United States Coast Guard
Research and Development Center

2013
Annual Report
The Research and Development Center (the RDC) is the sole facility for conducting research, development, test, and evaluation (RDT&E) in support of the Coast Guard’s major missions. The RDC mission is to provide innovative technologies, analysis, and decision support to reduce acquisition risk and enhance operations across all Coast Guard missions. In 1968, Coast Guard Headquarters recognized the value of emerging technologies and established the Office of Research and Development (R&D). The RDC opened in Groton, Connecticut in 1972 at the University of Connecticut, Avery Point Campus. In 2009 the RDC moved across the Thames River to New London, Connecticut next to historic Fort Trumbull, Station New London, and just three miles downriver from the Coast Guard Academy.

The RDC is home based in the Acquisition Directorate under the RDT&E Program Office (CG-926). The RDC is engaged in research and technology demonstrations that affect many corners of the Coast Guard enterprise. We solicit project ideas from across the Coast Guard in our annual Idea Submission Review (ISR). I send out the submission invitations to Headquarters Program Offices every year in March. In this same time frame, the Area Commanders send out a message inviting field elements and operators to submit their ideas. Our efforts to improve accessibility and transparency in how we develop the R&D portfolio resulted in 162 project ideas this past year. The great ideas we received were evaluated in a Project Portfolio Review using a repeatable process and assessment framework consisting of 13 criteria that assess the project idea’s operational focus, innovation, and use of partnerships. Third party benchmarking rated the R&D portfolio as being well-balanced and strong compared to other Science and Technology (S&T) organizations. Although the ISR is a deliberate annual project idea collection event, good ideas can be submitted throughout the year via the RDC Portal Page.

At any given time, we are working on 70 to 80 different projects for the Coast Guard and our S&T partners. We have many partnerships with the private sector in Cooperative Research and Development Agreements (CRADA) under the Technology Transfer Act and with other government agencies and laboratories. The Coast Guard was fortunate in retaining its own research center when it moved to the Department of Homeland Security (DHS), in part because research remains essential in support of traditional non-homeland security missions. However, we do have a strong business relationship within many DHS S&T Divisions in the collaboration of maritime security research. We produce a Quarterly Status Report that summarizes all of our projects objectives, deliverables, and identifies who the sponsors and stakeholders are. The Quick Response Code (QRC) found on the back of this Annual Report will take you directly to our website where you can find our current project portfolio.
Our biggest asset is the government staff with their project management expertise and diverse technical skills that range from oil spill response technology, sensor modeling, risk analysis, environmental science, and marine engineering to all areas of acquisition analysis. Military personnel bring their operational expertise to the RDC and work closely with the civilian scientists and engineers on projects that help close capability and knowledge gaps. Together, they offer a powerful understanding of Coast Guard challenges that reduce the risk and raise the value of introducing new technology into Coast Guard missions. I believe the RDC’s collective flexibility, technical skills, and project management discipline is unmatched. The RDC knows how to test and evaluate new capabilities and offer critical support with pre-transition evaluation of the most promising technologies.

As transparent as our portfolio is with internet-posted Quarterly Status Reports, annual Idea Submission Review messages, and our monthly project spotlights, I still encounter Coast Guard personnel that are not aware of the RDC’s strategic role and nature of the unique service we provide. I’ve also learned of situations where field units are going it alone in adapting new technologies and methods to improve mission operations. A few have come to us for help, but typically only when a technological capability is already developed and locally implemented and they cannot find a transition pathway. No one can argue that the Coast Guard faces many future challenges, including shrinking budgets and the fast-pace of technology development. My hope, in re-instituting annual reports, is that it will re-introduce who we are and what we do, reinforce the idea that the RDC should be your primary go-to resource to investigate new technologies, to inform during the early stages of technology transition, and to perform any analysis that is needed to make the many hard choices the Coast Guard faces.

I believe that when you review this report you can’t help but get excited about the work that is underway and planned, and see the return-on-investment the Coast Guard and taxpayer receives from the Research and Development Center.

Coast Guard Missions
- Ports, Waterways, and Coastal Security
- Defense Readiness
- Drug Interdiction
- Migrant Interdiction
- Other Law Enforcement
- Aids To Navigation
- Marine Environmental Protection
- Search And Rescue
- Ice Operations
- Living Marine Resources
- Marine Safety
Since its inception in 1972, the RDC has continuously been a valuable, agile asset to the Coast Guard as it faces its greatest challenges. The Figure above provides a high-level illustrative summary of this agility. In the 1970’s and early 1980’s, the focus was on modernizing the service’s aids to navigation capabilities (e.g., improved lanterns, solar power, lighted buoys, differential LORAN (LOng RAnge Navigation), and differential Global Positioning System (GPS)). In addition, critical foundational work was accomplished that provided the scientific basis for our current maritime Search and Research (SAR) capabilities. In the 1980’s and 1990’s, the focus was shifted, based on several high profile oil spills, to spill response (e.g., improved spill recovery systems, oil fingerprinting, dispersants, in-situ capabilities, spill management tools, and Incident Command System (ICS) selection and implementation). In the late 1990’s and the 2000’s, the focus was again shifted to support cutter acquisitions (e.g., WLB and WLM), improving the efficiency of a wide range of Coast Guard operations,
particularly those relating to the SAR and Law Enforcement missions, and developing Risk-Based Decision-Making (RBDM) tools for applying limited Coast Guard resources to the highest mission risk. After the 2001 terrorist attacks, the Coast Guard directed the RDC to focus on maritime security capabilities (e.g., port security systems, non-lethal technologies, and additional RBDM tools). The RDC has a long, rich history of significant projects and products. Examples include the development of the oil spill fingerprinting technology used at the Central Oil Identification Laboratory (now the Marine Safety Laboratory) and the first generation of oil spill containment and recovery equipment.

In 2007, the RDC moved to the Acquisition Directorate, providing critical support for the recapitalization of our surface and aviation fleets and Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR). In fact, it was the RDC that was called upon to oversee the analysis that restored congressional funding to this major fleet re-capitalization program. More recently, with the climate warming and subsequent receding ice in the Arctic, the Coast Guard called upon the RDC to conduct its High Latitude Study Mission Analysis of future Coast Guard mission and resource requirements in this new priority operational area. This study has become the foundational basis for initiating a variety of Arctic initiatives, strategy, and the major acquisition of new 21st century capabilities (i.e., polar icebreakers) in this critical region of our Exclusive Economic Zone. In recent years, the RDC has also supported the Assistant Commandant for Capability (CG-7), the Force Readiness Command (FORCECOM), the Atlantic and Pacific Area Commands, and others with a wide variety of technology-based tasks.

Samples of RDC Historic Projects

- Development of the oil spill fingerprinting technology used at the Central Oil Identification Laboratory, now the Marine Safety Laboratory, allows the Coast Guard to obtain a court-defensible match between oil samples taken from a spill and samples taken from the vessels cargo tanks, fuel tanks, or bilges. This capability put teeth in CG enforcement efforts under the Federal Water Pollution Control Act (FWPCA) and led to numerous successful prosecutions of polluting vessels (e.g., M/V Garbis in the Florida Keys and T/V Command off California).
- Development of the first generation of oil spill containment and recovery equipment, including the High Seas Skimming Barrier that is still in use today.
- Vessel Traffic Service (VTS) radar and display systems testing and evaluation.
- First flight deck launch of an Unmanned Aerial Vehicle (UAV).
The Program Office provides oversight for the RDT&E Program. They are responsible for policy, RDT&E funding and strategy. The RDC is responsible for the development and execution of the Coast Guard’s R&D project portfolio. The Program Office also serves as the RDT&E Program’s primary liaison with other program offices. They maintain an active strategic alignment and stakeholder outreach program that ensures the RDT&E Program’s Project Portfolio is consistent with strategic goals and stakeholder needs under six main domain areas: Surface; Aviation; Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR); Acquisition Support and Analysis; Environment and Waterways; and Modeling and Simulation (M&S). These domains are aligned with the RDC’s technical branches.

The RDC organization includes an Executive Director as well as Technical, Support, and Contracting Divisions that work together very closely to execute the RDC mission. The Technical Division is responsible for planning and executing projects in the RDC portfolio as well as providing subject matter expertise in the realms of science and technology that impacts the Coast Guard in the performance of their missions. To accomplish these responsibilities, the Technical Division consists of 61 professionals. These individuals include both military and civilian scientists, engineers, and analysts, with advanced degrees in their respective fields. In addition to their formal educations, the people assigned to the Technical Division have a vast wealth of Coast Guard-specific knowledge and experience. Many are recognized experts in topics such as Search and Rescue, Oil Spill Response, Ballast Water Treatment, Automatic Identification System, Unmanned Systems, Arctic Operations, Marine Safety, Less-than-Lethal technologies, and Modeling and Simulation. The Technical Division is divided into six branches, based primarily on Program Areas.
The RDC operates from an advantageous location between New York and Boston and is co-located with Station New London, the Coast Guard International Ice Patrol, the Coast Guard Marine Safety Lab and is in close proximity to the Coast Guard Academy, a university partner. The RDC employs the best that the New England scientific talent pool offers and the facility costs are less than in larger metropolitan areas. The geographic separation from the Washington DC Headquarters helps the RDC to serve as an independent agent for critical studies.

**RECENT AWARDS AND RECOGNITION OF THE RDC**

**CDR Joel Magnussen Innovation Award for Management (2011)**

Presented at the Coast Guard Innovation Expo in recognition of outstanding innovation and implementation in support of the Coast Guard innovation initiative in response to the Deepwater Horizon oil spill.

**David Meister Award (2011)**

Presented by the System Development Technical Group of the Human Factors & Ergonomics Society (HFES)

**EPA Office of Research and Development Bronze Award (2011)**

**Daniel H. Wagner Prize (2012)**

Presented by the National Center for Risk and Economic Analysis of Terrorism Events (CREATE)

**Coast Guard Meritorious Team Commendation (2013)**

Presented by CG Director of Incident Management & Preparedness Policy Office
Presented by Commander First CG District
The RDC employs a portfolio assessment framework as the foundation to a rigorous multi-step process to develop its annual project slate. The assessment framework has 13 measures and is based on best practices used in DHS S&T’s portfolio assessment process. We have six strategic imperatives that represent the “must haves” as threshold levels of project performance. For example, the partnership imperative measures are used to answer the question of how well we are utilizing our partners in maximizing effectiveness.

The bubble chart represents the positioning of the FY14 portfolio. The upper right quadrant represents high impact and low risk projects. The bubble diameters represent the amount of funding required to complete the project. The take away is that the RDC has a well-balanced portfolio with investments that positively position the Coast Guard for the future.

### Positioning of FY14 Portfolio

- **Total Impact**
- **Total Feasibility**

**Branch Legend**
- M&S COE
- C4ISR
- Aviation
- ASA
- Surface
- E&W

**Navigant Portfolio Rating System™**
- 100% Imbalance
- 75% Benchmark
- 55% Well-Balanced
- 35% Sub-Optimal
- 0% Well Balanced, Medium Certainty, Outlook Stable

The RDC executes a robust portfolio evaluation methodology that strategically positions the Coast Guard’s science and technology investments. The six Coast Guard Strategic Imperatives for its R&D portfolio are: Impact, Transition, Technical Positioning, Strategy Alignment, Partnerships, and Management Risk.
Project ideas can come from anyone in the Coast Guard or partner agencies at any time throughout the fiscal year. The annual portfolio development cycle begins by reaching out to sponsors to submit project ideas for consideration in the FY+1 and FY+2 project portfolio. Many of these project ideas originate from Strategic Project Portfolio Alignment workshops where technology gaps in Coast Guard missions are identified. The next step in the process is to conduct an Idea Submission Review (ISR) in March to ensure potential project sponsorship, the appropriateness for RDT&E funding (or determine other appropriate funding sources), and inform project/portfolio prioritization. Participants in the ISR include senior members of Program Offices, Area Operational Commanders, and other stakeholders. In FY13 we collected 162 project ideas from 45 different sponsors.

After the ISRs conclude, an evaluation board made up of senior RDT&E Program, Coast Guard, and DHS panel members meets to conduct the Project Portfolio Review (PPR). Each project is scored based on the criteria in the assessment framework. We then analyze the data by cross-walking the projects across strategic imperatives resulting in a final list of prioritized projects. Using this process provides the RDC leadership with useful programmatic and project-level insight and a portfolio that represents a balanced perspective that factors in continuing projects, available RDC staff skills, available funding, and the degree to which execution reliance is placed on external partners, agreements, and other factors.

In FY13, the RDC completed 20 projects and delivered 63 products. The bar chart on the next page shows our post-A76 (OMB Circular A-76 is the Federal Government's policy directive concerning performance of commercial activities) FY13-product-on-time-delivery-rate (92%). The projects included many notable studies that have provided operational benefit that include such things as: new sweep width data that will save more lives and make better use of assets for on-ice SAR missions; a methodological basis for new e-navigation performance standards; mission analysis studies on point defense and maritime security operations; and an anti-icing roadmap to support the application of anti-icing technology coatings on Coast Guard assets. In addition, the RDC and the Naval Research Laboratory (NRL) have repaired the Joint Maritime Test Detachment (JMTD) burn pan that had previously suffered hurricane damage. The nation’s only permitted open air in-situ burn pan for fire boom research will be at the ready for research next year. The Modeling and Simulation Center of Expertise (M&S CoE) conducted critical verification and validation testing of the addition of several new tools in the Coast Guard’s modeling toolkit and was instrumental in the recent accreditation of Coast Guard Search and Rescue Visual Analytics (CGSARVA) and Port Resilience Operational/Tactical Enforcement to Combat Terrorism (PROTECT) models.

The RDT&E Project Portfolio represents all projects that will be executed by the RDC for a particular fiscal year. It contains a mix of RDT&E, OE, AC&I and other Government Agency funded projects.
RDC FY13 Projects

Although we have some lab facilities, the field is our primary lab space. We sent many RDC teams out to the field to lead complex technology demonstrations and studies that included: oil-in-ice response testing as part of Arctic Shield, National Security Cutter testing of a small unmanned aerial system resulting in the first-ever drug interdiction assist by an unmanned system; electro-optical and infrared system operational testing against targets to support SAR sensor settings on our rotary fleet; and a recent technology demonstration with Joint Task Force North to evaluate tactical data link range enhancement technologies that use other blue force surveillance assets to enhance C4ISR net-centric capabilities.

As much as we need to have a strategic component to our portfolio, we also need to focus on nearer term technological opportunities and how best to transition them. Mission execution often begins with products developed through research. The RDC will be placing more emphasis on transition in the foreseeable future and intends to become the holders of technology transition agreements both internally, with RDT&E investments, but also with DHS S&T investments on behalf of the Coast Guard. Internal agreements will be established early in the project execution planning process, especially with customers that will receive a prototype handoff.

Arctic Shield 2013

We conducted a multi-organization technology demonstration in support of Arctic Shield 2013 in September from the USCGC HEALY. This technology demonstration utilized Commercial and Government-Off-The-Shelf technologies to investigate the ability to respond to oil spills in the Arctic, specifically testing search capabilities above and below an ice flow, detecting spilled oil, plotting the safest course to the spilled oil, deploying a brushed skimmer to recover the surrogate "spilled" oil and monitoring the recovery operation (above and below the ice) to ensure complete recovery. The team is currently planning the Arctic Shield 2014 technology with District 17 and other partners including National Oceanic and Atmospheric Administration (NOAA), Bureau of Safety and Environmental Enforcement (BSEE), and DHS S&T.
Sensor Performance Testing

Performance of deployed sensors on aircraft and surface vessels is key to the successful execution of Coast Guard missions. The RDC maintains the unique capability to evaluate sensor performance in typical Coast Guard mission environments. The RDC evaluates sensor performance through both mathematical modeling and validation of those models through execution of field tests. Results from the analysis and testing are used to generate lateral range curves and ultimately used as input parameters for the Coast Guard’s SAR planning system.

Recently the RDC completed a series of tests involving the ElectroOptical Sensor System (ESS) integrated onto MH-65 and MH-60 helicopters. The intent of this test was to determine the search capabilities of the system for common USCG search targets, such as Persons in the Water (PIW), rafts, and small boats. Once analyses of test results are complete, it is anticipated that track spacing for search patterns can be widened, resulting in more efficient and effective at-sea searches.

Using similar methodology, in February 2013 the RDC conducted an evaluation of the ability to search for persons and objects on ice. Prior to this test, the Coast Guard had little quantitative data to establish test patterns for persons that were missing in a frozen lake or sea environment. During the three week test multiple evolutions were conducted under various winter conditions to establish the ranges at which persons or objects could be detected using Coast Guard surface and aviation assets.

Unmanned Aircraft System (UAS)

The RDC has a long history in unmanned systems and is leading the way for integration of Unmanned Aerial Systems (UAS) into Coast Guard missions. We successfully executed the first UAS operations off a National Security Cutter (NSC) on board USCGC STRATTON (WMSL 752). Building upon this successful demonstration, a second demonstration in a representative Coast Guard mission environment was completed in May 2013 on board USCGC BERTHOLF (WMSL 750). The small UAS was instrumental in the confiscation of over one half-ton of cocaine during the demonstration period.

Nationwide Automatic Identification System (NAIS) Acquisition

In August 2013, the RDC closed out project 2411, Nationwide Automatic Identification System (NAIS) Acquisition. During its seven year history, project 2411 successfully supported the Coast Guard NAIS Acquisition Office in adapting AIS technology from the RDC’s research and development network to the first phase of an operational NAIS; the evaluation of commercial satellite AIS services as a Coast Guard long range receive system; and support in fielding of the final phase of NAIS as a transceiver-capable network.
The ASA Branch provides the Coast Guard and the RDC with expertise to address specific questions with skilled analysts armed with the right tools to produce analysis products for Coast Guard decision-makers.

**ASA Project Spotlights:**

**Domestic Icebreaking Simulation Model.** The DOMICE simulation model provides resource managers with a tool to assess the probabilistic risk that results from specific distributions of ice-breaking resources.

**PROTECT.**

Randomizing schedules: Makes it difficult for adversaries to plan how they will avoid security forces when plotting illegal activities; Enables security forces to maximize the effectiveness of their limited resources; Reduces costs.

**PRE-PROTECT**
- Predictable
- Value of targets not considered

**POST-PROTECT**
- No visible pattern
- Highest value targets are visited more often
Develop Sweep Width Tables for Search Objects on Ice. Results included new probability of detection lateral and radial range curves for search objects on ice for detection from MH-65’s and District 9 airboats. Search objects included persons-on-ice and ice vehicles.

The Aviation Branch develops, maintains, and applies competencies in mission-relevant test and evaluation, sensor and airborne platform technologies, performance measurement and analysis, performance model validation, and aids to navigation (AtoN).

**Aviation Project Spotlights:**

**General Engineering Laboratory Support (GELS).**
This ongoing project performs tests and evaluation of AtoNs to improve performance, lower costs and extend maintenance intervals. One of the primary objectives is to evaluate the viability of emerging technologies to reduce Coast Guard operating and maintenance costs or alleviate AtoN signal problem areas.

**AtoN Model’s Vertical Intensity Profile Analysis**

**GELS Lab (above)**
The C4ISR Branch conducts analyses, assessments, and integration of information technology management, communications, intelligence, surveillance, and reconnaissance technologies, devices, and systems that support and improve the collection, processing, exploitation, and dissemination of critical information on contacts and targets of interest.

**C4ISR Project Spotlights:**

**Underwater Imaging System Prototype Development.**

An Underwater Imaging System (UIS) was placed with different operating units, including AtoN teams, cutters, and small boats to assess its capability and performance under actual operational and environmental conditions.

**Analysis of Solid State Marine Radar.**

The number of Solid State Marine Radar manufacturers and their respective models and variants has increased. New Technology Radar manufacturers are producing models whose purposes range from marine navigation radar, to coastal surveillance, to vessel traffic systems (VTS).

**Joint Technology Demonstration.**

This project is exploring the use of Tactical Data Links to increase Situational Awareness and the near real-time wide dissemination of that data during Coast Guard operations. This effort involves use of a CRADA with industry.
ENVIRONMENT AND WATERWAYS (E&W)

The E&W Branch provides technical expertise in the areas of Aids to Navigation, Pollution Prevention and Response, Non-Indigenous Species, and the Automatic Identification System (AIS).

E&W Project Spotlights:

Aquatic Nuisance Species.

The RDC has supported the Coast Guard’s Marine Environmental Protection mission to mitigate the introduction of aquatic nuisance species by developing knowledge products and test protocols related to vessel ballast water treatment systems. Accomplishments include providing knowledge on the physical and economic impacts of installing ballast water management systems (BWMS); developing and verifying shore-based test protocols for type approval of commercial BWMS; and developing ship-based protocols for type approving BWMS. The RDC has also partnered with the EPA and other government agencies to determine the risk of introducing the invasive Asian carp into the Great Lakes ecosystem via barge and tow boat ballast water. After an exhaustive investigation and experimentation, the conclusion was that barges and tow boats presented very little risk as vectors for introducing Asian carp into the Great Lakes.

Recovery of Heavy Oil.

This project included prototype tests with Remotely Operated Vehicles (ROVs), a manned submersible, and a bottom crawler system based on dredging technology.

Aids to Navigation Comparative Risk Model for Design Standard Changes.

This project developed a prototype Comparative Deep Draft Maintained Waterway Transit Risk Model.
Providing comprehensive research, development, analysis, and testing support to Coast Guard programs in Arctic missions, vessel technology, port security, law enforcement, alternative energy, and weapons of mass destruction.

**Surface Project Spotlights:**

**Anti-Icing Technologies Investigation.**

This project produced an anti-icing roadmap that identified the activity recommended, the technical maturity of the technology, the cost of the effort, the technology effectiveness, probability of implementation, duration of the effort, and the respective priority.

**Laser Deposited Non-Skid (LDN) Analysis.**

LDN is a new technology that uses a laser-based process to deposit nodules of alloy material on the surface of the base metal. Weldability, structural (mechanical) property, corrosion and wear tests were conducted to determine if applying the LDN affected key material properties of the base metal, e.g. cutter decking.
We are excited about standing up the M&S COE. This new Coast Guard center-of-excellence provides decision-makers with access to campaign and mission-level tools that support fleet mix analysis, tactical mission engagement what-ifs, sensor optimization, resource allocation, and use of game-theory based scheduling tools. Although we are supporting the operations and maintenance of critical accredited tools and models that the Coast Guard routinely employs, our analysts are not tied to tools, but more importantly, are tied to appropriate analysis techniques for the customer’s particular problem. An added organizational benefit is that the M&S COE provides a career path for talented operations research personnel.

**M&S COE Project Spotlights:**

**Coastal Operations Analytical Suite of Tools (COAST).** Accredited M&S tools that support operational and programmatic decision-making within the Coastal Zone, Great Lakes or Inland Waters.

**Search and Rescue Visualization Analytics (SARVA).** Risks and Consequences from Sandy: Coast Guard Resource analysis during one week in November 2011 for area between New York and New Jersey shore.

**The M&S COE has a team with core skill sets augmented by a contracting mechanism that allows a quick turn around on Short Term Analysis Tasks.**
Congress provides the Coast Guard an RDT&E appropriation. In FY13, the RDC received $19.6 million. This covered salaries, rent and other fixed costs, and specific project execution costs. Although we have linkages to Coast Guard Program Offices that provide oversight and policy functions (CG-926 and CG-912), the RDC is generally speaking, a small, self-functioning command that does not significantly rely on external offices/programs to execute its uniquely-funded Coast Guard R&D mission.

About $4M of the RDT&E appropriation goes directly towards project work each year. While the majority of the RDC portfolio is covered by RDT&E funds, the RDC also accepts fee-for-service work from the Coast Guard Operating Expense (OE) and Acquisition, Construction, and Improvements (AC&I) appropriations, as well as other government agencies. Our unique financial business model allows us to partner with other agencies in efforts that will benefit the Coast Guard. Past and current partnerships include Department of Homeland Security (DHS) Science and Technology Borders and Maritime Security Division, Office of Naval Research (ONR), Environmental Protection Agency (EPA), Naval Postgraduate (NPG) program, and the Bureau of Safety and Environmental Enforcement (BSEE).

The core resource the R&D program brings to every project is our staff. The RDC is leading the way in RDT&E with our project management and financial processes. Our practices and processes allow us to work closely with the technical staff to determine the appropriate path forward for all projects ensuring we follow appropriation law and use the proper vehicles to accomplish the assigned task. Our financial team monitors and reconciles all transactions regardless of the source of funds, ensuring timely expenditures and recovery of funds. We are able to provide prompt and accurate responses to the numerous data calls we routinely receive.

RDC Funding History

Although the RDC’s annual RDT&E budgetary funding level has fluctuated over the years, the average annual funding level over the past decade has been approximately $20 million per year. It is clear in the figure on the next page that inflation has significantly reduced the buying power of this $20 million, such that in 2011 it is less than $15 million (in 1992 dollars). The effect of this budgetary erosion has been to constrain what the Coast Guard’s technically skilled, in-house staff can accomplish. This reduces the Coast Guard’s ability to improve its operational efficiencies in the present austere budgetary environment and re-capitalizes critical capabilities to meet the emerging new challenges of the 21st century. Shortly after DHS S&T was established, a 2004 Congressionally mandated independent report was commissioned that re-affirmed the importance of the Coast Guard having its own dedicated R&D organization which coordinates with DHS S&T and leverages its (and other governmental) resources when appropriate. In 2007, the RDC was selected by the Coast Guard to undergo an A-76 competition (competitive performance for commercial activities) to see if its mission could be accomplished more
FY10 includes a $4M post Deep Water Horizon earmark and maintains several R&D-focused Indefinite Delivery, Indefinite Quantity (IDIQ) contracts against which Task Orders for Coast Guard-specific R&D support work can be established. Presently, these IDIQ contracts include the following:

- Research, Design, Development Support Services (RDDSS)
- Systems Engineering and Technical Assistance (SETA)
- Administrative and Technical Support (ADMIN)
- Operations Research & Mathematical Modeling Support Services (ORMMSS)
- Automatic Identification System (AIS) Technical Support Services

Since all Coast Guard R&D contracting needs cannot be accomplished via the above IDIQ contracts, the RDC is also frequently involved with the execution and/or utilization of Broad Agency Announcements (BAA); Inter-Agency Agreements (IAA)/Military Inter-departmental Procurement Requests (MIPR); Requests For Information (RFI); Requests for Proposal (RFP); DHS Center-of-Excellence Basic Ordering Agreements (COE BOA); DHS Strategic Sourcing Contracts; GSA Schedules; etc. In an effort to meet the need for other obligation vehicles intended for the R&D community, grant authority is currently being pursued.

R&D Contracting Office. While the RDC strives to maintain a “critical mass of in-house intellectual capital” to address the Coast Guard R&D needs, a significant amount of formal contracts and small purchase actions are required to support and augment in-house staff capabilities and needs. Since the RDC Contracting Office must comply with the Federal Acquisition Regulation (FAR), as most other Federal contracting offices are required to do, the application of these regulations, along with the Homeland Security Acquisition Regulations (HSAR), Homeland Security Acquisition Manual (HSAM), DHS Management Directives, and Coast Guard Application Procedures (CGAP) often require critical thinking/innovative approaches to accommodate the unique challenge of one R&D command supporting an entire military organization.

The R&D Contracting Office is adept at awarding and administering cost reimbursement contracts, an expertise that is unique and invaluable due to the uncertain nature of R&D. The Contracting Office is supervised by a Senior Field Contracting Officer who holds an unlimited warrant.

In order to facilitate timely response to dynamic, complex RDC contracting and small purchase requirements, the RDC Contracting Division has established and maintains several R&D-focused Indefinite Delivery, Indefinite Quantity (IDIQ) contracts against which Task Orders for Coast Guard-specific R&D support work can be established. Presently, these IDIQ contracts include the following:

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Significant Partnerships and Leveraging

Internal Partnerships... We are certified partners with the Acquisition Directorate and provide them an independent analytical resource for conducting alternatives analysis, business case analysis, program life-cycle-cost estimates, and other acquisition analysis. Our analytical skills and shared interest with the Operational Commanders and Assistant Commandant for Operations (CG-7) in rapidly piloting new concepts (e.g., PROTECT) and technologies (e.g., contraband marking) have created an enduring relationship with the CG-7 Program Offices and Area Command analytical elements (e.g., LANT-7, PAC-7). We are inextricably linked in the idea submission review process for new projects, request for forces for technology demonstrations, and in the coordination of Sector/District pilots. We also have enduring partnerships within DCO and the Vice Commandant’s Office in supporting pre-acquisition analysis (e.g., mission analysis), campaign modeling and simulation (e.g., CGMOES fleet mix studies), oil spill response technology development and analysis (e.g., recovery of heavy oil from deep waters), and with the Coast Guard’s Enterprise Strategic Management & Doctrine Directorate (CG-095) Innovation Program in deliberate efforts that link Evergreen Strategic Needs to specific projects executed through our portfolio.

We are tied to the Coast Guard’s M&S Council in our role of being the accreditation agent for the creation of critical new decision support tools. In addition, R&D Program staff in Headquarters participate in requirements councils and a variety of other forums to maintain and/or build new internal partnerships necessary to collectively address capability gaps or try out new technology.

External Partnerships... Our external partnerships are critical. They feed us new ways of thinking as well as opportunities to: co-fund projects; work directly with talented organizations in the private sector; influence/leverage Other Government Agency (OGA) investments in ways that help close Coast Guard knowledge gaps; and provide funding to allow the RDC to serve as project performers. (However, we only accept those projects that provide a knowledge advantage to the Coast Guard.) The use of Cooperative Research and Development Agreements is the key partnership-enabling tool that we routinely employ to create private-public partnerships to test new technologies of mutual development interest. Our partnerships are often manifested in our projects. For example, this past summer we could not have conducted a quantitative risk assessment without the participation of multiple agencies and dedicated waterway stakeholders on the Chicago Sanitary and Ship Canal to determine the annual loss associated with maritime and shore-side activity in the vicinity of the electrified fish barriers.

Innovation is alive and well in the Coast Guard and particularly so at the operational “pointy end of the spear”. That innovative spirit must be supported and we see ourselves engaged in more and more transition partnerships with operators and plan to help the best-in-breed ideas move forward in the organization.

CAPT Arsenault meeting with RADM Devaney to discuss the hunt for USCG Revenue Cutter BEAR project.
We have ongoing efforts where we fund Universities in directed research, where Office of University Programs (OUP) authorizes Coast Guard-related research initiatives through the COE five-year work plans, or both RDC and OUP stand-up complimentary projects (e.g., Port Resilience Toolkit). Borders and Maritime Division is also a key DHS partner with which we have a strong maritime science and technology kinship. Outside the Department, we work closely as collaborators and performers with an alphabet soup of other agencies (e.g., ACOE, BSEE, CRREL, and NOAA) that have equity in maritime research, safety, and port operations.

For example, we are currently co-funding efforts with BSEE including airborne sensing of spills and hope to collaborate on in-situ burn research at our refurbished open-air burn pan located at our Joint Maritime Test Detachment in Mobile, Alabama. BSEE provided the Woods Hole Oceanographic Institute (WHOI) autonomous underwater vehicle for our Arctic Shield 2013 oil-in-ice technology demonstration. In addition, the RDC is pursuing international MOUs that include the Royal Navy’s Maritime Warfare Center to pursue mutually supportive research in sensor modeling, tactical unmanned systems, and non-lethal technologies.

Joint Maritime Test Detachment

The RDC has been delegated authority to enter into Cooperative Research and Development Agreements (CRADAs) with industry partners. CRADAs are used to evaluate the feasibility and affordability of mission solutions and assist the commercialization of technology through co-development of a product or software. They are legal documents but not procurement contracts or grants; no Federal funding is provided to industry under a CRADA.

Current CRADAs:

- **Honda**: Operational Testing of Alternative Fuels (9 June 11)
- **Mercury Marine**: Operational Testing of Alternative Fuels (12 Jan 12)
- **Cummins**: Operational Testing of Alternative Fuels (2 Feb 12)
- **UrsaNav**: Wireless Precise Time (13 Feb 12)
- **GDC4S**: Mobile Asset Tracking & Reporting Device (26 Apr 12)
- **Engility**: Tactical Data Link Range Enhancement (9 May 13)
- **Marine Exchange of AK**: Next Gen Arctic Maritime Nav Safety Info System (16 Oct 13)
Outreach Partnerships

We continue to increase our participation in Partnership in Education (PIE) programs with the local schools. For example, we have a three-year partnership with a local magnet school where we host students on-site and lecture about the use of science and technology on real-world issues. Last year our staff worked with local grade school children on simulated investigations and experiments on substances that washed up on the beach.

In addition, we have had volunteer tutors in the local middle school on a weekly basis for the past several years. One of our staff received the 2013 Coast Guard PIE award but more importantly, numerous positive experience comments from teachers and students alike. We also provide technical experts to act as judges for the annual statewide For Inspiration and Recognition of Science and Technology (FIRST) robotics competition.

Although we may at times appear to be a project portfolio execution machine from the outside looking in, we are much more and have positive influences inside and outside the organization.
Executive Director’s Look Ahead

Fiscal Year 2014 funding will bring the Coast Guard M&S CoE to full operational capability. In addition, we will continue both small and large unmanned aircraft systems testing; technology evaluations/demonstrations of unmanned maritime vehicles; Arctic capability research involving navigation and communications; planning for a follow-up joint technology demo for Arctic Shield 2014 with the HEALY; oil detection/response; piloting of non-material game-theoretic tools in our mission spaces; and using Cooperative Research and Development Agreements to build public-private partnerships to enhance maritime domain awareness. Our staff will serve as liaisons to other labs and universities, provide Coast Guard operators with early acquisition transition guidance on their innovations, and continue support of technological issues that are beyond the normal Coast Guard knowledge-base. I am excited about new project starts in FY14 that include such areas like testing of non-lethal impact munitions and multiple-person recovery techniques. I believe the extensive internal and external partnering, implemented efficiencies, emphasis on transition support, ability of the RDC organization to respond to complex contingencies, and adaptability and agility to shift our portfolio product mix described in this annual report uniquely positions the RDC as a strategic resource for the Coast Guard and DHS in FY14 and beyond.

Mission
Provide innovative technologies, analysis and decision support to reduce acquisition risk and enhance operations across all Coast Guard missions.

Vision
To be recognized as the Coast Guard Authority for Research & Development; Test & Evaluation; and acquisition & operational analysis.