
FINAL TECHNICAL REPORT

Development of Analytical and Environmental Diagnostic Techniques

GC-FR-2834 REVISED

**As Required by
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Prepared for
U.S. Naval Research Laboratory
4555 Overlook Avenue, S.W.
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Prepared by
GEO-CENTERS, INC.
7 Wells Avenue
Newton Centre, MA 02459

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13. ABSTRACT (Maximum 200 words) This final report is a compilation of the publications and presentations generated, and/or the accomplishments made per task/project, for the tasks performed in support of the development of analytical and environmental diagnostic techniques during the period of September 1995 - September 1999. The task description of each task/project - as designated in the Statement of Work - is included for convenience.				
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1.0 INTRODUCTION

This Final Report lists the publications and presentations generated and/or the accomplishments made – for the diverse tasks performed by GEO-CENTERS, INC. in support of the Naval Research Laboratory (NRL) Contract Number N00014-95-C-2054, during the period of September 1995 to September 1999. The work includes tasks designated in the original Statement of Work, as well as additional tasks that were later appended to the existing contract. The specific tasks include the following:

- Analysis and Control of Airborne Chemicals.
- Chemical Analysis and Chemical Sensor Development
- Environmental Remediation Site Characterization
- Airborne and Marine Magnetic Site Characterization

2.0 SCOPE

These research efforts require the expertise of skilled, highly-technically qualified contractor scientists and engineers in support of the Branch obligations to carry out these chemical development studies. The range of skills required for these studies includes laser studies, optical spectroscopies, mass spectrometry, reaction kinetics and mechanisms, modern instrumental analytical technique development and applications, advanced chemical sensor development, computer modeling and graphics, software development, sophisticated data reduction and analysis, generation of briefings and reports for sponsors, and hardware design and system engineering experience.

The R&D requirements include tasks that vary considerably in their scope and in the complexity of the deliverable products. However, the tasks are interrelated in that they support the central mission of the Branch and must be coordinated with each other.

3.0 TASK DESCRIPTIONS

3.1 TASK 1 – ANALYSIS AND CONTROL OF AIRBORNE CHEMICALS

Technical Requirements

- (1) The contractor shall use standard analytical methods and techniques for the characterization of trace organic components from submarine atmospheres.
- (2) The contractor shall investigate and develop new technologies that will be used in obtaining information about trace organic levels aboard submarines.
- (3) The contractor shall analyze the results of atmospheric chemical measurements made on operational submarines.
- (4) The contractor shall undertake laboratory chemical studies to investigate gas phase chemical reactions. These studies shall be conducted to determine the environmental fate and affect of the use of replacement refrigerants and their reactive products on machinery, instrumentation, electronics and personnel in ship and submarine environments.
- (5) The contractor shall design test protocols, support field studies, evaluate results and draft reports describing performance.

Accomplishments

The contractor designed and fabricated a device in the laboratory for generating precise, part-per-billion atmospheric concentrations of formaldehyde and acrolein (both constituents of concern in submarine atmospheres). The gas generator was connected to a small chamber designed for testing new passive sampling devices for the compounds of interest. Comparison studies of active and new passive sampling technology were initiated.

Whole air samples (in canisters) and samples collected on carbon media were taken on the USS Boise and analyzed for trace organic compounds. A total of 15 canister samples and 48 carbon tube samples from the Boise cruise were analyzed. During the same cruise, samples for the determination of atmospheric aldehydes and ketones were also collected on tubes containing special media designed for this purpose. The sample tubes were returned to NRL, extracted and analyzed by HPLC. The data were used to help determine the impact of refrigerant alternatives to CFCs aboard submarines.

Samples of hydraulic fluids from SSN 705 and SSN 719 were tested to characterize their gaseous emissions via gas chromatography and flame ionization or thermal conductivity detection. Levels of carbon monoxide emission were determined using a CAMS system.

Analyzed samples acquired from submarines, USS Kentucky, USS Boise and USS West Virginia. Canister samples and adsorbed tube samples were analyzed by thermal desorption gas chromatography/mass spectrometry. Analysis of the resultant chromatograms indicated the presence of several volatile organic compounds, including benzene, toluene, xylene and chlorinated hydrocarbons.

Other laboratory activities included the analysis of polyol ester lubricants and the characterization of gases from oil samples taken from hydraulic systems aboard submarines. The latter were characterized by gas chromatography using flame ionization and thermal conductivity detection.

Reports

9610/61-3800-A-9 Ser 6110/287, "Subject Report – Alternate Refrigerant Program: Results of Air Sampling and Analysis aboard USS Boise (SSN 764), Patrols 2 and 3, Post-CFC Conversion," 9/28/99.

"International Project Summaries – Navy," Nunn Cooperative R&D Project.

Point Papers

“Uniform National Discharge Standards FY99 Funds”

“From Discharge Assessment Report to Implementation: Ideas on How to Proceed”

Meeting Reports

Record of the Environmental Training Workshop, Nemencine, Lithuania – Baltics.

Issue Papers

“Hull Antifouling Paints PR-01”

Articles

“Compliance in Acquisition” to Currents magazine.

Briefings Written/Presented

“Waste Gasification Technology for Navy Ships: Thermogenics, Inc. Process”

“Shipboard Waste Management”

“Shipboard Waste Management RDT&E”

“Submarine Self-Lubricated (Non-Lubricated) Bearings”

“Update on the Navy’s CFC Conversion Program for the Combatant Technical Issues Conference”

“CCVN-68 Class R614 AC Conversion Update for CVN 68/69 RCOH Quarterly Review

“Shoreside Blackwater/Graywater Disposal Study”

“21st Century Vision for Shipboard Liquid Waste Management”

“The Environmentally Sound Ship of the 21st Century: New Pollution Control Systems & Technologies”

“Environmentally Sound Ships, Logistics, and Operations for the 21st Century”

“Navy Maritime Environmental Protection – Opportunities for Cooperation”

“Ship Magnetic Silencing Program”

“Navy Maritime Environmental Protection – Opportunities for Success”

“Military Environmental Protection Requirements for Environmental Training Workshop Participants”

“Plasma Arc Thermal Destruction”

“Navy Solid Waste Requirements”

“Environmentally Sound Ship, Logistics and Operations”

“MEP Strategy”

“AEPC Training”

“Environmental Protection”

“Revised NAAQS and Regional Haze Rules”

“Navy Experience with General Conformity”

“Oily Waste Membrane Polishing Systems: DDG-51 Class System”

“U.S. Navy R&D Vision for Shipboard Thermal Destruction of Solid and Liquid Wastes”

“Environmentally Sound Ship Requirements”

“Ship & Submarine Waste Management RDT&E”

“Environmental Protection RDT&E: Shipboard Waste Management”

“N4 Future Naval Capability “Environmentally Compliant Operations”

“SWG/12 Maritime Environmental Protection Strategy”

“Minimizing Environmental Impacts on Naval Forces: RDT&E Strategy for Environmental Systems Cross-Fleet Commonality”

“Achieving the Environmentally Sound Ship of the 21st Century Through RDT&E”

Other Tasks Completed

Title V Guidance Binder (available on DENIX web site, “www.denix.osd.mil”).

Outline for revised CAA compliance section of Navy PCO/PXO Training Course.

Ocean, Atmosphere, Space - Fiscal Year 1998 Annual Reports for ONR 32, CD-ROM.

Developed Shipboard Environmental Information Clearinghouse (SEIC) Web site.

3.2 TASK 2 - CHEMICAL ANALYSIS AND CHEMICAL SENSOR DEVELOPMENT

Technical Requirements

- (1) The contractor shall investigate standard techniques and modifications of standard techniques that can be employed in the characterization of water from shipboard waste streams.
- (2) The contractor shall explore and develop new technologies to be used in the characterization of water from shipboard waste streams.
- (3) The contractor shall evaluate available technologies and develop new sensors and monitoring capabilities suitable for monitoring effluents from shipboard solid waste treatment facilities.
- (4) The contractor shall undertake development of alternate concepts for solid waste treatment techniques appropriate for shipboard use.
- (5) The contractor shall design and support field test protocols as required. The contractor shall compile and analyze data, prepare reports and briefings as directed.

Publications (18)

"Shock Test Report on the Closed Loop Cooling Unit," GEO-CENTERS' letter serial number 97-081, June 1977, submitted to SEA 03R16, SEA 03L1 and NSWCCD Bethesda (Code 634).

Sean Gill, "Shock Test Report on the Solid Waste Management Equipment," GEO-CENTERS letter serial number 97-055, 25 April 1997, submitted to SEA 03R16, SEA 03L1 and NSWCCD Bethesda (Code 634); copy provided to NSWCCD-SSES on 6 May 1997.

"Solid Waste Equipment Shock Test Plan of Action and Milestones," issued to SEA 03R16 and SEA 03L1.

Final Report on "DD 988 Shipboard Evaluation Graywater System Safety Analysis," issued to NSWCCD Bethesda.

W. Drosjack, "CFD Model Study of the US Navy Waste Incinerator," submitted to NSWCCD Bethesda.

M.T. Montgomery, T.J. Boyd, B.J. Spargo, R.B. Coffin, **J.K. Steele**, D.M. Ward, and D.C. Smith, "Bacterial Assemblage Adaptation In PAH-Impacted Ecosystems," In Situ and On-Site Bioremediation, B.C. Alleman and A. Leeson (eds.), Battelle Press, Columbus, OH, Vol. 5(8):223-228 (1999).

T.J. Boyd, M.T. Montgomery, B.J. Spargo, and **J.K. Steele**, "PAH Distribution and Biodegradation in the Delaware and Schuylkill Rivers," In Situ and On-Site Bioremediation, B.C. Alleman and A. Leeson (eds.), Battelle Press, Columbus, OH, Vol. 5(8):295-300 (1999).

T.J. Boyd, M.T. Montgomery, B.J. Spargo, R.B. Coffin, **J.K. Steele**, J.P. Pohlman, and D. Velinsky, "Characterization of Intrinsic Bioremediation within the Philadelphia Naval Complex Reserve Basin," NRL Technical Report, NRL/PU/6115-99-374 (1999).

R.B. Coffin, **J.W. Pohlman**, and **C.S. Mitchell**, "Fate and Transport of PAH and Metal Contaminants in the Anacostia River Tidal Region," NRL Memorandum Report, NRL/MR/6110-99-8327 (1999).

R.B. Coffin, M. Orr, E. Carey, L.A. Cifuentes, and **J. W. Pohlman**, "Contaminant Distribution and Fate in Anacostia River Sediments: Particulate Transport Survey," NRL Memorandum Report, NRL/MR/6110-98-8139 (1998).

M.T. Montgomery, B.J. Spargo, and T.J. Boyd, "Ecosystem Level Evaluation of Intrinsic Biodegradation at Naval Shipyards and Impact on Adjacent Ecosystems: A Preliminary Report," NRL Technical Memorandum Report, NRL/MR/6115-98-8140 (1998).

B.J. Spargo, **M.T. Montgomery**, T.J. Boyd, R.B. Coffin, L.A. Cifuentes, J.G. Mueller, and W.W. Schultz, "In Situ Bioremediation and Efficacy Monitoring SERDP Project CU-030," NRL Technical Memorandum Report, NRL/MR/6115-98-8179 (1998).

M.T. Montgomery, B.J. Spargo, and T.J. Boyd, "Ecosystem Level Evaluation of Intrinsic Biodegradation at Naval Shipyards and Impact on Adjacent Ecosystems: A Preliminary Report," NRL Technical Memorandum Report. NRL/MR/6115-98-8140 (1998).

S.E. Lantz, **M.T. Montgomery**, W.W. Schultz, P.H. Pritchard, B.J. Spargo, and J.G. Mueller, "Constituents of Organic Wood Preservatives that Inhibit the Fluoranthene Degrading Activity of Bacterial Strain *Sphingomonas Paucimobilis* Strain EPA505," Environ. Sci. Technol. 31:3573-3580 (1997).

B.J. Spargo, R.B. Coffin, **M.T. Montgomery**, J. Jones-Mehan, and C. Kelley, "Exploiting Microbiology to Enhance Biodegradation of Hydrocarbon-Contaminated Environments," NRL Review, NRL/PU/5230-97-320, April, pp. 74-77 (1997).

M.T. Montgomery, T.J. Boyd, B.J. Spargo, J.G. Mueller, and R.B. Coffin, "Bacterial Productivity in BTEX- and PAH-Contaminated Aquifers," *In Situ and On-Site Bioremediation*, B.C. Alleman and A. Leeson (eds.), Battelle Press, Columbus, OH, Vol. 4(4):125-130 (1997).

T.J. Boyd, **M.T. Montgomery**, and B.J. Spargo, "Utilization Rates of Benzene and Toluene from a BTEX-Contaminated Aquifer," *In Situ and On-Site Bioremediation*, B.C. Alleman and A. Leeson (eds.), Battelle Press, Columbus, OH, Vol. 4(2):399-404 (1997).

R.B. Coffin, **M.T. Montgomery**, C.A. Kelley, and L.A. Cifuentes, "Assessment of Nutrient-Contaminant Carbon Ratios for Enhancing *in situ* Bioremediation," *In Situ and On-Site Bioremediation*, B.C. Alleman and A. Leeson (eds.), Battelle Press, Columbus, OH, Vol. 4(4):297-404 (1997).

Presentations (29)

M.T. Montgomery, T.J. Boyd, **J.K. Steele**, D.M. Ward, D.C. Smith, B.J. Spargo, R.B. Coffin, **J.W. Pohlman**, M. Slenska, and J.G. Mueller, "Measuring Intrinsic Bacterial Degradation of PAHs in a Salt Marsh," presentation at the International Conference on Wetlands & Remediation, Salt Lake City, UT, November 16-17, 1999. (INVITED)

T.J. Boyd, M.T. Montgomery, J.G. Mueller, **J.K. Steele**, B.J. Spargo, R.B. Coffin, **J.W. Pohlman**, T. Demetriades-Shah, and M.. Slenska, "Source Reduction Effect on Creosote PAH Bioremediation in Marsh Sediments," presentation at the Second International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 22-25, 2000. (INVITED)

T.J. Boyd, **J.W. Pohlman**, R.B. Coffin, M.T. Montgomery, B.J. Spargo, and **J.K. Steele**, "Coupling Contaminant Fate and Transport with Biodegradation: Is a Small Tidal Basin a Source or a Sink for Hydrocarbons," presentation at SETAC, Philadelphia, PA, November 16-18, 1999. (INVITED)

R.B. Coffin, T.J. Boyd, M.T. Montgomery, **J.W. Pohlman**, **C.S. Mitchell**, **J.K. Steele**, and B.J. Spargo, "Transport and Degradation of PAHs in the Tidal Region of the Anacostia River," presentation at SETAC, Philadelphia, PA, November 16-18, 1999. (INVITED)

K.S. Grabowski, D.L. Knies, T.M. DeTurck, D.J. Treacy, **J.W. Pohlman**, R.B. Coffin, and G.K. Hubler, "A Report on the Naval Research Laboratory AMS Facility," presentation at AMS-8 Conference, Vienna, Austria, 1999.

R.B. Coffin, K.S. Grabowski, I. MacDonald, L.A. Cifuentes, and **J.W. Pohlman**, "Analysis of Ocean Methane Hydrate Formation and Fate," presentation at the Conference of the American Society for Limnology and Oceanography, San Diego, CA, 1999.

B.J. Spargo, M.T. Montgomery, T.J. Boyd, and **J.K. Steele**, "Influence of the Tidal Cycle on Petroleum Biodegradation in Groundwater," presentation at the International Conference on Wetlands & Remediation, Salt Lake City, UT, November 16-17, 1999. (INVITED)

M.T. Montgomery, T.J. Boyd, B.J. Spargo, R.B. Coffin, D.M. Ward, **J.K. Steele**, and D.C. Smith, "Bacterial Assemblage Changes as an Ecological Impact Indicator on Ecosystems," presentation at the Fifth International Symposium on In Situ and On-Site Bioremediation, San Diego, CA, April 19-22, 1999.

T.J. Boyd, M.T. Montgomery, B.J. Spargo, and **J.K. Steele**, "PAH Distribution and Biodegradation in the Delaware and Schuylkill Rivers," presentation at the Fifth International Symposium on *In Situ* and On-Site Bioremediation, San Diego, CA, April 19-22, 1999.

R.B. Coffin, **J.W. Pohlman**, M.T. Montgomery, T.J. Boyd, J. Jones-Meehan, C.J. Kolanko, and B.J. Spargo, "Fate of PAHs in the Anacostia River Tidal Region," presentation at the Fifth International Symposium on In Situ and On-Site Bioremediation, San Diego, CA, April 19-22, 1999.



T.J. Boyd, M.T. Montgomery, B.J. Spargo, and **J.K. Steele**, "PAH Distribution and Biodegradation in the Delaware and Schuylkill Rivers," presentation at the Fifth International Symposium on In Situ and On-Site Bioremediation, San Diego, CA, April 19-22, 1999.

R.B. Coffin, **J.W. Pohlman**, M.T. Montgomery, and T.J. Boyd, "Transport and Fate of PAHs in the Anacostia River Tidal Basin," Federally Supported Science and the Chesapeake Bay Program, Patuxent National Wildlife Visitors Center, December 9-10, 1998.

M.T. Montgomery, T.J. Boyd, B.J. Spargo, R.B. Coffin, D.M. Ward, **J.K. Steele**, and D.C. Smith, "Bacterial Assemblage Changes as an Early Indicator of Ecological Impact of Military Operations on Industrialized Ecosystems," Partners in Environmental Technology Symposium and Workshop, Arlington, VA, December 1-3, 1998.

T.J. Boyd, M.T. Montgomery, B.J. Spargo, R.B. Coffin, D.M. Ward, **J.K. Steele**, and D.C. Smith, "Bacterial Assemblage Changes as an Early Indicator of Ecological Impact of Military Operations on Estuarine Sediments," presentation at the Workshop on Contaminated Sediment Management, Office of Naval Research and NAVFAC, San Diego, CA, October 14-16, 1998.

J.G. Mueller, F. Lakhwala, J. Carter, B. Spargo, **M.T. Montgomery**, and M. Brouman, "Economics and Performance of UVB Technology at a Creosote Site," presentation at Battelle's First international Symposium on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May 18-21, 1998.

M.T. Montgomery, T.J. Boyd, B.J. Spargo, and D.C. Smith, "Heterotrophic Bacterial Production in the Waters and Sediments of Two PAH-Impacted Ecosystems near Charleston, SC and Philadelphia, PA (USA)," presentation at the 98th general meeting of the American Society for Microbiology, Atlanta, GA, May 16-20, 1998.

T.J. Boyd, **J.K. Steele**, **M.T. Montgomery**, and B.J. Spargo, "Biodegradation of PAHs in the Cooper River Estuary, Charleston, SC (USA)," presentation at the 98th general meeting of the American Society for Microbiology, Atlanta, GA, May 16-20, 1998.

M.T. Montgomery, T.J. Boyd, B.J. Spargo, J.G. Mueller, and R.B. Coffin, "Bacterial Productivity in BTEX- and PAH-Contaminated Aquifers," presentation at the Fourth International Symposium on *In Situ* and On-Site Bioremediation, New Orleans, LA, April 28-May 1, 1997.

M.T. Montgomery, T.J. Boyd, B.J. Spargo, J.G. Mueller, L.A. Cifuentes, C.A. Kelley, and R.B. Coffin, "Effect of a Groundwater Circulation Well on BTEX Degradation in a Gasoline Contaminated Aquifer," presentation at the 97th general meeting of the American Society for Microbiology, Miami, FL, May 11-14, 1997.

T.J. Boyd, **M.T. Montgomery**, B.J. Spargo, J.G. Mueller, C.A. Kelley, L.A. Cifuentes, and R.B. Coffin, "Effect of a Groundwater Circulation Well on PAH Degradation in a Creosote Contaminated Aquifer," presentation at the 97th general meeting of the American Society for Microbiology, Miami, FL, May 11-14, 1997.

T.J. Boyd, **M.T. Montgomery**, and B.J. Spargo, "Utilization Rates of Benzene and Toluene from a BTEX-Contaminated Aquifer," presentation at the Fourth International Symposium on *In Situ* and On-Site Bioremediation," New Orleans, LA, April 28-May 1, 1997.

R.B. Coffin, **M.T. Montgomery**, C.A. Kelley, and L.A. Cifuentes, "Assessment of Nutrient-Contaminant Carbon Ratios for Enhancing *In Situ* Bioremediation," presentation at the Fourth International Symposium on *In Situ* and On-Site Bioremediation, New Orleans, LA, April 28-May 1, 1997.

M.T. Montgomery and R.B. Coffin, "*In Situ* Bioremediation and Efficacy Monitoring," presentation at the 2nd Annual SERDP Symposium, Tysons Corner, VA, November 20-22, 1996.

M.T. Montgomery, R.B. Coffin, L.A. Cifuentes, J.G. Mueller, and B.J. Spargo, "Encapsulated Bacteria for *In Situ* PAH Bioremediation," FY94 Progress report presented to the SERDP Council, Fort Belvoir, VA, May 28, 1996.

M.T. Montgomery, R.B. Coffin, L.A. Cifuentes, J.G. Mueller, and B.J. Spargo, "*In Situ* Bioremediation and Efficacy Monitoring," FY96 Progress report presented to the SERDP Council, Fort Belvoir, VA, May 28, 1996.

M.T. Montgomery, T.J. Boyd, B.J. Spargo, J.G. Mueller, R.B. Coffin, **R.A. Owlett**, D.C. Smith, "Bacterial Productivity in a BTEX-Contaminated and a Creosote-Contaminated Aquifer: A Comparison of ^3H -leucine and ^3H -thymidine Incorporation Methods," presentation at the 96th general meeting of the American Society for Microbiology, New Orleans, LA, 1996.

T.J. Boyd, B.J. Spargo, and **M.T. Montgomery**, "Improved Method for Measuring Biodegradation Rates of Hydrocarbons in Natural Water Samples," presentation at the 96th general meeting of the American Society for Microbiology, New Orleans, LA, May 20-24, 1996.

M.T. Montgomery, R.B. Coffin, L.A. Cifuentes, J.G. Mueller, and B.J. Spargo, "Encapsulated Bacteria for *In Situ* PAH Bioremediation," FY94 Progress report presented to the SERDP Council, Fort Belvoir, VA, May 28, 1996.

M.T. Montgomery, R.B. Coffin, L.A. Cifuentes, J.G. Mueller, and B.J. Spargo, "In Situ Bioremediation and Efficacy Monitoring," FY96 Progress report presented to the SERDP Council, Fort Belvoir, VA, May 28, 1996.

Accomplishments

Designed and fabricated a graywater membrane test stand (for test LPU-4). Sent to CDNSWC/Annapolis on 4/1/96.

Designed and delivered a glass reinforced plastic (GRP) housing that had been fabricated for the Zenon ZPF-8 dense pack membranes.

Replacement mechanical seals were delivered for a concentrate pump being used in graywater laboratory tests at CDNSWC/Annapolis.

An updated safety analysis report for the pierside graywater membrane test unit was completed and delivered to CDNSWC/Annapolis.

Completed and delivered drawings of the adsorption system to CDNSWC/Annapolis for use by the installation contractor.

Designed, fabricated, and delivered the prototype Sorbent Polishing System (SPS) components to USS Arleigh Burke (DDG 51) at the Naval Operating Base, Norfolk, VA.

Designed and assembled a graywater electrical control panel and instrumentation for CDNSWC/Annapolis for calibration and output verification on the electrical panel's graphical interface unit (GIU).

Designed and fabricated a completed prototype 3 gpm graywater membrane polishing system including piping, electrical power panel, and flow meter instruments.

Fabricated and delivered eight canisters filled with a new type of adsorbent media for testing during a subsequent deployment of USS Arleigh Burke.

Designed, fabricated and delivered first Aerated Membrane Treatment System electrical control enclosure to CDNSWC Bethesda.

Shipped a 1.00 nps duplex strainer and a duplex pressure gage to SUPSHIP Newport News to support the Large Pulper installation aboard the USS John C. Stennis (CVN 74).

Assembled and delivered large pulper repair parts to the USS Theodore Roosevelt (CVN 71) at the Naval Operating Base, Norfolk, VA to support deployment.

Designed, procured and shipped three revised-design impeller assemblies to CDNSWC Bethesda for the Large Pulper (LP) retained at their facility.

Procured and delivered ten cast cobalt LP security ring blades for impact strength testing to CDNSWC Bethesda.

Refurbished compress melt units (CMUs) 003, 006, 007, and 008; and closed loop cooling units (CLCUs) 003, 005, 006. These machines and miscellaneous repair parts were delivered to USS George Washington (CVN 73) for reinstallation.

Assembled and delivered to USS Kearsarge (LHD3) onboard repair parts for their preproduction CMUs and plastic shredder (PS).

Specified, procured and delivered a second-generation prototype graphical interface unit to replace the current prototype and resolved outstanding technical problems to CDNSWC Bethesda.

Sent a draft version of an update of all the detailed fabrication drawings to reflect the as-built configuration of the ultrafiltration oily waste membrane polishing system installed on USS Carney (DDG 64).

Assembled and delivered seawater components and other parts, such as resilient mounts, the main switch, and repair parts, with two large pulper units as directed by SEA 03R16 and CDNSWC Bethesda.

Designed and delivered the aerated membrane treatment system electrical control panel with micro-PLC control to CDNSWC Bethesda (P. Foley). In addition, an information booklet, which includes a system description, basic process and instrument diagrams, enclosure layout sketch, electrical schematic, wiring diagram, PLC program, and component vendor information, was delivered.

Changes were incorporated to the graywater ultrafiltration membrane system manual, new drawings were printed and twenty copies of the updated manual were delivered to CDNSWC Bethesda.

Specified and procured a laboratory oil content monitor (OCM) from Horiba Instruments and delivered it to CDNSWC Bethesda to support laboratory testing.

Delivered a COMPAQ laptop with vortex incinerator control software to CDNSWC Bethesda (S. Brown).

Photographs of additional spray nozzle tests to determine spray patterns at maximum expected waste flow rates and air pressures inside the vortex incinerator were delivered to CDNSWC Bethesda.

Designed and delivered an engineering development model, instrument console, high-temperature and micro cameras, and the incinerator instrumentation hardware for the laboratory vortex incinerator at CDNSWC Bethesda.

Fabricated and delivered large pulper (LP) 008, electrical control enclosure LP008C, small pulper (SP) 009, electrical control enclosure SP009C, and local status indicator SP009C to the Naval Surface Warfare Center, Carderock Division Philadelphia, PA (CDNSWC-SSES).

Completed and delivered the final "Shock Test Report on the Solid Waste Management Equipment" (GEO letter 97-055) to SEA 03R16, SEA 03L1, CDNSWC Bethesda (Code 634), and CDNSWC-SSES.

Fabricated and shipped large pulper serial number 011 and its associated military specification electrical control enclosure, and installation spare parts to CDNSWC Bethesda.

Fabricated and delivered small pulpers serial number 007 and 008 (SP007 and SP008), and their associated mil-spec electrical control enclosures and installation spare parts to CDNSWC Bethesda.

Wrote and delivered copies of the smaller pulp technical manual; to support the follow-on test and evaluation (FOTE) of the SP on board the USS Vandergrift (FFG 48) to SEA 03R16 (A. Nickens) and CDNSWC Bethesda (G. Alexander).

Fabricated and delivered compress melt unit (CMU U009) and CMU electrical control enclosure U009 to CDNSWC-SSES.

Fabricated and delivered solid waste shredder 005 to CDNSWC Bethesda.

Designed, procured and delivered a one-fourth scale model of the vortex incinerator engineering development model (EDM) and the EDM instrumentation operations manual to CDNSWC Bethesda.

Delivered marked-up schematics, developed new logic files, and assembled the necessary electrical components for CDNSWC Bethesda (P. Foley) to revise the logic for the programmable logic controller (PLC) used in the aerated membrane treatment system (AMTS).

Fabricated and delivered large pulper serial number 011 (LP011) with a control enclosure and spare/repair parts to CDNSWC Bethesda.

Delivered an updated draft report on oily waste system (OWS) vendors and the technical characteristics of their equipment to CDNSWC Bethesda (L. Murphy).

Wrote and delivered the changeout procedure for the intermediate shells for vortex incinerators on board DD 963 class ships to CDNSWC Bethesda Code 633 (B. White).

Designed, fabricated, and delivered a small electrical enclosure to be added to the existing AMTS graywater system installed at CDNSWC Bethesda.

Delivered the LP alternative eductor and the one-piece impeller/ear casting assembly to CDNSWC Bethesda for testing.

Developed dimensional schematics and calculated the center-of-gravity for the six principle large pulper (LP) modules. These schematics were delivered to CDNSWC-SSS which will use these schematics to develop procedures for moving the LP onto ships in hatchable modules.

Procured and delivered the small pulper (SP) alternative eductor to CDNSWC Bethesda for testing.

Delivered draft copies of large pulper technical manual chapter 8, "Installation," to NSWCD Philadelphia for review and comment.

Procured and delivered two pneumatically-actuated Navy standard ball valves for use in the laboratory oily waste ultrafiltration system to CDNSWC Bethesda. The valves are identical to those installed on the MOPS on board the USS Carney (DDG 64).

Procured and delivered a GE FANUC Micro PLC with analog capability and prepared and delivered an electrical schematic drawing to CDNSWC Bethesda (J. Benson) for use in testing and cycling of the valve actuator.

3.3 TASK 3 - ENVIRONMENTAL REMEDIATION SITE CHARACTERIZATION

Technical Requirements

(1) Sensors:

- (a) Full-field Cs vapor magnetometer (equivalent to the DOD Mk22) are the default Multi-Sensor Towed Array Detection System (MTADS) magnetometers. The contractor must evaluate alternative sensors in conjunction with their use with the MTADS concept and their utility in developing extended target analysis and mapping capabilities.
- (b) The contractor must evaluate capabilities of chemical vapor sensors to determine their usefulness for MTADS.
- (c) The contractor must develop sensors for detecting radiological hazards for integration into MTADS.

(d) The contractor shall propose and evaluate alternative sensor concepts which must be suitable for imaging and integration into MTADS.

(2) Sensor Platforms:

(a) The contractor shall develop and deliver both a tow vehicle and a sensor support platform suitable for the MTADS prototype.

(b) The contractor shall develop concepts for both hand held and man-portable sensor detection systems.

(3) Navigation:

(a) The contractor shall incorporate future improvements in DGPS instrumentation into MTADS.

(b) The contractor shall evaluate other navigation concepts which might be complementary to DGPS.

(4) Data Acquisition and Preprocessing:

(a) The contractor shall produce a data acquisition system with capability to acquire the real-time sensor and navigation data compatible with the Unix-based MTADS data analysis system (DAS).

(b) The contractor shall provide for and maintain compatibility of the data acquisition and preprocessing system with the DAS.

(5) Real Time Display, Survey Guidance, and Target Marking:

The contractor shall design and implement a Realtime DGPS navigation information available in the Tow Vehicle to create a vehicular track and survey progress display.

(6) System Integration:

The contractor shall provide this system integration for: a DGPS navigation system; alternate sensor technologies; a Unix-based data analysis system; theoretical studies culminating in new algorithms and software for near field and extended target analysis.

(7) Demonstrations and Evaluation Surveys:

The contractor shall conduct demonstrations and field evaluations of the MTADS system. The contractor shall provide personnel who are qualified to conduct studies at both EOD sites and toxic/hazardous waste sites.

(8) Documentation:

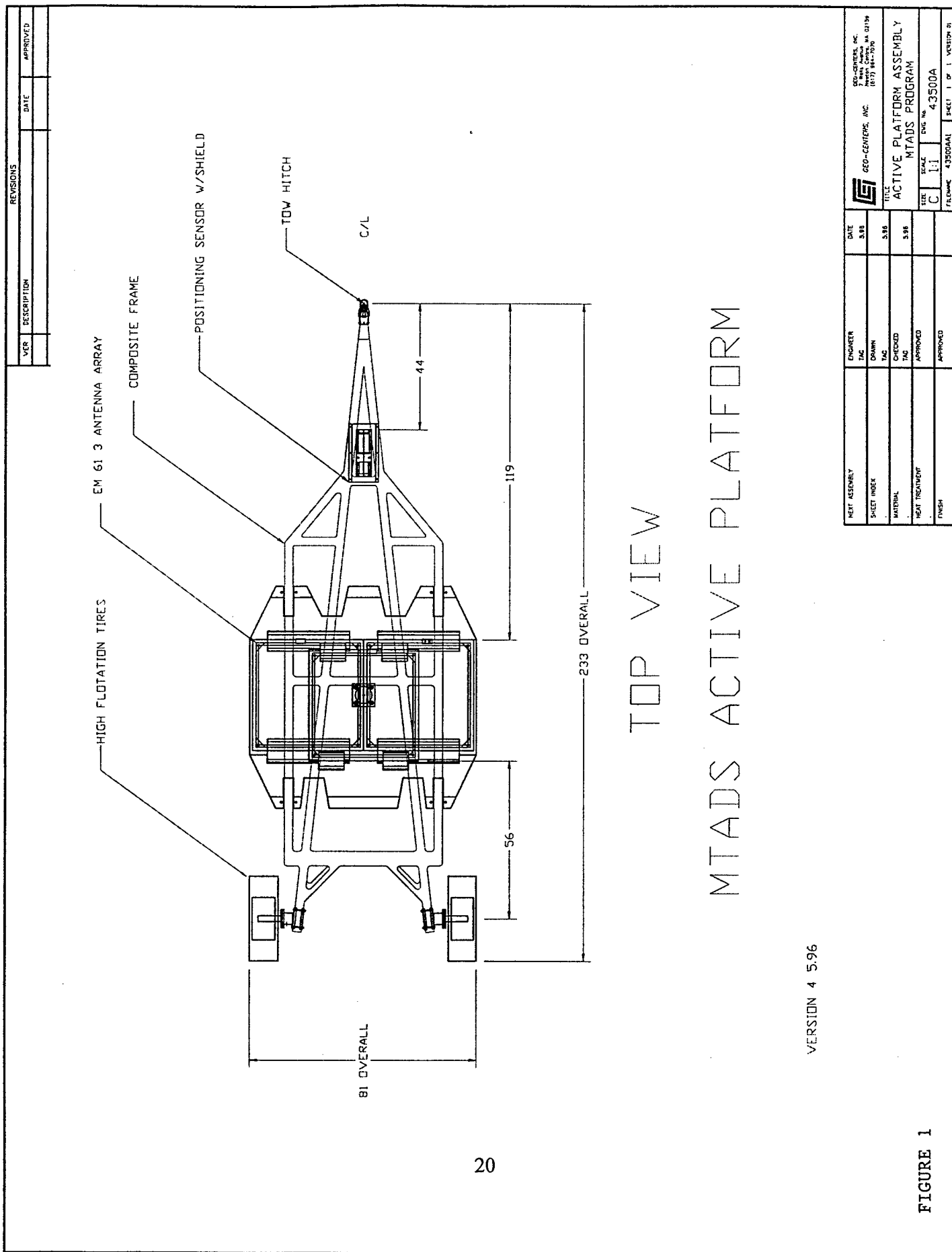
The contractor shall provide all engineering drawings, electrical and electronic schematics, full operational manuals, and fully documented software.

Accomplishments

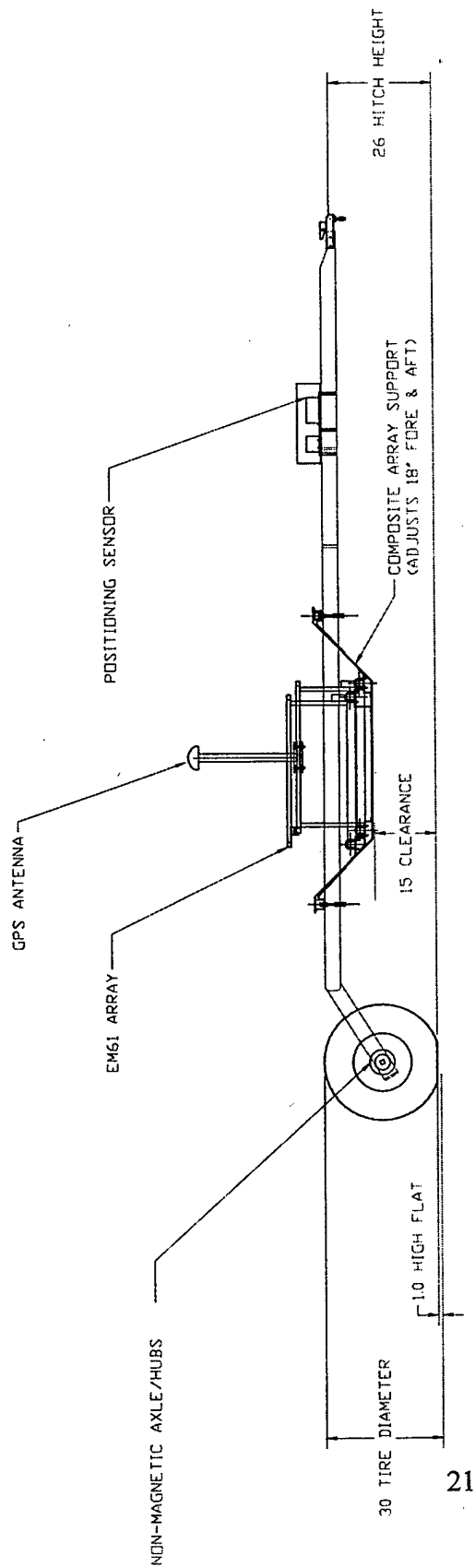
Designed, fabricated and delivered MTADS Active Tow Platform. See Figure 1 (Top View) and Figure 2 (Side View).

The contractor supported the research, development, and application of the automated technologies for detection of buried materials and non-intrusive characterization. This work involved all phases of operation and maintenance of the Multi-Sensor Towed Array Detection System (MTADS).

Defined task requirements for the support of the operation of the MTADS includes inventory and initial packing of equipment; arranging and/or transportation of equipment and vehicles; site setup and daily operations of all assigned equipment; post-operation packing and transportation; and post-operation evaluation of equipment and system capabilities. Maintenance requirements include both preventative maintenance and corrective maintenance.



REVISIONS			
VER	DESCRIPTION	DATE	APPROVED



SIDE VIEW

MTADS ACTIVE PLATFORM

VERSION 4 5 96

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Past Program Associations and Tasking: Participation in these endeavors usually required the packaging/unpacking, shipment/movement, setup and operation of all MTADS vehicles and associated equipment.

Chesapeake Beach, MD, October 1996: Operational Evaluation of data acquisition and data analysis software.

Twenty-nine Palms, CA, December 1996: Field Evaluation of MTADS capabilities while operating in a defined arena.

Jefferson Proving Grounds, Indiana (JPG III), January 1997: Participation in a DOD sponsored program evaluation of new technologies of Unexploded Ordnance (UXO) Detection and Classification.

UXO Survey of Badlands Bombing Range, Pine Ridge Indian Reservation, SD, July 1997: Performed UXO Survey of Federal Land and adjoining Pine Ridge Indian Reservation.

UXO Survey of Vero Beach, Florida, January 1998: At the request of the US Army Corps of Engineers, performed a 15 mile UXO survey of beach-front property at Vero Beach, Florida in connection with a Engineering Evaluation/Cost Analysis. This land was formerly used as a practice-landing site for WWII Normandy Landings.

UXO Survey at Former Buckley Field, Arapahoe County, CO., June 1998. At the request of the US Army Corps of Engineers, performed a wide area UXO Survey of past bombing sites on the Former Buckley Field.

UXO Survey of the Pueblo of Laguna, NM., July 1998: Performed UXO Survey of former ordnance ranges per direction of the Environmental Security Technology Certification Program (ESTCP)

MTADS Underground Investigation at Portsmouth Naval Base, NH., October 1998: Assisted the Department of the Navy at Portsmouth Naval Base in the location and classification of underground anomalies.

Jefferson Proving Grounds, Indiana (JPG IV), October 1998: Participation in a DOD sponsored program evaluation of new technologies of Unexploded Ordnance (UXO) Detection and Classification.

UXO Survey of Walker River Paiute Reservation, Fallon, NV, November 1998: Performed UXO Survey of land adjacent to ordnance ranges per direction of the Environmental Security Technology Certification Program (ESTCP)

Electronic Induction and Magnetic Sensor Fusion for Enhanced UXO Target Classification, Blossom Point, MD, February 1999.

Electromagnetic Induction and Magnetic Sensor Fusion for Enhanced UXO Target Classification and Man-portable Systems demonstrations, July 1999.

UXO Survey of Badlands Bombing Range, Pine Ridge Indian Reservation, SD, September 1999. Performed UXO Survey of Former US Air Force Bombing Range within the Pine Ridge Indian Reservation

Attended ESTCP/MTADS Program Review to discuss the Passive Platform and review the Active Platform Development Plan.

3.4 TASK 4 - AIRBORNE AND MARINE MAGNETIC SITE CHARACTERIZATION

Technical Requirements

The contractor shall conduct a research and development program and provide specified R&D support, including but not limited to the areas associated with this task as enumerated below. The majority of the effort shall be accomplished at the contractor's facility. Demonstrations and surveys will be conducted at government sites as directed by the COTR. These sites may be seriously contaminated with explosive and/or chemical ordnance or by the presence of toxic/hazardous chemicals. Access to these sites will require appropriate training, protective gear and certifications.

(1) Sensors:

(a) The contractor shall deploy airborne and marine mobile sensors (magnetometers) qualified for shallow underwater use as they are envisioned to be deployed in arrays either floating on a surface boom or towed underwater but above the bottom.

(2) Sensor Platforms:

(a) The contractor shall develop marine platforms which must be nonmagnetic, rugged and designed for shallow water environments.

(b) The contractor shall develop airborne platforms that might be remotely controlled or preprogrammed to fly a set grid under control of DGPS navigation systems.

(3) Data Acquisition and Preprocessing:

(a) The contractor shall produce a data acquisition system with capability to acquire and integrate real-time sensor and navigation data compatible with that being developed for MTADS with adaptation for the special requirements of this application.

(b) The contractor shall directly apply the MTADS data acquisition to the marine mobile system with the additional data stream to record the distance from the bottom to the sensor heads.

(4) Navigation:

The contractor shall improved DGPS capabilities for use in altitude control for the platform and sensors.

(5) Demonstration and Evaluation Surveys:

The contractor shall conduct demonstrations and field evaluations of the airborne and marine MTADS systems.

Accomplishments

No work was performed on this project and no charges were incurred.