

CEROS



*The National Defense Center of Excellence
for Research in Ocean Sciences (CEROS)*

FINAL TECHNICAL REPORT

for

DARPA Cooperative Agreement No. MDA972-02-2-0002

Federal Fiscal Years 2002 through 2006

June 2009

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CEROS is a State of Hawai'i program
of the Natural Energy Laboratory of Hawai'i Authority (NELHA)
funded through a Cooperative Agreement with the
Defense Advanced Research Projects Agency (DARPA)

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A compact disc (CD) is enclosed in a sleeve on the inside back cover of this report; the CD contains a copy of the Final Report for each of the contracts awarded under this Cooperative Agreement.

INTRODUCTION

The National Defense Center of Excellence for Research in Ocean Sciences (CEROS) was created by congressional action. House Bill 8761, published in the 18 September 1992 *Congressional Record*, contained a section entitled *Research, Development, Test, and Evaluation, Defense Agencies* and provided for

“. . . an additional amount for RESEARCH, DEVELOPMENT, TEST AND EVALUATION, DEFENSE AGENCIES, \$74,800,000, to remain available for obligation until September 30, 1993. Provided that \$5,000,000 of the funds appropriated in this paragraph shall be made available only for a National Defense Center of Excellence for Research in Ocean Sciences to be established through cooperation between the Defense Advanced Research Projects Agency (DARPA) and the Hawai'i High Technology Development Corporation (a government entity) for the purpose of conducting research and development (R&D) activities of interest to the Department of Defense on such topics as ocean environment preservation technology, new ship hull design concepts, shallow water and surveillance technologies, ocean measurement instrumentation, and the unique properties of the deep ocean environment."

In February 1993, CEROS was established through a grant from the Defense Advanced Research Projects Agency (DARPA) to the High Technology Development Corporation (HTDC), an agency of the State of Hawai'i attached to the Department of Business, Economic Development and Tourism (DBEDT). CEROS was funded

“. . . for the purpose of conducting research and development activities of interest to the Department of Defense . . . and . . . to support and stimulate a broad spectrum of research in ocean science in the State of Hawai'i."

CEROS is a unique technology development program between the State of Hawai'i and the federal Defense Advanced Research Projects Agency. Federal support for CEROS comes to the State through grants and cooperative agreements with DARPA, who also provide technical and administrative guidance to assure that the program remains responsive to the needs of national defense while helping the technology community in Hawai'i.

PROGRAM SUMMARY

Structure and Organization

When CEROS was created, it was administered by the State of Hawai'i through the Hawai'i High Technology Development Corporation. In December 1995, CEROS was transferred to the Natural Energy Laboratory of Hawai'i Authority (NELHA), another State of Hawai'i agency administratively attached to DBEDT. The NELHA Board of Directors sets broad goals, develops policy, and provides guidance for the general management and direction of CEROS. As CEROS funding agent, DARPA reviews and evaluates CEROS programs and management to assure grant conformance and consistency with congressional intent.

CEROS is headed by a Technical Director, and has a staff of four additional personnel. The Technical Director is the agreement's Principal Investigator and is responsible for technical program development and execution. The Technical Director impanels a Research Advisory Board (RAB) to provide functional oversight, guidance, and advice throughout the CEROS source-selection process and to plan and implement strategic development. As a condition of funding, CEROS programmatic goals and managerial approaches are presented to DARPA annually as an operational plan.

Program Objectives and Scope

The purpose of CEROS is to solicit and support innovative technology development for national maritime military applications and sustained technology-based economic development in Hawai'i. This includes demonstrating capabilities and building residual benefits.

The CEROS technical program seeks to identify leading-edge, value-added technologies that support Department of Defense requirements, use facilities, and infrastructure in Hawai'i, and foster potential commercial development. The technical topic areas addressed by the CEROS program were identified in the congressional legislation as

- Ocean environmental preservation technology
- New ocean platform and ship concepts
- Shallow water surveillance technologies
- Ocean measurement instrumentation and ocean engineering tools
- Unique properties of the deep ocean environment.

CEROS supports R&D projects that are intended to produce measurable results or products within 12 months. Procurement is based on priorities that are issued in published solicitations, emphasizing near-term results. Proposals can include options for an extended period of performance. However, incremental or follow-on funding of any such option is not guaranteed. If a project is proposed that probably cannot be procured within time or budget limitations, the CEROS Technical Director and the CEROS Research Advisory Board will try to reduce the risks and consequences of postponing, scaling, or not funding. Trade-offs among cost, performance, and schedule are evaluated relative to programmatic goals and planned procurement schedule and appropriate risk-reduction strategies are identified and implemented.

The CEROS program has been formulated as an exploratory and advanced technology development program, with little, if any, basic research.

Procurement Procedures

CEROS hosts an annual Industry Day meeting to provide to the high technology community the current needs of the Department of Defense. Speakers typically include DARPA Program Managers, representatives from DoD laboratories and research facilities, and Science and Technology (S&T) advisors from military commands. Opportunities are provided for company representatives to meet one-to-one with DoD personnel to explore requirements and development concepts.

CEROS solicits proposals for concept development and demonstration of ocean technologies and applied ocean sciences for military maritime purposes through annual Broad Agency Announcements (BAAs) through FY05 and thereafter through Solicitations. An offeror must be a commercial enterprise to be eligible for consideration. CEROS selects and supports technical projects that conform to its mission. CEROS procures R&D based on programmatic priorities and goals; the resultant procurement contracts include terms and schedules for delivery. The selection process emphasizes technology development in Hawai'i and the Pacific without eliminating applicable projects of merit with a focus elsewhere. CEROS determines best value through technical and programmatic evaluations that match proposed efforts with DoD technology needs and CEROS programmatic objectives within funding constraints. As a condition of funding, DARPA approves CEROS contract policy and procedures and assures that they are consistent with applicable federal acquisitions regulations and guidelines.

The BAA or Solicitation for each program year covered under this agreement was released on the CEROS web site, on the Hawai'i State Procurement Office web site, and on the FedBizOpps website (formerly the Commerce Business Daily) as follows:

YEAR	SOLICITATION	RELEASE DATE
FY02	BAA-CEROS-02-01	1 Oct 2001
FY03	BAA-CEROS-03-01	1 Oct 2002
FY04	BAA-CEROS-04-01	1 Oct 2003
FY05	CEROS-CORE-05-01	8 Oct 2004
FY06	CEROS-CORE-06-01	3 Oct 2005
	CEROS-CORE-06-02	6 Feb 2006

The CEROS program operates on less than 8% administrative overhead, with more than 92% of the federal funds allocated to research and development contracts. The CEROS staff comprise a Technical Director, a Contracts and Grants Administrator, a Research Administrator, an Program Manager for Outreach and Administrative, and a Fiscal Assistant.

DARPA Grants and Cooperative Agreements

DARPA Grant No. MDA972-93-1-0008

DARPA awarded Grant No. MDA972-93-1-0008 for \$5,000,000 to HTDC for CEROS in February 1993. This grant supported a core program of eleven projects involving twelve prime contractors during CEROS FY93. Technical work was complete for this grant by December 1997, and the final grant report was delivered to DARPA in September 1998.

DARPA Grant No. MDA972-94-1-0010

DARPA awarded Grant No. MDA972-94-1-0010 to HTDC for CEROS in May 1994. This grant, with total funding of \$18,737,796, supported a core program of thirty-nine projects involving nineteen prime contractors during CEROS FY94, FY95, and FY96. Technical work was complete for this grant by June 1999, and the final report was delivered to DARPA in September 1999.

DARPA Cooperative Agreement No. MDA972-97-2-0001

DARPA awarded Cooperative Agreement No. MDA972-97-2-0001 to the Natural Energy Laboratory of Hawai'i Authority (NELHA) in September 1997. This agreement, with total funding of \$31,707,564, supported a core program of eighty projects involving thirty-five prime contractors during CEROS FY97, FY98, FY99, FY00 and FY01.

DARPA Cooperative Agreement No. MDA972-02-2-0002

DARPA awarded Cooperative Agreement No. MDA972-02-2-0002 to the Natural Energy Laboratory of Hawai'i Authority (NELHA) in May 2002. This agreement, with total funding of \$30,257,000, supported a core program of 76 projects involving 30 prime contractors during CEROS FY02, FY03, FY04, FY05 and FY06. This report describes the work done under the 2002 agreement.

The goals of this cooperative agreement are:

"...to promulgate technological approaches and to demonstrate advanced innovative concepts, leveraging the facilities and infrastructure available in the state of Hawai'i in support of Department of Defense requirements."

Contract details are listed in Tables 1 through 5 for each of the fiscal years of Cooperative Agreement MDA972-02-2-0002. Brief project descriptions are provided for each contract, and Final Reports for each Contract can be found on the compact disc attached to the back cover of this report.

TABLE 1. FY02 CEROS Contracts

CONTRACTOR	PROJECT TITLE	NO.	AMOUNT	Page
BBNT Solutions, LLC	<i>Netted CCS Phase II: A Proposal to Demonstrate ASW Targeting and Weapon Control Utilizing Submarine and P-3 Platforms</i>	49305	\$979,901	10
Detection Limit Technology, Inc.	<i>Improved "Dog Nose" Sensor for Real time Ocean TNT Detection and Quantification and Fish Virus Detection</i>	49262	\$350,000	11
Knapp Engineering, Inc. dba Structural Solutions	<i>Structural Modeling of Synthetic Fiber Ropes</i>	49866	\$195,000	112
Makai Ocean Engineering, Inc.	<i>Computation of Submarine Towed Array Shapes and Dynamics based on Array Sensors, Indirect Current Sensing and In-situ Drag Coefficient Measurements</i>	49628	\$479,513	13
Navatek, Ltd	<i>Modification of a Whole Ship Design Synthesis Model to Accept Ship Designs Employing Advanced Lifting Body Technology</i>	49271	\$356,000	14
Oceanit Laboratories, Inc.	<i>Three-Dimensional Cloud Height Indicator for Marine Application (Phase II - System Marine Testing)</i>	49332	\$360,390	15
ORINCON Corp.	<i>Safety-of-Ship System</i>	49673	\$350,000	16
ORINCON Corp.	<i>Portable and Improved Mission Reconfigurable Signal Processor (PIMRSP)</i>	49634	\$440,000	17
Scientific Solutions, Inc.	<i>Ocean Acoustic Laboratory at PMRF, Continuation</i>	49263	\$500,000	18
SEE/RESCUE Corp.	<i>Emergency Supplemental Floatation System (ESFS)</i>	49272	\$45,007	19
		TOTAL	\$4,055,811	

TABLE 2. FY03 CEROS Contracts

CONTRACTOR	PROJECT TITLE	NO.	AMOUNT	Page
BBNT Solutions, LLC	<i>Implement and Demonstrate a NetCentric Air-deployed Portable Range</i>	50592	\$879,000	20
Black Pearls, Inc.	<i>Refining and Broadening the use of pearl oysters as Sensitive Biomonitors for Heavy Metal Contamination</i>	50590	\$119,920	21
Concurrent Analytical, Inc.	<i>Improved Resolution in Fourier Transform Spectroscopy</i>	50591	\$325,443	22
Innovative Technical Solutions, Inc. dba NovaSol	<i>Temporally Enhanced Adaptive Multi-spectral (TEAMS) System for Detection of Underwater Objects</i>	50585	\$700,000	23
Knapp Engineering, Inc. dba Structural Solutions	<i>STARs - Computer-Aided Design of Synthetic Fiber Ropes</i>	51104	\$205,000	24
Makai Ocean Engineering, Inc.	<i>Real-time, Dynamic Modeling of Multi-Line Towed Array Systems</i>	50992	\$450,000	25
Navatek, Ltd.	<i>Analysis of the Potential Benefits of Integrating a Lifting Body Bow to Large Ships</i>	50587	\$150,000	26
Ocean Engineering Consultants, Inc.	<i>Swath Ship Motion Software</i>	50627	\$172,200	27
Oceantek, Inc.	<i>An Ocean Bottom Span analyzer for Survey Planning and Installations of Submarine Cables and Pipelines</i>	50628	\$94,563	28
ORINCON Defense	<i>Safety-of-Ship System Phase 2</i>	50987	\$585,996	29
ORINCON Defense	<i>Combined Optical Acoustic Tracking System (COATS)</i>	50986	\$200,000	30
Pacific Environmental Technologies LLC	<i>AQUASENSE: A Low-power, High-Sensitivity, Portable Mass Spectrometer</i>	51228	\$153,690	31
Science Applications International Corp.	<i>Development and Demonstration of a 3-D Flapping Foil Motion Control System for Advanced Marine Vehicles</i>	50583	\$320,000	32
Scientific Solutions, Inc.	<i>Data Assimilation, Productization and Dissemination for the Ocean Acoustic Laboratory at PMRF</i>	50584	\$210,500	33
WeatherGuy.com, LLP	<i>Feedback Planning: Fundamentally Improving Undersea Warfare Acoustic Mission Planning Through Event Reconstruction and Analysis for U.S. Navy Maritime Patrol and Reconnaissance Force</i>	50586	\$332,595	34
TOTAL			\$4,898,907	

TABLE 3. FY04 CEROS Contracts

CONTRACTOR	PROJECT TITLE	NO.	AMOUNT	Page
Aero Union Marine Systems Corp.	<i>Marine Air-deployed Rescue Vehicle (MARV)</i>	51944	\$310,000	35
Applied Marine Solutions	<i>Feedback Planning: Fundamentally Improving Undersea Warfare Acoustic Mission Planning Through Event Reconstruction and Analysis – Phase II</i>	51954	\$403,350	36
BBNT Solutions LLC	<i>Submarine Combat Control System Trainer and Support and Demonstrate Anti-submarine Warfare (ASW) Capabilities with COMSUBPAC, Pearl Harbor</i>	52371	\$524,948	37
BBNT Solutions LLC	<i>Infrasonic Remote Sensing of Breaking Ocean Waves in the Surf and Littoral Zones</i>	52192	\$349,979	38
BBNT Solutions LLC	<i>TREDS Software Interface for Net Centric Portable Range</i>	50592-S2	\$239,756	39
Black Pearls, Inc.	<i>Extending Technology for Probiotic Cultures in Deep Seawater to Enhance Marine Finfish Hatchery Efficiencies</i>	51945	\$157,360	40
Cellular Bioengineering, Inc.	<i>Neural Matrix Chips for Chemical and Biological Weapons Detection</i>	51946	\$309,326	41
Concurrent Analytical, Inc.	<i>Improved Resolution in Fourier Transform Spectroscopy</i>	51947	\$434,700	42
Concurrent Analytical, Inc.	<i>Detection System for Weapons of Mass Destruction</i>	51948	\$265,440	43
Knapp Engineering, Inc. dba Structural Solutions	<i>Computer-Aided Design of Complex Umbilical Cables</i>	52751	\$210,000	44
Lockheed Martin ORINCON Defense	<i>Autonomous Passive Acoustic Classification System (APACS)</i>	51949	\$654,334	45
Makai Ocean Engineering, Inc.	<i>Validation of Towed Array Shapes Using At-sea Data and Smart Beamforming</i>	52644	\$475,000	46
Neptune Technologies Inc.	<i>A Secure Homing System for ASDS SEAL Teams</i>	51950	\$362,320	47
Oceanic Imaging Consultants, Inc.	<i>Smart Sonar Suite Test and Evaluation</i>	51951	\$450,000	48
Oceantronics, Inc.	<i>IFF Modification Kit</i>	51952	\$222,860	49
Science Applications International Corp.	<i>Development and Demonstration of Articulated Motion Control Fins for a Prototype Underwater Vehicle</i>	52370	\$664,000	50
Science Applications International Corp.	<i>Modeling Multi-hull Stability in Insular Littoral Waters</i>	50583-S2	\$150,000	51
SEE/RESCUE Corp.	<i>Emergency Pocket Water Desalinators (EPWD)</i>	51953	\$50,300	52
SEE/RESCUE Corp.	<i>Evaluation of LIFE/FLOAT Technology for Special Operations</i>	LOA-04-259	\$13,700	53
	TOTAL		\$6,247,373	

TABLE 4. FY05 CEROS Contracts

CONTRACTOR	PROJECT TITLE	NO.	AMOUNT	Page
Applied Marine Solutions	<i>Feedback Planning: Fundamentally Improving Undersea Warfare Acoustic Mission Planning Through Event Reconstruction & Analysis - Phase III</i>	53864	\$395,000	54
BAE Systems Spectral Solutions LLC	<i>Single Camera Multispectral Imager Study</i>	53390	\$341,044	55
BBNT Solutions LLC	<i>Proposal for a UAV-Enabled Wireless Network for Littoral ASW</i>	53906	\$312,988	56
Cellular Bioengineering, Inc.	<i>Neural Matrix Chips for Chemical and Biological Weapons Detection</i>	53391	\$557,243	57
Concurrent Analytical, Inc.	<i>Improved Virus Detection Capability</i>	53414	\$314,574	58
Creative Technology Applications, Inc.	<i>Soft Rail Launch and Recovery System</i>	53798	\$150,000	59
Lidar Pacific Corp.	<i>The Use of Texel 3D Imaging for Shallow Water Bathymetric Measurements</i>	53437	\$401,218	60
Lockheed Martin Orincon Defense	<i>Doppler-Compensated Interarray Broadband Cross-Correlation (DIBX) for Sonar Contact Geo-Localization</i>	53644	\$585,277	61
Makai Ocean Engineering, Inc.	<i>A Deep Ocean Anti-Neutrino Detector Near Hawaii</i>	53439	\$625,000	62
Makai Ocean Engineering, Inc.	<i>Development of a Simplified ADS Deployment Approach</i>	53440	\$359,949	63
Matrix Defense Corp.	<i>Optical Identification Technology for Man Overboard at Sea Rescue</i>	53825	\$160,171	64
Navatek, Ltd.	<i>Design and Testing of a High Efficiency, Lifting Body Integrated Propulsion Pod with Electric Drive</i>	53637	\$640,698	65
Oceanit Laboratories, Inc.	<i>Three-Dimensional Cloud Height Indicator for Marine Application (Phase III)</i>	53438	\$427,630	66
Oceanit Laboratories, Inc.	<i>Real-Time Tactical Bioluminescence Detector</i>	53662	\$403,330	67
Science Applications International Corp.	<i>A Shallow Water Concept Demonstration for Signature Measurements</i>	53819	\$445,796	68
		TOTAL	\$6,119,918	

TABLE 5. FY06 CEROS Contracts

CONTRACTOR	PROJECT TITLE	NO.	AMOUNT	Page
BBN Technologies Corp.	<i>Airborne-Enabled Wireless Network Demonstration for Littoral Net-Centric ASW</i>	55305	\$372,855	69
		56631	\$104,981	
Creative Technology Applications, Inc.	<i>Soft Rail Launch and Recovery System</i>	55213	\$260,000	70
		56978	\$10,000	
Frank Garske III dba Nextwave Engineering	<i>Reaper Cheater – A Mechanical Rebreather Control System</i>	55699	\$37,550	71
HR Biopetroleum, Inc.	<i>Genetic Adaptation and Screening of Marine Algae to Increase Lipid Yield and Photosynthetic Efficiency for Biodiesel Production</i>	55218	\$644,586	72
Innovative Technical Solutions, Inc.	<i>Customer and Requirements Delineation for the Miniature Reconnaissance & Surveillance System</i>	55417	\$25,000	73
Innovative Technical Solutions, Inc.	<i>Compact Airborne Signal Processing Exploitation (CASE) System</i>	55806	\$505,233	74
Knapp Engineering, Inc. dba Structural Solutions	<i>Experimental Validation of Cable Design Software</i>	55376	\$440,000	75
Lockheed Martin Orincon Defense	<i>Contact Detector and Follower for Naval Classification (CDFNC)</i>	55429	\$504,942	76
Makai Ocean Engineering, Inc.	<i>Modeling and Evaluation of DADS Deployment Approaches</i>	55428	\$355,186	77
MIKEL	<i>Hybrid Hyperbolic Multilateration and Doppler Measurement Model for UUV Navigation</i>	55271	\$367,612	78
Navatek, Ltd.	<i>A New Device for the Control of High Speed (100 KT) Underwater Vehicles and Surface Craft</i>	55214	\$427,195	79
Neptune Technologies, Inc.	<i>Signal Processing Methods for Highly Mobile Underwater Acoustic Communications Networking</i>	55392	\$540,000	80
Oceanic Imaging Consultants, Inc.	<i>SmartSonar II</i>	55816	\$329,565	81
Oceantek, Inc.	<i>Advanced, PC-Based Interactive 3D/4D Visualization Environment with Applications in Data Fusion</i>	55292	\$522,498	82
Science Applications International Corp.	<i>Portable Vector Sensor System for Acoustic Measurements</i>	55427	\$233,541	83
Science Applications International Cor.	<i>Use of Acoustic Signals for Tsunami Warnings</i>	55426	\$204,169	84
Scientific Solutions, Inc.	<i>Development and Validation of Ocean Acoustic Data Assimilation Technology with Implementation at the Pacific Missile Range Facility</i>	55365	\$114,637	85
TOTAL			\$5,999,550	