribution Plan.*
- Kerr, A. U. & Farrell, W. E. (1995). *ATOC Data Center Status Report.*
- Mercer, J. A. (1997). *ATOC Cruise Plan: Pioneer Seamount Source Cable Repair: Applied Physics Laboratory - University of Washington.*
- Mercer, J.A. (1999) *Acoustic Thermometry of Ocean Climate Cruise Plan: Recovery of the Pioneer Seamount Source.* Applied Physics Laboratory - University of Washington.
- Mercer, J.A. (1999) *Technical Specification for the Recovery of the ATOC Acoustic Source and Undersea Cable.* Applied Physics Laboratory - University of Washington.
- SAIC. (1995). *Cultural Resources Baseline Study and Sensitivity Assessment for the ATOC Onshore/Submarine Cable Route Pt. Sur, California.*
- SAIC-MariPro. (1994). *Test Report VLA Termination Rod Modified Bending Test: SAIC R95-36.*
- Scrimger, J. A., Racca, R., Schumacher, I. & Henderson, D. (1994). *Considerations for Optimal Siting of Receiving Arrays off Canada's West Coast for ATOC (Acoustic Thermometry of Ocean Climate): JASCO Research Ltd. Report 94-63: Sidney, B.C.*
- Scrimger, J. A., Racca, R., Schumacher, I. & Henderson, D. (1994). *Addendum to Considerations for Optimal Siting of Receiving Arrays off Canada's West Coast for ATOC (Acoustic Thermometry of Ocean Climate): JASCO Research Ltd. Report 94-63: Sidney, B.C.*
- Seafloor Surveys Intl., Inc. (1993). *Final Report: Cable Route Selection Survey for the Acoustic Thermometry of Ocean Climate (ATOC) California Site.*
- Seafloor Surveys Intl., Inc. (1993). *Final Survey Report for the Kauai Acoustic Thermometry of Ocean Climate Site.*
- Worcester, P. (1995). *ATOC95: Autonomous Vertical Line Arrays Experiment Plan. Version 1.1: Scripps Institution of Oceanography.*

## ATOC Publications – Occasional Notes

- Baggeroer, A. & Schmidt, H. (1995) Cramer-Rao Bounds for Matched Field Tomography and Ocean Acoustic Tomography (*ATOC Occasional Note #27*): Scripps Institution of Oceanography.
- Birdsall, T. G. (1993) How Many Bits Should an A/D Converter Have? (*ATOC Occasional Note #1*): Scripps Institution of Oceanography.
- Brundrit, G. (1993) Sound Speed and Subduction (*ATOC Occasional Note #9*): Scripps Institution of Oceanography.
- Cartwright, D. E. (1993) Preliminary Estimates of Tidal Variations Along ATOC Transmission Paths (*ATOC Occasional Note #3*): Scripps Institution of Oceanography.
- Cartwright, D. E. (1994) Part 1. Comparison of Three Recent Models for the Barotropic Tidal Currents and Part 2. A Feasible Duty Cycle for Extracting Tide Information from ATOC Transmissions (*ATOC Occasional Note #19*): Scripps Institution of Oceanography
- Chiu, C.-S. (1993) Downslope Modal Energy Conversion (*ATOC Occasional Note #10*): Scripps Institution of Oceanography.
- Curtis, K. & Howe, B. (1995) ATOC Ambient Noise Measurements (*ATOC Occasional Note #28*): Scripps Institution of Oceanography.
- deGroot-Hedlin, C. (1995). Detection of ATOC Signals on Land-based Seismometers (*ATOC Occasional Note #25*): Scripps Institution of Oceanography.
- Dushaw, B.D., Howe, B., Mercer, J. A., Spindel, R. C. & Metzger, K. (1996) Acoustic Receptions at SOSUS Arrays "k" and "l" of Transmissions from Pioneer Seamount and Pacific Basin Acoustic Thermometry (*ATOC Occasional Note #35*): Scripps Institution of Oceanography.
- Dushaw, B. D. (1997) The Effect of the California Current on Acoustic Transmissions from Pioneer Seamount (*ATOC Occasional Note #36*): Scripps Institution of Oceanography.
- Dushaw, B. D. (1998) Ray Tracing Issues for ATOC (*ATOC Occasional Note #37*): Scripps Institution of Oceanography
- Dzieciuch, M. (1993) Seasonal Variability in Ocean Acoustic Thermometry (*ATOC Occasional Note #4*): Scripps Institution of Oceanography.
- Dzieciuch, M. (1993) The Sea Floor and Modal Excitation (*ATOC Occasional Note #12*): Scripps Institution of Oceanography.

- Forbes, A. (1993) Possible Extensions of the Pacific Network into the Southern and Indian Oceans (*ATOC Occasional Note #15*): Scripps Institution of Oceanography.
- Gould, W. J. & The Atlantic ATOC Group (Desaubies, Y., Howe, B.M., Palmer, D.R., Schott, F. and Wunsch, C.). (1994) The Design of an ATOC Network for the North Atlantic (*ATOC Occasional Note #22*): Scripps Institution of Oceanography.
- Grabb, M. & Birdsall, T. (1995) Comparison of Ray and Normal-Mode Constructed Acoustic Waveforms (*ATOC Occasional Note #31*): Scripps Institution of Oceanography.
- Grabb, M. & Birdsall, T. (1995) Diffracted Wavefronts (*ATOC Occasional Note #32*): Scripps Institution of Oceanography.
- Hill, C., Marshall, J. & Perelman, L. (1994) A New Ocean Circulation Model for ATOC (*ATOC Occasional Note #20*): Scripps Institution of Oceanography.
- Hyde, D. W. (1993) ATOC Network Definition (*ATOC Occasional Note #5*): Scripps Institution of Oceanography.
- Maier-Reimer, E. (1994) CFC-Simulations (*ATOC Occasional Note #18*): Scripps Institution of Oceanography.
- Menemenlis, D. & Wunsch, C. (1994) Ocean-Climate Estimation Using ATOC (*ATOC Occasional Note #23*): Scripps Institution of Oceanography.
- Menemenlis, D. & Wunsch, C. (1995) Recent North Pacific Climatology for ATOC (*ATOC Occasional Note #30*): Scripps Institution of Oceanography.
- Munk, W. (1993) Response of Acoustic Rays and Modes to Surface Warming (*ATOC Occasional Note #2*): Scripps Institution of Oceanography.
- Munk, W. (1993) It's the Shear Velocity, Stupid! (*ATOC Occasional Note #8*): Scripps Institution of Oceanography.
- Munk, W. (1993) It's the Slope, Stupid! (*ATOC Occasional Note #13*): Scripps Institution of Oceanography.
- Munk, W. (1995) How to Resolve Modes with Sparse Arrays (*ATOC Occasional Note #29*): Scripps Institution of Oceanography.
- Palmer, D. (1994) ATOC-FACT Arrival-Time Differences (*ATOC Occasional Note #17*): Scripps Institution of Oceanography.
- Pawlowicz, R., Farmer, D., Sotirin, B. & Ozard, S. (1995) Long Distance Arctic Transmissions to the Lincoln Sea (*ATOC Occasional Note #33*): Scripps Institution of Oceanography.

- Poplawski, J. E. & Birdsall, T. G. (1996) Multimodal Dispersion Identification (*ATOC Occasional Note #34*): Scripps Institution of Oceanography.
- Shang, E. C. & Wang, Y. Y. (1993) Propagation of Hawaii-Northward Path - Pretty Adiabatic! (*ATOC Occasional Note #6*): Scripps Institution of Oceanography.
- Shang, E. C. & Wang, Y. Y. (1993) Watch Out for the Coastal ("Up-Slope") Effect! (*ATOC Occasional Note #11*): Scripps Institution of Oceanography.
- Shang, E. C. & Wang, Y. Y. (1994) Tomographic Inversion of the El Niño Profile by Using a Matched-Mode Processing (MMP) Method (*ATOC Occasional Note #21*): Scripps Institution of Oceanography.
- Shang, E. C. & Wang, Y. Y. (1994) The Frontal Effects (*ATOC Occasional Note #24*): Scripps Institution of Oceanography.
- Spindel, R. C. (1993) Notes on a Simple ATOC Receiver (*ATOC Occasional Note #7*): Scripps Institution of Oceanography.
- Stammer, D. & Wunsch, C. (1993) Large Scale Modeling in the ATOC Context (*ATOC Occasional Note #14*): Scripps Institution of Oceanography.
- Tindle, C. T., Casey, P. A. J., Bold, G. E. J. & Tan, S. M. (1995) Normal Mode Extraction for ATOC Signals (*ATOC Occasional Note #26*): Scripps Institution of Oceanography.
- Wang, S., Grabb, M.L. & Poplawski, J.E. (1994) ATOC FM Signal Design (*ATOC Occasional Note #16*): Scripps Institution of Oceanography.

## ATOC – MMRP Peer-reviewed Publications

- Au, W. W. L., Nachtigall, P. E. & Pawloski, J. L. (1997). Acoustic effects of the ATOC signal (75 Hz, 195 dB) on dolphins and whales. *Journal of the Acoustical Society of America*, 101(5) Pt.1, 2973-2977.
- Boehlert, G. W., Costa, D. P., Crocker, D. E., Green, P., O'Brien, T., Levitus, S. & Le Boeuf, B. J. (2001). Autonomous pinniped environmental samplers: Using instrumented animals as oceanographic data collectors. *Journal of Atmospheric and Oceanic Technology*, 18(11), 1882-1893.
- Burgess, W. C., Tyack, P. L., Le Boeuf, B. J. & Costa, D. P. (1998). A programmable acoustic recording tag and first results from free-ranging northern elephant seals. *Deep-Sea Research Part II-Topical Studies in Oceanography*, 45(7), 1327-1351.
- Cerchio, S. (1998). Estimates of humpback whale abundance off Kauai, 1989 to 1993: evaluating biases associated with sampling the Hawaiian Islands breeding assemblage. *Marine Ecology Progress Series*, 175, 23-34.
- Costa, D. P., Crocker, D. E., Gedamke, J., Webb, P. M., Houser, D. S., Blackwell, S. B., Waples, D., Hayes, S. A. & Le Boeuf, B. J. (2003). The effect of a low-frequency sound source (acoustic thermometry of the ocean climate) on the diving behavior of juvenile northern elephant seals, *Mirounga angustirostris*. *Journal of the Acoustical Society of America*, 113(2), in press.
- Crocker, D. E., Le Boeuf, B. J. & Costa, D. P. (1997). Drift diving in female northern elephant seals: Implications for food processing. *Canadian Journal of Zoology-Revue Canadienne De Zoologie*, 75(1), 27-39.
- Croll, D.A., Tershy, B.R., Hewitt, R.P., Demer, D.A., Fiedler, P.C., Smith, S.E., Armstrong, W., Popp, J.M., Kiekhefer, T., Lopez, V.R., Urban, J. & Gendron, D. (1998). An integrated approach to the foraging ecology of marine birds and mammals. *Deep-Sea Research Part II-Topical Studies in Oceanography*, 45(7), 1353-1371.
- Fletcher, S., Le Boeuf, B. J., Costa, D. P., Tyack, P. L. & Blackwell, S. B. (1996). Onboard acoustic recording from diving northern elephant seals. *Journal of the Acoustical Society of America*, 100(4), 2531-2539.
- Frankel, A. S. & Clark, C. W. (1998). Results of low-frequency playback of M-sequence noise to humpback whales, *Megaptera novaeangliae*, in Hawai'i. *Canadian Journal of Zoology-Revue Canadienne De Zoologie*, 76(3), 521-535.
- Frankel, A. S., & Clark, C. W. (2000). Behavioral responses of humpback whales (*Megaptera novaeangliae*) to full-scale ATOC signals. *Journal of the Acoustical Society of America*, 108(4), 1930-1937.

- Frankel, A.S. & Clark, C.W. (2002) ATOC and other factors affecting the distribution and abundance of humpback whales (*Megaptera novaeangliae*) off the north shore of Kauai. *Marine Mammal Science*, 18(3), 644-662.
- Klimley, A. P. & Beavers, S. C. (1998). Playback of acoustic thermometry of ocean climate (ATOC)-like signal to bony fishes to evaluate phonotaxis. *Journal of the Acoustical Society of America*, 104(4), 2506-2510.
- Le Boeuf, B. J., Crocker, D. E., Costa, D. P., Blackwell, S. B., Webb, P. M. & Houser, D. S. (2000). Foraging ecology of northern elephant seals. *Ecological Monographs*, 70(3), 353-382.
- Le Boeuf, B. J., Crocker, D. E., Grayson, J., Gedamke, J., Webb, P. M., Blackwell, S. B. & Costa, D. P. (2000). Respiration and heart rate at the surface between dives in northern elephant seals. *Journal of Experimental Biology*, 203(21), 3265-3274.
- Le Boeuf, B. J., Morris, P. A., Blackwell, S. B., Crocker, D. E. & Costa, D. P. (1996). Diving behavior of juvenile northern elephant seals. *Canadian Journal of Zoology-Revue Canadienne De Zoologie*, 74(9), 1632-1644.
- Mobley, J. R. Jr., Smultea, M., Norris, T. & Weller, D. (1996). Fin whale sighting north of Kaua'i, Hawai'i. *Pacific Science*, 50(2), 230-233.

## ATOC – MMRP Other Publications

- Costa, D. P., Crocker, D. E., Waples, D. M., Webb, P. M., Gedamke, J., Houser, D. S., Goley, P. D., Le Boeuf, B. J. & Calambokidis, J. (1997). The California Marine Mammal Research Program of the Acoustic Thermometry of Ocean Climate Experiment. In O.T. Magoon et. al. (Eds.) *California and the World Ocean '97*, 1542-1553, San Diego, CA, March 24-27, 1997. American Society of Civil Engineers: Reston, Virginia.
- Harvey, J. T. & Eguchi, T. (1997). Effects of ATOC sounds on the Harbor Seal, *Phoca Vitulina Richardsi*, in Monterey Bay (*Moss Landing Marine Laboratories Technical Publication No. 97-1*): Moss Landing, California.
- Harvey, J. T., Raum-Suryan, K. L. & Suryan, R. M. (1996). Distribution and abundance of marine mammals near Sur Ridge, California, the former proposed site of the ATOC sound source (*Moss Landing Marine Laboratories Technical Publication No. 96-2*): Moss Landing, California.
- Mobley, J. R. Jr., Spitz, S. S., Forney, K. A., Grotefendt, R. & Forestell, P. H. (2000). Distribution and abundance of odontocete species in Hawaiian waters: Preliminary results of 1993-1998 aerial surveys (*Southwest Fisheries Science Center Administrative Report LJ-00-14C*): La Jolla, California.

## ATOC – MMRP Unpublished Publications

- ARPA & NMFS. (1994). *Draft Environmental Impact Statement/Environmental Impact Report for the California Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program*: Advanced Research Projects Agency, Arlington, VA and National Marine Fisheries Service, Silver Spring, MD.
- ARPA & NMFS. (1994). *Draft Environmental Impact Statement/Environmental Impact Report for the Kauai Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program*: Advanced Research Projects Agency, Arlington, VA and National Marine Fisheries Service, Silver Spring, MD.
- ARPA & NMFS. (1995). *Final Environmental Impact Statement/Environmental Impact Report for the California Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program (Scientific Research Permit Application [P557B])*: Advanced Research Projects Agency, Arlington, VA and National Marine Fisheries Service, Silver Spring, MD.
- ARPA & NMFS. (1995). *Final Environmental Impact Statement/Environmental Impact Report for the Kauai Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program*: Advanced Research Projects Agency, Arlington, VA and National Marine Fisheries Service, Silver Spring, MD.
- ARPA & UCSD/SIO. (1994). *Environmental Assessment for the Acoustic Thermometry of Ocean Climate (ATOC) Marine Mammal Research Program (MMRP) Acoustic Engineering Test (AET) (EA)*: Advanced Research Projects Agency, University of California San Diego/Scripps Institution of Oceanography.
- ATOC/MMRP. (1996). *ATOC/MMRP "Quick Look" Report for the period December 1995 - June 1996 (California MMRP)*.
- ATOC/MMRP. (1996 - 1998). *MMRP/ATOC Bi-Monthly Reports #1 - 17*.
- Bowles, A.E. (1995) *Summary of Results of 1993 and 1994 Aerial Observations of Humpback Whales, Kauai, Hawaii*.
- Calambokidis, J. (1995). *Preliminary (Quick-Look) Analysis of Photo-identification Surveys for 1995*.
- Calambokidis, J. (1996). *Preliminary (Quick-Look) Analysis of Aerial Survey Data, Surveys Conducted Through March 1996*.
- Cerchio, S.Jr. (1993). *Photographic Identification of Humpback Whales (Megaptera Novaeangliae) off Kauai, Hawaii during Winter and Spring, 1993*.
- Eckert, S. A. (1996). *Pilot study of leatherback sea turtle (Dermochelys coriacea) heart rate, swimming and dive behavior. (Final Report)*.

- Frankel, A.S. & Clark, C.W. (1995). *A Report on the Preliminary Measurements of Ambient Noise in Hanalei Bay.*
- Frankel, A.S. & Clark, C.W. (1998). *Quick-look Report of the Hawai'i ATOC-MMRP Hawaiian 1997/98 Results.*
- Frankel, A.S., Smultea, M.A. & Kieckhefer, T.R. (1998). *Humpback Whale Behavior Observed from Kauai Shore Stations 1994: Baseline Behavior and Vessel Effects.*
- Clark, C.W. & Frankel, A.S. (1999) *Interim MMRP/ Final Pilot Study Report of the Hawaiian ATOC-MMRP.*
- Gordon, J.C.D., Gillespie, D., Rendell, L.E. & Leaper, R. (1996). *Draft report on playback of ATOC like sounds to sperm whales (Physeter macrocephalus) off the Azores.*
- Mobley, J.R.Jr., Forestell, P.H. & Grotefendt, R. (1994). *Results of 1993 aerial surveys in Hawaiian waters.*
- Mobley, J.R.Jr. & Grotefendt, R. (1994). *ATOC Marine Mammal Research Program (ATOC MMRP): Preliminary Report: 1994 Aerial Surveys for Waters North of Kauai.*
- Smultea, M.A., Kieckhefer, T.R., Bowles, A.E. & Zoidis, A.M. (1993). *Results of Tracking, Behavioral Observations, and Scan Sampling from North and South Shore Stations, Kauai 1993.*
- Smultea, M.A., Kieckhefer, T.R. & Frankel, A.S. (1994). *Results of 1994 ATOC-MMRP Shore-Based Scan Sample Observations.*
- UCSD, ONR & SIO. (1996). *Environmental Assessment/Initial Study for the Ocean Acoustic Observatories Alternate Source Test (AST) (EA):* University of California San Diego, Office of Naval Research, Scripps Institution of Oceanography.

## ATOC - Arctic Peer Reviewed

- Johnson, M.A., Proshutinsky, A.Y. & Polyakov, I.V. (1999). Atmospheric patterns forcing two regimes of Arctic circulation: A return to anticyclonic conditions? *Geophysical Research Letters*, 26(11), 1621-1624.
- Mikhalevsky, P. N., Baggeroer, A. B., Gavrilov, A. N. & Slavinsky, M. (1995). Experiment tests use of acoustics to monitor temperature and ice in the Arctic Ocean. *EOS, Transactions, American Geophysical Union*, 76(27), 265, 268-269.
- Mikhalevsky, P. N., Gavrilov, A. N. & Baggeroer, A. B. (1999). The Transarctic Acoustic Propagation experiment and climate monitoring in the Arctic. *IEEE Journal of Oceanic Engineering*, 24(2), 183-201.
- Pawlowicz, R., Farmer, D., Sotirin, B. & Ozard, S. (1996). Shallow-water receptions from the transarctic acoustic propagation experiment. *Journal of the Acoustical Society of America*, 100(3), 1482-1492.
- Polyakov, I.V., Proshutinsky, A.Y. & Johnson, M.A. (1999). Seasonal cycles in two regimes of Arctic climate. *Journal of Geophysical Research*, 104(C11), 25761-25788.

## ATOC - Arctic Other Publications

- Gavrilov, A. N. & Mikhalevsky, P. N. (1995). Modeling an acoustic response to long-term variations of water and ice characteristics in the Arctic Ocean. *OCEANS 95 MTS/IEEE Proceedings, Vol. 1*, 247-253, San Diego, CA, October 9-12, 1995.
- Gavrilov, A. N. & Mikhalevsky, P. N. (1996). Phase acoustic tomography with broadband signals in the Arctic. In J.S. Papadakis (Ed.) *Proceedings of the Third European Conference on Underwater Acoustics, Vol. II*, 851-856, Heraklion, Crete, Greece, June 24-28, 1996. FORTH-IACM: Heraklion.
- Gavrilov, A. N. & Mikhalevsky, P. N. (2001). Mode-coupling effects in acoustic thermometry of the Arctic ocean. In M.I. Taroudakis & G. Makrakis (Eds.) *Inverse Problems in Underwater Acoustics*, 105-126, First Workshop on Inverse Problems in Underwater Acoustics, Heraklion, Crete, Greece, May 21-23, 1999. Springer-Verlag: New York.
- Gavrilov, A. N., Mikhalevsky, P. N. & Andreyev, M. Y. (1995). Measurements of low-frequency transmission loss in the Trans-Arctic Acoustic Propagation experiment. *OCEANS 95 MTS/IEEE Proceedings, Vol. 2*, 941-948, San Diego, CA, October 9-12, 1995.
- Mikhalevsky, P. N. (1995). Transarctic Acoustic Propagation (TAP) feasibility experiment. *Proceedings of the 15<sup>th</sup> International Congress on Acoustics, Vol. I*, Trondheim, Norway, June, 1995.
- Mikhalevsky, P. N. (1999). Arctic Climate Observations using Underwater Sound (ACOUS). *International Symposium Acoustic Tomography and Acoustic Thermometry Proceedings*, 125-131, Tokyo and Yokosuka, Japan, February 8-10, 1999.
- Mikhalevsky, P. N., Keenan, R. E. & Baggeroer, A. B. (1996). Measured transarctic acoustic travel times and model comparisons. In J.S. Papadakis (Ed.) *Proceedings of the Third European Conference on Underwater Acoustics, Vol. II*, 773-777, Heraklion, Crete, Greece, June 24-28, 1996. FORTH-IACM: Heraklion.
- Mikhalevsky, P. N., Muench, R. & Baggeroer, A. B. (1993). Acoustic thermometry for Arctic Ocean climate. *IEEE Oceans '93 Conference Proceedings*, I-263-I-266, Victoria, British Columbia, Canada, October 18-21, 1993.
- Sotirin, B. J. & Mikhalevshy, P. N. (1996). Receiver arrays for the Arctic Climate Observations using Underwater Sound (ACOUS) program. In J.S. Papadakis (Ed.) *Proceedings of the Third European Conference on Underwater Acoustics, Vol. II*, 1055-1060, Heraklion, Crete, Greece, June 24-28, 1996. FORTH-IACM: Heraklion.

## ATOC - Arctic Unpublished Reports

- Baronkin, V., Kodanov, V. & Dubrovsky, N. (1995). *Forward to Creation of System of Underwater Monitoring of Marine Mammals (SUMMM) in the Eastern Arctic, Vol. 2:* N.N. Andreyev Acoustics Institute.
- Bel'kovich, V. M., Bibikov, N. G. & Dubrovsky, N. (1995). *Tentative Estimates of Marine Mammals Distribution and its Seasonal Variations in the Eastern Arctic:* N.N. Andreyev Acoustics Institute.
- Bibikov, N. G., Bel'kovich, V. M. & Dubrovsky, N. (1995). *A Tentative Study of Low Frequency Sound Effects on the Food Chains of the Marine Mammals in the Eastern Arctic, Vol. 1:* N. N. Andreyev Acoustics Institute.
- Brestkin, S. V., Porubayev, V. S., Akseonov, E. O. & Zakharov, V. F. (1994). *Statistical Characteristics of the Bottom Profile of the Arctic Ice Cover. Analysis of Climatic Changes of the Arctic Ice Cover Extent:* AcoustInform - 94/03.
- Doroshenko, A. A., Budnev, N. M., Panfilov, A. I., Tchensky, A. G., Morozov, A. K. & Gavrilov, A. N. (1996). *Development of the Method for Deployment of an Autonomous Source for Year-Round Acoustic Monitoring of the Arctic Ocean and the Acoustic Complex for Horizontal Location of an Autonomous Source and Communication of the Navigation Data:* MSIC Report.
- Dubrovsky, N., Bel'kovich, V. M., Bibikov, N. G., Sukhoruchenko, M. N., Zhuravlev, V. A. & Zorikov, T. V. (1994). *Preliminary estimates of low-frequency sound effect on sea animals in the Eastern Arctic:* N.N. Andreyev Acoustics Institute.
- Dubrovsky, N., Pirogov, V. A. & Urusovsky, I. A. (1994). *Low Frequency Arctic Capable Acoustic Source: Feasibility Test, Design and Manufacture Prototype:* N.N. Andreyev Acoustics Institute.
- Dylev, P. A., Karlik, J. S., Mitrofanov, O. G., Pegeev, V. P. & Postoenko, J. K. (1998). *Activate ATOC Signal Receiving Equipment in Kamchatka:* Advanced Science & Technology Center (GRAN) Technical Report.
- Gavrilov, A. N. & Kudryashov, V. N. (1994). *Numerical Modeling of Low-Frequency Sound Propagation in Horizontally Stratified Arctic Waveguide:* AcoustInform - 94/01.
- Gavrilov, A.N. (1994) *Modeling Acoustic Response on Long-Term Variation and Climatic Change of the Water and Ice Cover Characteristics on the Trans-Arctic Paths:* AcoustInform - 94/05.
- Gavrilov, A. N. & Morozov, A. K. (1997). *Modelling of Acoustic Thermometry at the Transarctic Franz Victoria Strait-Lincoln Sea Path. Final Report:* MSIC Report.
- Gavrilov, A. N. & Pisarev, S. V. (1996). *Hydrologic Conditions in the Santa Anna and Franz Victoria Troughs:* MSIC Report No. 4/96.

- Gavrilov, A. N. & Lyubtchenko, A.Y. (1995). *Planning of Deployment of an Autonomous source for Year-Round Acoustic Monitoring of the Arctic Ocean*: MSIC Report.
- Gavrilov, A. N. & Andreyev, M. Y. (1996). *Analysis of the Results of the Trans-Arctic Propagation Experiment (Transmissions from i/c Turpan to i/c Narwhal.)*: MSIC Report.
- Petnikov, V. G. & Andreev, M.Y. (1994). *Experimental Data Analysis of Long-Range Sound Propagation in Arctic*: AcoustInform - 94/02.
- Pirogov, V. A., Urusovsky, I. A. & Mironov, M. A. (1995). *Low-frequency acoustic source: design and manufacture of the driver optimized for 70-Hz and its operation in combination with a thin-walled tube radiator*: N.N. Andreyev Acoustics Institute.
- Pisarev, S. V. (1996). *Interannual Variability of the Atlantic Water in the Arctic Basin*: MSIC Report.
- Sabinin, K. D. (1996). *Variability of the Arctic Basin Oceanographic Fields*: MSIC Report.
- Sabinin, K. D., Brestkin, S. V., Petnikov, V. G., Shmelerv, A.Y. & Gavrilov, A.N. (1993). *Selected Topics in Arctic Ocean Climate Feasibility Research and Modeling*: AcoustInform - 93/02.
- Sabinin, K. D. & Pisarev, S. V. (1994). *Oceanographic Background to the Arctic ATOC Feasibility Study. Final Report, Vol. 1*: AcoustInform - 94/04.
- Sabinin, K. D., Sokolov, B. T., Sarkisyan, A. S., Yakovlev, N. G., Gavrilov, A. N. & Andreyev, M.Y. (1997). *Large Scale Variations in the Arctic Ocean and the Acoustic Monitoring Scheme Optimal for Observations of Climate Changes. Final Report*: MSIC Report No. 1/97.
- Slavinsky, M. (1993). *Requirements analysis for the design of an installation of an acoustic emission system in the far east of Russia as a part of the ATOC network in the North Pacific Ocean*: Advanced Science & Technology Centre (GRAN).
- Slavinsky, M., Abrosimov, D., Artel'nyi, V., Belov, V., Gorskii, S., Khil'ko, A., Kuznetsov, V., Lebedev, O., Raevsky, M., Turchin, V., Ugrinovskiy, R., Virovlyansky, A. & Zalezsky, A. (1994) *The Investigation of Propagation and Processing of Signals for Acoustical Monitoring of Climate Changes of Arctic Ocean*: Advanced Science & Technology Centre (GRAN).
- Slavinsky, M., Bogolubov, B. & Virovlyansky, A. (1995). *Initial Arctic Acoustic Source Design Study*: Advanced Science & Technology Center (GRAN) Final Technical Report.
- Yakovlev, N. G., Sarkisyan, A. S. & Pisarev, S. V. (1996). *Study of the Spatial Structure of Arctic Ocean Variability. Progress Report*: MSIC Report No. 3/96.