SSC San Diego

BRIEF

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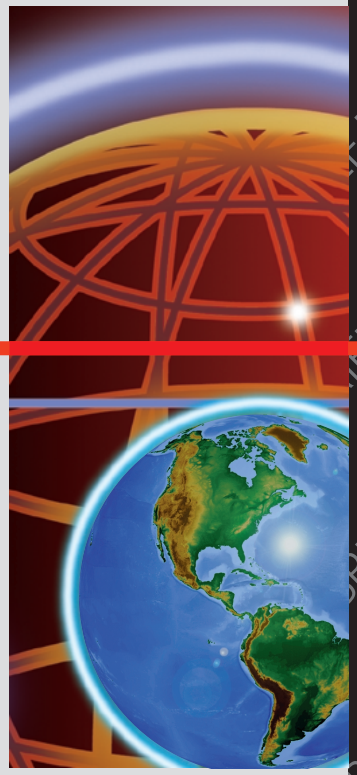


SPAWAR
Systems Center
San Diego

Foreword

Along with diplomatic skills and economic and military strength, information dominance is now one of the four primary instruments of national power. Information dominance means providing the warfighter sufficient and timely information and associated tools to plan and execute effectively, while denying—through both active and passive means—the enemy adequate information on which to plan and execute effectively.

The Space and Naval Warfare Systems Center, San Diego, known as SSC San Diego, is uniquely qualified to provide the expertise and tools to achieve information dominance. We are at the cutting edge of the processes of transforming data into information, information into knowledge, and knowledge into understanding.

We have defined and articulated an integrated, futuristic vision: To be the nation's pre-eminent provider of integrated C4ISR solutions for warrior information dominance. We intend to continue and expand SSC San Diego's leadership in defining, developing, integrating, installing, and sustaining C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) systems. This Brief summarizes our broad range of programs, capabilities, and accomplishments—a summary of our work toward achieving our vision.

Contents

Introduction to SSC San Diego **2**

Programs **6**

Capabilities **30**

Personnel, Organization, and Funding **38**

Introduction to SSC San Diego

NRaD Renamed SSC San Diego—The Naval Command, Control and Ocean Surveillance Center Research, Development, Test and Evaluation Division (NRaD) was renamed the Space and Naval Warfare Systems Center, San Diego (SSC San Diego), on 30 September 1997. The new title reflected the change in the Center's direct reporting responsibility from the Naval Command, Control and Ocean Surveillance Center, which was disestablished, to Space and Naval Warfare Systems Command. The change also elevated the Center to Echelon 3.

Our great strength at SSC San Diego is our unique expertise across the full spectrum of C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance). Our work ranges from basic research and prototype development through systems engineering and integration to life-cycle support of fielded systems. Major SSC San Diego programmatic and technical thrusts are directed toward merging advanced technology and systems into integrated C4ISR capabilities; supporting joint C4ISR needs of the military; and cooperating but not competing with industry. While most of SSC San Diego's work addresses Navy needs, we actively support Marine Corps, Air Force, Army, and Coast Guard programs. We also support other government agencies in addressing their unique C4ISR requirements.

People are critical to the successful achievement of our vision. The majority of our people are scientists and engineers, many of them with decades of experience in the Navy acquisition community. One of our most pressing current challenges is recruiting and developing the next generation of information technologists. Our organization continues to evolve to support our work across the spectrum of C4ISR.

SSC San Diego's facilities, laboratories, and fleet communications capabilities allow our engineers and scientists to replicate an operational environment unachievable in the commercial world. Only at SSC San Diego can the pieces of the overall C4ISR system be integrated and tested in both laboratory and operational contexts.

SSC San Diego is uniquely positioned geographically to perform its mission. We are close to major operational commands of the air, surface, and submarine Navy; air, expeditionary, and electronic components of the Marine Corps; the amphibious forces; and the special forces.

Our fleet support extends thousands of miles beyond San Diego Harbor and includes the SPAWAR Systems Activity in Hawaii that supports the Commander in Chief, U.S. Pacific Command, and Commander in Chief, U.S. Pacific Fleet, on-site, and the SPAWAR Systems Facilities in Guam and Japan that support the ships of the Seventh Fleet.

Mission

To be the Navy's full-spectrum research, development, test and evaluation, engineering and fleet support center for command, control and communications systems and ocean surveillance and the integration of those systems which overarch multiplatforms.

Leadership and Technology Areas

Consistent with our mission, eight leadership areas are formally assigned to SSC San Diego. These leadership areas clearly represent SSC San Diego's C4ISR charter as well as leadership areas outside that scope—ocean engineering and marine mammals. Beyond these, SSC San Diego has demonstrated national- and international-level expertise in a broad range of technology areas.

Assigned Leadership Areas

- *Command, control and communication systems*
- *Command, control and communication system countermeasures*
- *Ocean surveillance systems*
- *Command, control and communication modeling and analysis*
- *Ocean engineering*
- *Navigation systems and techniques*
- *Marine mammals*
- *Integration of space communication and surveillance systems*

Technology Areas

- *Ocean and littoral surveillance*
- *Communications and networking*
- *Topside design/antennas*
- *Command systems*
- *Computer technology*
- *Navigation*
- *Intelligence/surveillance/reconnaissance sensors*
- *Atmospheric effects assessment*
- *Marine mammals*
- *Environmental quality technology/ assessment*
- *Robotics and physical security*

Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR)
Effective C4ISR will integrate disparate units and functions into coordinated operational capabilities.

Information Dominance
To achieve information dominance, our warfighters must have sufficient and timely information and associated tools to plan and execute effectively while denying—through both active and passive means—the enemy adequate information on which to plan and execute effectively.

Vision

The overriding goal of C4ISR must be to provide our warfighters the tools necessary to achieve information dominance over all known and potential adversaries. This goal is in concert with the operational precepts outlined in Joint Vision 2010; achieving information superiority is crucial to the full-spectrum dominance sought by our Armed Forces. SSC San Diego's vision—to be the Nation's pre-eminent provider of integrated C4ISR solutions for warrior information dominance—guides our work.

" To be the Nation's pre-eminent provider of integrated C4ISR solutions for warrior information dominance "

Programs

SSC San Diego conducts a broad range of programs focused on integrated C4ISR. We also conduct several unique programs outside of our primary C4ISR focus. Innovative new research is encouraged through our In-house Laboratory Independent Research program. Representative examples of the Center's C4ISR programs are described on the following pages, grouped in six subsections consistent with our six Corporate Imperatives. Programs outside of our primary C4ISR focus are described in a final subsection: Other Technologies and Research.

SSC San Diego seeks to provide the joint warfighter with technology to collect, process, display, and transfer information critical to mission execution. Our six Corporate Imperatives define the capabilities that we must incorporate in our systems to provide optimal C4ISR to the warfighter.

- Dynamic Interoperable Connectivity—The warfighter must have have assured, user-transparent connectivity that is reliable, secure, and flexible.
- Universal Information Access—The warfighter must have access to the right information at the right time, at any desired location.
- Information Operations/Assurance—Information and information management systems must be secure from attack or exploitation.
- Consistent Situation Representation—Warfighters at all levels must have consistent understanding of the operational situation that can be shared.
- Resource Planning and Management—The warfighter must be able to husband critical resources—people, platforms, weapons, and information management systems.
- Distributed Collaboration—Warfighters of all services must be able to work together to execute a common mission; few of them will be on-scene, so many will need to provide support from afar.

Other Technologies and Research—In addition to the programs directly supporting the Corporate Imperatives, other important programs under the Center's cognizance include high performance computing and networking, environmental sciences, and marine mammals. We also encourage our scientists and engineers to explore new ideas and conduct initial research through our In-house Laboratory Independent Research program.

Dynamic Interoperable Connectivity

Our warfighters require seamless, user-transparent connectivity that offers: flexibility to accommodate changing information needs; interoperability for Joint, Allied, and Coalition operations; diversity for world-wide connectivity to military forces and commercial entities; multi-level security; and economy.

Automated Communications Management System (ACMS)

ACMS is a major element of the Milstar Mission Control Segment. ACMS provides all of the capabilities required to satisfy the complex Milstar planning process.

These capabilities are implemented in a state-of-the-art product that incorporates the Milstar knowledge base in its planning algorithms and rules. The operator is presented with a sequence of graphical screens that lead the user through the Milstar planning tasks.

ACMS interfaces with the Navy EHF SATCOM Program (NESP) terminal and with the Air Force Command Post Terminal. ACMS is the Terminal Data Node for the Army's Single Channel Anti-Jam Manportable (SCAMP) and Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T) terminals, generating and distributing the required planning database to the terminals. It also provides terminal control for SMART-T.

ACMS creates and distributes key authorization and payload tables to the Satellite Mission Control System and transmits and receives payload tables to the Milstar Auxiliary Support Center.

ACMS provides a networked, multi-user planning environment that services all Milstar user echelons from the Joint Staff down to the field units. ACMS Build 1 is currently in user evaluation at Air Force Space Command, Colorado Springs. It is also being used to support Milstar factory testing. ACMS Build 1 was released for operational use in February 2000.

Milstar

Milstar is the next-generation military satellite communication system, designed to serve the National Command Authority and the Unified and Specified commanders and their operational forces. Milstar will be the Department of Defense's core command and control communications system for U.S. strategic and tactical combatant forces in hostile environments well into the next century.

The Milstar system is composed of the Space Segment, Mission Control Segment, and Terminal Segment. The Space Segment will consist of a cross-linked constellation of satellites to provide worldwide coverage. The Mission Control Segment will control Milstar satellites in orbit. It will perform satellite health maintenance, satellite constellation control, and communications management. A primary attribute of this Milstar segment is survivability, with a fixed site at Falcon Air Force Base, CO, and multiple mobile control stations. The Terminal Segment includes fixed and mobile ground terminals, ship and submarine terminals, and airborne terminals.

The Milstar program is managed by the MILSATCOM Joint Program Office at the Space and Missile Systems Center, Los Angeles Air Force Base, CA. SSC San Diego participates in Milstar as a primary development organization for the Automated Communications Management System, a major element of the Milstar Mission Control Segment.

ACMS Build 1 Maintenance, completed in December 2000, provides updates to Crypto Planning, additional Dynamic Service Loader capability, enhancements to Communications Asset Monitoring, addition of Global Data Management services, and added Data Distribution Security features.

ACMS Build 2, to be completed in early 2003, will incorporate Milstar EHF enhancements, Milstar UHF Planning, UHF Follow-On/ Enhanced Planning, the interface to Dual Modem Upgrade-2 Terminal, the interface for Milstar UHF images for Air Force Command Post, and the tracking of Terminal Outage Reports.

Automated Digital Network System (ADNS)

ADNS provides seamless and secure connectivity for voice, video, and data applications afloat and pierside through automated network and radio frequency (RF) resource management. ADNS incorporates the latest advances in commercial and military communications technology with a goal to maximize bandwidth, enabling the sharing of information seamlessly, in real or near real time, through flexible, adaptive, and interoperable systems and services. ADNS provides both tactical improvements to the warfighter and non-tactical quality-of-life services to sailors at sea and ashore.

ADNS provides baseband connectivity and networking services (voice, video, and data) to/from end user systems. ADNS uses standards-compliant, commercial product networking and control technology to achieve Joint and Allied interoperability and to comply with the Joint Technical Architecture. By using standards-compliant packet network technology that makes efficient use of available RF resources, ADNS increases throughput efficiency over existing capabilities while providing both flexibility and interoperability to meet mission requirements.

ADNS development is based on the incorporation of commercial off-the-shelf (COTS) and government off-the-shelf (GOTS) hardware and software, such as Internet Protocol routers and asynchronous transfer mode switches. The integration of COTS/GOTS products significantly reduces ADNS development, procurement, and maintenance costs.

ADNS has been implemented in over 100 U.S. Navy ships including aircraft carriers, guided missile destroyers, cruisers, amphibious ships, and all four Command ships. Whether the Fleet is underway or alongside the pier, ADNS allows our naval forces to share information with a common architecture that will soon exist on every ship.

Extending the Littoral Battlespace (ELB)

The ELB Advanced Concept Technology Demonstration (ACTD) evaluates advanced capabilities for Navy and Marine Corps use in littoral warfare. The objective of the ELB ACTD is to demonstrate an enhanced integrated C2/fires and targeting capability to enable rapid employment/maneuver/fire support from the sea of dispersed units operating in a littoral battlespace. The approach to accomplish this objective is a multi-phased demonstration that leverages other Department of Defense ACTD efforts and unique Navy/Marine Corps initiatives to develop new capabilities.

The ELB ACTD is co-sponsored by the U.S. Navy and the U.S. Marine Corps. The executing agents are the Office of Naval Research and the Marine Corps Combat Development Command. The ELB ACTD consists of teams from government and industry.

In 1999, SSC San Diego's ELB ACTD team successfully completed the first major system demonstration. The demonstration used three ships off the coast of southern California, a shore-based monitoring station, several mobile land platforms, and numerous dismounted warfighters. Utilizing multiple airborne routers, all participants were able to establish wireless communications networks during the demonstration, some spanning 200 miles.

SSC San Diego's ELB team was key to the success of the demonstration. The team provided technical support, management, and leadership to the program and spearheaded the communications and networking efforts. The team planned and engineered the command and control variants, coordinated the sensors participation, installed the shipboard systems and subsystems, and documented the efforts.

The Naval Surface Weapons Center, Naval Air Warfare Center, and Naval Research Laboratory were other participating government laboratories. The primary industry team members were General Dynamics, Litton/PRC, Lucent Technologies, Raytheon, and Stanford Research International. The Office of Naval Research was the demonstration manager and Commander in Chief, U.S. Forces Pacific, was the operational manager.

Advanced Concept Technology Demonstrations (ACTDs)
ACTDs are a means for rapid, cost-effective introduction of new capabilities. ACTDs are designed to rapidly transfer technological solutions to warfighting requirements from the developer to the warfighter in the field. The demonstrations provide a means for operators and developers to evaluate the operational utility, technological feasibility, and life-cycle implications of the new technologies. Pairing the warfighting Commander-in-Chief with the technology developer during product development helps ensure the product has military utility and fulfills an identified operational shortfall. Both government off-the-shelf and commercial off-the-shelf technologies are used to the maximum extent possible.

Current SSC San Diego ACTD involvement includes Extending the Littoral Battlespace (presented in this section), National Distress and Response System Modernization Project (NDRSMP) Radio Direction Finding/Digital Selective Calling (RDF/DSC), and the High-Altitude Endurance (HAE) Unmanned Aerial Vehicle.

The second major ELB system demonstration was completed in 2001. SSC San Diego will continue to provide technology, management, and leadership to key aspects of the ELB program.

Topside and Antenna Design

Today's crowded electromagnetic spectrum, increased information requirements, and complex weapon systems create challenging communication problems on Navy ships and airborne platforms. Network-centric operations require greater bandwidth, forcing larger numbers of antennas on Navy ships. Satellite communications antennas now dominate ship deck space. Current antenna designs cannot be accommodated due to topside constraints (i.e., volume, weight, moment, electromagnetic interference, and signature). In addition, lower life-cycle costs and personnel requirements are mandated.

SSC San Diego is leading the way in design for improving sensor performance, reducing signatures, solving electromagnetic interference problems, and increasing affordability. Our work includes the design of antennas and mitigation of all electromagnetic interference problems as well as communication technology design, development, and implementation. Sophisticated electromagnetic interference test range facilities,

advanced workstation analysis tools, and a total ship engineering test bed for the 21st century with connectivity to other government and industry laboratories facilitates our work.

Advanced Enclosed Mast/Sensor (AEM/S). AEM/S is the U.S. Navy's first advanced hybrid composite structure. AEM/S has been installed aboard the USS RADFORD (DD 968) replacing her conventional main (aft) mast. The new, advanced composite mast is an 87-foot high, 40-ton, 35 feet in diameter, hexagonal structure enclosing existing radars and providing important signature and other operational benefits.

The AEM/S system mast is affordable, solves problems associated with current masts, enables new technology required for the Navy's next generation of stealthy ships, reduces life-cycle costs, enhances sustainability, and most importantly, enhances warfighting capabilities. This technology is also being used to develop composite masts for the LPD 17, the Navy's latest class of amphibious force ship. SSC San Diego was the Advanced Technology Demonstration leader for the AEM/S at-sea demonstration aboard RADFORD.

Topside Design. Recent SSC San Diego contributions in this area include topside definition support to the Blue and Gold industry teams for the DD 21 Destroyer, topside definition support to the Naval Sea Systems Command (NAVSEA) for CVN 77/CVN(X) next-generation aircraft carrier, and topside design support for JCC(X) Joint Command Ship.

Universal Information Access

Ready access to tactical information is vital—our warfighters must have access to the right information at the right time, at any desired location.

Command, Control, and Intelligence Systems

Command, control, and intelligence systems provide interoperable command, control, and intelligence for Navy and Joint decision-makers afloat and ashore. The systems provide access to current force status and readiness information. A leader in this field since the mid-1960s, SSC San Diego is the prime systems engineer, integrator, and software support activity for the Navy's command and control systems fielded on all ships and major shore commands. The Center is currently developing joint command centers for the U.S. Joint Forces, Pacific, Space, and Strategic Commands.

Global Command and Control System–Maritime (GCCS–M)

As the naval implementation of the Global Command and Control System (GCCS), GCCS–M is the designated command and control (C2) migration system for the Navy, representing the evolutionary integration of many previous C2 and intelligence systems. GCCS-M supports network-centric warfare by receiving, displaying, correlating, fusing, and integrating all available information for the warfighter.

GCCS–M supports multiple warfighting, manpower, and logistics missions for commanders at every echelon, in all afloat, ashore, and tactical naval environments, and for Joint, Coalition, and Allied forces. Key capabilities include multi-source information management, display and dissemination through extensive communications interfaces, multi-source data fusion and analysis, decision-making tools, and force coordination.

Throughout the evolution of GCCS, SSC San Diego has contributed to programs that include the Navy Tactical Command System–Afloat (NTCS–A), Joint Maritime Command Information System (JMCIS), and Operational Support System (OSS). Currently, SSC San Diego performs GCCS–M test and evaluation and is the

Software Support Activity. Center capabilities include hardware, software, and communications environments for application development and integration, as well as compliance, functional, and interoperability testing for the two GCCS–M variants: Afloat and Ashore.

GCCS–M Afloat. Formerly NTCS–A and JMCIS Afloat, GCCS-M Afloat will be installed on more than 300 ships and submarines throughout the Navy.

SSC San Diego's GCCS–M Afloat Test Bed and Integration Facility provides mockups of the installations on aircraft carriers, command ships, and unit-level platforms to support afloat systems.

GCCS–M Ashore. Formerly OSS and JMCIS Ashore, GCCS-M has been installed at numerous ashore fixed command centers.

SSC San Diego's GCCS–M Ashore Integration and Test Facility supports development and testing of ashore command systems.

Tactical Data Links

A critical segment of warfighter universal information access is the ability to share near-real-time tactical data in a distributed, interoperable, and secure environment. Tactical data links, specifically Link-11 and Link-16, and the future Link-22, provide this capability to Navy, Joint, and Allied forces. SSC San Diego has been involved with tactical data link development, test, evaluation, integration, and life-cycle support since the early 1960s and continues this involvement with unique, world-class expertise and facilities.

SSC San Diego began development of Link-11 in the 1960s and has continued to support developments of new Link-11 data terminal sets, such as the recently deployed Common Shipboard Data Terminal Set (CSDTS). SSC San Diego has also developed and fielded tools such as the Multi-Link Display System (MLDS) that enhance Link-11 data display aboard smaller platforms. The long involvement with Link-11 is now benefiting the development of Link-22, which will provide Navy and Allied forces with significantly improved HF, UHF, and SATCOM tactical data connectivity.

SSC San Diego began development of Link-16 in the 1980s. Link-16 provides for high-capacity, secure tactical data communications in a distributed, networked architecture with a significantly enhanced message structure. Link-16 has been fielded as a Joint and now international program. Over 200 Navy ships, aircraft, and shore sites are equipped with Link-16. A growing number of Allied countries are being equipped with Link-16, supporting the interoperability goals of U.S. forces.

Link-16 consists of the Joint Tactical Information Distribution System (JTIDS) data terminal and the Common Data Link-Management System (CDLMS) for shipboard applications, which includes the Command and Control Processor (C2P) and the unique Link-16 antenna set. SSC San Diego has led development of these systems since their inception and continues to develop, test, integrate, and support them on a growing number of new platforms. SSC San Diego has significant involvement in the development and testing of the new Link-16 data terminal, the Multifunction Information Distribution system (MIDS). MIDS is an international development program that will result in a lower cost, smaller, and more readily upgraded Link-16 terminal that will allow integration of Link-16 on a wide range of new platforms. SSC San Diego is the lead Navy test activity for MIDS and is actively involved in integration aboard the F/A-18 aircraft and for the MIDS On Ship program.

Key to SSC San Diego's tactical data link leadership are unique facilities such as the

System Integration Facility (SIF). The SIF lab hosts eight JTIDS and MIDS terminals and can support both live and simulated Link-16 operations. SIF and the Center's Combat Direction System Development and Evaluation Site allow detailed testing of CDLMS, C2P, Link-11, and Link-16 in a true multi-TADIL environment. Link-16 connectivity to other labs both in the U.S. and abroad allows integration testing for a variety of platforms including E2C, F14D, F/A-18, Airborne Early Warning and Control System (AWACS), and Aegis ship platforms. The SIF and its connectivity are central elements of the Distributed Engineering Plant (DEP), allowing shore-based battle group C4I testing.

SSC San Diego also provides world-class life-cycle support capabilities in in its role as the Link-16 In-Service Engineering Agent (ISEA). ISEA engineers have conducted numerous Link-16 installations and continue to support the over 200 Link-16 platforms with technical assistance, training, and documentation. The Link-16 ISEA laboratory supports training and documentation development as well as troubleshooting with a fully capable Link-16 system.

Data Link Test Tools. Developed by SSC San Diego and Digital Wizards, Data Link Test Tools are personal computer-based applications that make the connections between ship and shore assets possible. The Data Link Gateway, cornerstone of the Data Link Test Tools, provides a low-cost, logistically feasible way to expand the Link-16 communications horizon between geographically separate test facilities and host combat systems over secure phone lines. This eliminates line-of-site restrictions imposed by RF communications. SSC San Diego's technical teams have used the Data Link Test Tools to support a series of interoperability demonstrations, tests, and training exercises.

Base Level Information Infrastructure (BLII)

The Navy's Base Level Information Infrastructure (BLII) concept extends the Defense Information Infrastructure (DII) concept to the Navy base level and is derived from the DII Master Plan, which directs the Services to upgrade 80% of their bases by 2003 and 100% by 2008. BLII incorporates the Joint Chiefs of Staff C4I for the Warrior and Information Technology for the 21st Century (IT-21) objectives of providing a seamless, secure, and interoperable global C4I network for the warrior.

BLII regionalizes voice, data, and video by consolidating wide-area networks service delivery points via asynchronous transfer mode (ATM)/synchronous optical network (SONET) metropolitan area networks, extended to users via fiber base area networks (BANs). BLII provides global, regional, and local management capabilities. It also provides Secret Internet Protocol Router Network (SIPRNET), Non-secure Internet Protocol Routing Network (NIPRNET), and Joint Worldwide Intelligence Communications System (JWICS) services to the Fleet.

SSC San Diego is the program director for BLII and has completed the design, installation, configuration, testing, and acceptance of operational BLII infrastructure at sites in the Pacific Region [Pacific Southwest (PACSW) and Pacific Northwest (PACNW)], Naval Air Station Lemoore, and the Far East (Japan).

The Center's BLII Integration Laboratory provides a state-of-the-art systems integration and testing capability to support all BLII efforts. Efforts include ATM network testing and configuration, proof of concept, and BAN/WAN/LAN simulations/testing. It is also used as a BLII equipment pre-installation, test, and checkout facility.

Information Operations/ Assurance

Our warfighters must have secure information and information management systems. Protecting our information base from attack or contamination is critical. But assurance is not merely new and better technology. Creating new doctrine to use with the new technology is just as important as defining the needed operational capability.

Information Operations/Assurance (IOA)

SSC San Diego's IO/A capabilities are based on a series of Center-developed security engineering processes that include trusted software engineering processes, trusted system engineering processes, vulnerability and risk assessment processes, and certification and accreditation processes. The Center was the first Navy activity assessed as having a trusted software capability maturity (following a model developed by the Software Engineering Institute (SEI) and the National Security Agency (NSA)). All of these processes have procedures tailored for commercial products as well as for DoD-developed systems. Unlike most activities in IO/A, SSC San Diego processes are proactive rather than reactive.

The Center has well-developed capabilities for information engineering and for system engineering applied to security issues. These capabilities enable SSC San Diego to be a value-added partner to government technology base activities, acquisition organizations, infrastructure managers, and operational commands. The Center performs tasks that range from basic research in information assurance and requirement definition of secure systems to life-cycle management of fielded security products.

The Center's credentials for performing certification and accreditation on security products and systems, for embedding cryptologic solutions in systems, for multi-level security products, and for operational computer network defense/attack, make the Center a total solution provider for IO/A.

SSC San Diego has integrated IO/A expertise and facilities from across the Center. The Center's networked facilities are also connected with test and evaluation facilities at NSA, the Defense Advanced Research Projects Agency (DARPA), and other activities outside the Center. External connectivity allows SSC San Diego to participate on-the-air with operational units, providing a highly effective environment to develop IO/A solutions. The Center's Information Operations Center of the Future (IOCOF) provides a focal point for IO/A activities at SSC San Diego and external developers and agencies.

Information Operations Center of the Future (IOCOF)

SSC San Diego's IOCOF is a flexible, modular facility that incorporates emerging technologies, development programs, and real-world challenges into a common environment. The IOCOF:

- *Provides education and training for information operations needs*
- *Provides operators and acquisition managers the opportunity to experience realistic information operations in a forward-looking environment*
- *Supports development of critical IO/A technologies and processes*
- *Supports SSC San Diego interaction with external developers and agencies*
- *Facilitates IO wargames and exercises*

The IOCOF began as an idea to develop an area within SSC San Diego that could help coordinate work in the rapidly developing field of information operations. While providing a common ground for integrating systems developed by scientists and engineers at SSC San Diego, the IOCOF also facilitates highly productive teaming with industry.

With the goal of bringing information warriors together with concepts and technologies to excel in information operations, the IOCOF enhances the Center's participation in both Navy and Joint IO activities. Since achieving initial operational capability in 1999, IOCOF personnel have successfully supported several war games and experiments, including Vigilant Protector, Brazen Tsunami, and Insider Threat. The IOCOF has also served as the demonstration center for Time-Critical Strike. These and other continuing successes demonstrate the value the IOCOF and IO community can provide our Nation's warfighters.

The importance of IO/A reaches across a broad spectrum of applications. For example, IO/A includes ensuring that navigational information from the Global Positioning System also remains secure. In this area, the Center has helped define the programmatic structure to deal with near-term jamming threats. The Center is not only testing existing equipment for robustness, but is also developing the hardware/software arrays for the next generation of GPS equipment to defeat jamming.

Consistent Situation Representation

For our warfighters to achieve a shared understanding of the operational situation, information from many sources must be represented consistently across all command levels. Achieving consistent situation representation requires: sensors to collect tactical data, data fusion capabilities, the ability to interpret the information/situation, and the means to share the information as appropriate.

Tactical Cryptologic Systems

SSC San Diego performs systems engineering, software development (integration), and test and evaluation of tactical cryptologic systems to detect, identify, and exploit signals of interest for a variety of missions. The integration of signals intelligence with command and control systems will ensure faster delivery of information to the Joint user and significantly enhance situational awareness.

The Center provides development and support of several tactical cryptologic systems, including OUTBOARD (Navy shipboard direction finding system) and OUTBOARD Upgrade Programs; Combat Direction Finding; Ship Signal Exploitation System; Battle Group Passive Horizon Extension System (BGPHES) Airborne Receiving System-Surface Terminal; and the Common High-Bandwidth Data Link (CHBDL) System. The Center's Cryptologic Unified Build software provides the basis for most current tactical cryptologic systems.

Cryptologic Unified Build (CUB). Developed by SSC San Diego, CUB provides a common operating system for afloat cryptologic applications. The CUB software build initially formed the cryptologic segment of the Joint Maritime Command Information System (JMCIS), and later migrated to the Global Command and Control System–Maritime (GCCS–M). The Center also develops associated CUB databases and the Cryptologic On-Line Training (COLT) system, which provides performance-based training. CUB is currently used as the basis for most tactical cryptologic systems. For example, the Cooperative OUTBOARD Logistics Update (COBLU), a joint U.S./UK program to modernize the detection, location, and analysis capability of U.S. and UK OUTBOARD systems, utilizes standard CUB software to reduce operator training/workload and provide a GCCS–M interface.

Integrated Broadcast Service (IBS)

IBS was created to develop a new standardized architecture to replace various dissemination systems (e.g., the TRAP Data Dissemination System (TDDS); the Tactical Reconnaissance Intelligence Exchange System (TRIXS); the Tactical Intelligence Broadcast Service (TIBS); and the Near-Real-Time Dissemination (NRTD) system). IBS will bring these systems together under a common data format via a common dissemination architecture to provide timely dissemination of threat warnings and other perishable intelligence to the warfighter. IBS will develop a theater-tailored intelligence dissemination architecture that is interoperable with other dissemination systems. It will provide data to any user who needs it, at the appropriate security level, and via whatever method required. IBS integrates multiple intelligence broadcasts into a system of systems, and migrates tactical receive terminals into a single, related Joint Tactical Terminal (JTT) family. SSC San Diego provides systems engineering for IBS and JTT.

Information Dissemination

To meet the warfighters' requirements for a common, unified picture of the battlefield, timely dissemination of threat warnings and other intelligence is critical. Systems must incorporate a theater-tailored intelligence dissemination architecture that is interoperable with other dissemination systems. SSC San Diego has led developments in this area, with systems such as Tactical Receive Equipment, the Multi-Mission Advanced Tactical Terminal (a multifunctional terminal for the receipt, processing, and distribution of tactical data to multiple local users), and the Tactical Related Applications (TRAP) Data Dissemination System. SSC San Diego's continuing involvement includes system engineering for the Integrated Broadcast Service (IBS) and Joint Tactical Terminal (JTT).

TRAP Data Dissemination System (TDDS). SSC San Diego conceived and developed TDDS, which provides near-real-time global dissemination of tactically significant data from national systems. This system evolved from requirements to test another SSC San Diego development: the Tactical Receive Equipment (based on the Tactical Data Information Exchange System-B, TADIXS-B). TDDS is migrating into the IBS along with other narrowband tactical systems.

Deployable Autonomous Distributed Systems (DADS)

A revolutionary innovation consisting of distributed networks of autonomous undersea surveillance sensors, DADS is quickly moving from the conceptual stage into prototype development and testing at sea. The Center played a key role in initiating the development of this new class of sensor through its Autonomous Off-board Surveillance Sensor Science and Technology Capability Initiative. This initiative has integrated many of the Office of Naval Research's exploratory development products into a demonstrable autonomous surveillance package. The Center is currently working closely with the Navy Warfare Development Command and the Defense Advanced Research Projects Agency (DARPA) on the Capabilities for the Navy after Next Study, an investigation chartered to define the Navy's capabilities in the year 2020 timeframe, with distributed autonomous sensors playing a central role.

The DADS program will extend knowledge and control of the undersea battlespace through the development of clandestine off-board sensors. Autonomous distributed sensors will provide the joint force commander with surveillance options in areas where current and projected capability is either too costly, too overt, too slow to deploy, or limited by the number of manned platforms available.

Undersea Surveillance

SSC San Diego has been a leader in the development of fixed, deployable, and mobile surveillance capabilities to detect and track submarines. During the Cold War, the Center focused those efforts on specific targets—Soviet nuclear submarines operating in deep water—achieving success with such systems as the Surveillance Towed Array Sensor System /Low Frequency Active, Sound Surveillance System, and Fixed Distributed System. Our current challenge is to develop similar capabilities to track diesel–electric submarines operating in the littoral areas—a quieter platform operating in a much more complex sonar environment.

Integrated Undersea Surveillance System (IUSS). IUSS consists of fixed, mobile, and deployable acoustic arrays that provide vital tactical cueing to antisubmarine warfare forces. IUSS is a model for innovation and the smart use of technology. Workstations, enhanced signal processing, and modern communication technologies enable remote array monitoring, thereby reducing personnel requirements and improving efficiency. The Center has been a leading technical force behind IUSS since its inception, and the Center's role continues to evolve along with IUSS.

Advanced Deployable System (ADS). A component of IUSS, ADS is a rapidly deployable undersea surveillance system for littoral water missions. ADS will provide continuous acoustic coverage over vast ocean areas for an extended period. ADS will be capable of detecting quiet nuclear submarines, diesel–electric submarines on the battery, ships exiting or entering harbors, or mine-laying operations. The importance of this portable capability will intensify as our surveillance requirements increase, owing to the Navy's focus on the littorals, the worldwide dissemination of diesel submarines, and the downsizing of our own forces. SSC San Diego provides engineering support for all aspects of ADS. The program recently successfully passed its Milestone II decision point, leading to the Engineering and Manufacturing Development phase. ADS is one of only a few Acquisition Category II programs to have so progressed under the current DoD development and acquisition process.

Navigation

NAVSTAR Global Positioning System (GPS). Precise navigation information is critical to situation representation. SSC San Diego is the Navy leader for navigation support, and performs research and development for all the services' GPS receivers. GPS is a space-based radio positioning and time-transfer system consisting of a constellation of 24 satellites. SSC San Diego plays the leadership role for the user segment of GPS and provides software support for Tomahawk GPS receivers.

Navigation Sensor System Interface (NAVSSI). NAVSSI is a shipboard navigation processor designed to integrate shipboard navigation sensors and systems and distribute a central source of highly accurate real-time navigation and time data to combat, combat support, and communication systems. NAVSSI also provides an electronic navigator's workstation to support safe navigation using digital nautical charts. NAVSSI is deployed on numerous surface combatants. The NAVSSI program is in its fourth phase: the development of Block 3 hardware and software. The Block 3 configuration is being developed to expand the number of sensor and user systems supported.

GPS VME Receiver Card (GVRC). GVRC is the first GPS "on a card" (Versa Module Eurocard [VME]) and the forerunner of a new generation of GPS Receiver Application Modules to be embedded into navigation systems of the future. As the designated Central Engineering Activity Laboratory test agency, SSC San Diego conducted developmental and operational testing that was essential in the development of GVRC by Trimble Navigation, the major contractor. The GVRC will replace existing receivers aboard U.S. and Allied surface and submarine naval combatants where it will be embedded in NAVSSI. The receiver also provides a "blended navigation solution" for use with naval and avionics Inertial Navigation Systems.

Mobile C4I Systems

Enhanced Position Location Referencing System (EPLRS). EPLRS is an ultra-high-frequency data radio used on the tactical battlefield to provide secure, reliable data in real time. In addition, EPLRS processes position, location, and identification information, giving warfighters greater awareness of their situation on the battlefield. SSC San Diego's work has included integrating GPS into EPLRS, devel-

oping downsized EPLRS shelter/vehicle engineering development models, and acting as In-Service Engineering Activity. SSC San Diego also participated in definition of the Joint Tactical Radio System (JTRS), a software-based radio architecture for voice, data, and video communications to provide interoperability for future joint and coalition operations. The JTRS family will be an open-systems architecture, interoperable with legacy communications systems, and capable of future technology insertion.

Sensors and Unmanned Systems Development and Integration

Networks of sensors and unmanned systems offer the military enormous potential for risk and cost reduction. Technology developments in unmanned aerial vehicles, unmanned undersea vehicles, and unmanned ground vehicles, as well as a large variety of individual intelligence, surveillance, and reconnaissance sensors provide our warfighters with unprecedented capabilities for information dominance. SSC San Diego is developing ways to integrate the information from these systems into the tactical picture.

Unmanned Aerial Vehicles (UAVs). UAV technology has matured sufficiently to make UAVs an indispensable C4ISR tool for the warfighter. UAVs provide a relatively inexpensive, low risk, and covert means of advantageously positioning sensors in the battlespace. SSC San Diego is exploiting these capabilities to ensure that the sensor packages and data and the command and control links are fully integrated with Navy tactical systems.

Unmanned Undersea Vehicles (UUVs). Missions that will require future military UUV systems include surveillance, intelligence collection, tactical oceanography, special warfare, counter-narcotics, counter-terrorism, and mine countermeasures. SSC San Diego continues to develop technology and systems that support the military requirement for UUVs.

Unmanned Ground Vehicles (UGVs). UGVs provide remote (mobile) situational awareness in environments that are either hostile or lethal to humans. UGVs allow commanders to project their presence on the battlefield ahead of friendly forces. Advances in supporting technologies have resulted in sophisticated UGVs capable of fully autonomous operation with little or no human supervision. SSC San Diego is a recognized leader in the research and development of the core C4ISR UGV technologies and in the development of autonomous and teleoperated UGV command and control systems.

Mobile Inshore Undersea Warfare–System Upgrade (MIUW–SU). The MIUW–SU is an upgrade program for the Naval Reserves sponsored by the Office of the Chief of Naval Operations (OPNAV) that provides enhanced surveillance and communication capabilities for port security, harbor defense, and coastal warfare missions. The rapidly deployable system consists of mobile radar and imaging platforms, underwater acoustic sensors and processing, electronic support measures, and tactical communications equipment. MIUW–SU is currently in production. SSC San Diego is the technical design agent, software support activity, and In-Service Engineering Agent.

Resource Planning and Management

The warfighter must be able to husband critical resources—people, platforms, weapons, and information management systems.

Human–Systems Technology

As we help design the next-generation Navy ashore and afloat, we must develop capabilities based on systems with fewer people. Human–system interaction is critical to the success of these capabilities. SSC San Diego's conducts research and development in human–computer interface, automated speech understanding, tactical decision-making, and workload management. The Center was the first Navy organization for human factors technology and is a leader in decision-making under combat conditions. We are also providing human–systems technology support for the development of the Navy's next-generation destroyer and carrier.

Tactical Decision-Making Under Stress (TADMUS). SSC San Diego is conducting several programs that are improving the human–computer interface. The Center's TADMUS program seeks to improve the human–computer interface, both by enhancing computer capabilities to provide information to the warfighter in a more efficient, more comprehensible manner, and by improving the training and behavioral responses of the warfighters to the information provided. The TADMUS program was spawned by the 1988 USS VINCENNES (CG 49) incident in which the cruiser, engaged in a littoral warfare mission, shot down an Iranian airbus. Investigations following the incident suggested that stress might have effects on decision-making and that these effects were not well understood.

Under TADMUS, SSC San Diego developed a prototype Decision Support System (DSS) to enhance Navy tactical decision-making based on "naturalistic" decision processes. Test results of the DSS prototype showed that it enhanced the commanders' awareness of the tactical situation, which in turn contributed to greater confidence, lower workload, fewer errors, and more effective performance. The TADMUS DSS is being adapted to the needs of Third Fleet in supporting Joint and Coalition battle group operations. The system development and ultimate performance evaluation is being conducted as part of the TADMUS to Sea program. TADMUS is sponsored by the Office of Naval Research (ONR).

Advanced Human–Computer Interface. SSC San Diego has also developed an advanced human–computer interface (AHCI) that includes the Open System Advanced Workstation (OSAW) and Display User Enhancement Technology Systems (DUETS). OSAW was completed in 1999 and offers next-generation workstations for command and control systems by integrating state-of-the-art technologies. These include flat-panel displays, touch screens, speech recognition, and 3-D audio localization. OSAW work continues under DUETS, a program that provides common tactical pictures of the battlespace in 3-D to the tactical action officer in the combat information center. The AHCI (OSAW/DUETS) offers a cost-effective, user-centered, and mission-relevant 3-D tactical display system with multimodal human–computer interfaces. Both projects are funded by ONR.

Meteorology and Oceanography (METOC)

METOC systems integrate data from environmental satellites, shore facilities, and on-site sensors with sensor or weapon system data, platform parameters, and other intelligence to provide the warfighter an accurate, near-real-time assessment capability. METOC systems also allow integration of environmental conditions into resource planning. SSC San Diego provides a range of capabilities, from system engineering through life-cycle support, for Navy and Marine Corps C4ISR METOC Systems.

Tactical Environmental Support System Next-Century Transition (TESS NC T). TESS NC T provides METOC data and products designed to aid tactical planners. SSC San Diego designed the system change from proprietary architecture to IT-21-compatible non-developmental item/commercial-off-the-shelf platforms, performing all elements from design to initial fielding.

Naval Integrated Tactical Environmental Subsystem (NITES 2000). NITES 2000 is the follow-on effort to TESS. Each NITES system is a set of meteorology and oceanography forecast, database, and decision aid tools tailored for specific platforms and uses. Five variants support a variety of operators and platforms. The afloat version has been fielded on numerous combat ships, including carriers, command ships, and amphibious assault ships. The ashore configuration functions as a regional METOC data fusion hub and principal data delivery system for afloat and shore units. NITES 2000 follow-on efforts include development for select METOC shore facilities and detachments, mobile meteorological teams, and the AN/TMQ-44A(V) U.S. Marine Corps Meteorological Mobile Facility (Replacement) system.

Meteorological Mobile Facility (Replacement) (METMF(R)). METMF(R) provides a deployable weather office for Marine Corps Expeditionary Operations. This new facility consolidates and modernizes a four-van, 20-ton complex into a one-van, 8-ton complex. SSC San Diego designed, built, and integrated the METMF(R) system, achieving initial operating capability in 1998. Fourteen systems will be fielded, with ongoing support provided by the Center.

Distributed Collaboration

Future military operational organizations will be increasingly "virtual," meaning that geographically dispersed commands, from several of the Services (and, increasingly, from other U.S. federal agencies), at a number of echelons and a variety of levels within those echelons, will be called on to collaborate in the execution of a mission. Distributed collaboration requires tools to enhance the warfighter's ability to conduct distributed C4ISR in this multi-echelon, multi-force environment and to enable interoperability, analysis, and interactive mission planning.

COMPASS

Inadequate interfaces among various legacy planning systems hamper joint collaboration. The Common Operational Modeling, Planning, and Simulation Strategy (COMPASS) provides a near-term solution to allow information sharing among these legacy systems until formal system interfaces can be programmed.

COMPASS brings distributed collaborative planning and modeling and simulation services to a wide range of C4I systems at all command levels, providing interoperability among formerly incompatible systems. COMPASS provides analysis, preview, and rehearsal capabilities to transform C4I systems, including mission planning systems, into collaborative planning, rehearsal, and training systems.

The ultimate implementation of the concept is to use the same "virtual battlefield" to plan, re-plan, simulate, or train. Users share geo-registered and pixel-based data and discuss aspects of the mission via video teleconferencing and exchanged text. The results of individual planning sessions can then be consolidated and executed synchronously by each system to visualize interactions among friendly forces.

SSC San Diego's COMPASS program has successfully demonstrated distributed collaboration for force coordination, mission preview, and mission rehearsal in numerous Joint demonstrations, fleet exercises, and Joint exercises.

Other Technologies and Research

SSC San Diego employs nationally and internationally recognized experts working to improve the Navy's capabilities in several other areas: High Performance Computing and Networking, Environmental Sciences, Marine Mammals, and Physical Security and Law Enforcement Technology. In addition, the Center's In-House Laboratory Independent Research (ILIR) program supports innovative ideas proposed by SSC San Diego scientists and engineers.

High Performance Computing and Networking (HPCN)

SSC San Diego is a leader in Department of Defense (DoD) HPCN. The Center provides computational scientists with hands-on, interactive access to local systems for algorithm development and high-speed links to remote DoD systems with enormous computing power. The most recent additions to our capabilities are the latest scalable, parallel systems from Hewlett-Packard, powerful classified and unclassified computing resources in both UNIX and Windows environments, coupled with large disk and archival networked-storage systems.

These resources are linked by our high-bandwidth campus asynchronous transfer mode (ATM) network system to SSC San Diego scientists and engineers and to other DoD researchers and HPC facilities nationwide via the Defense Research and Engineering ATM Network. These SSC San Diego and other DoD systems provide employees world-class HPCN capabilities that enable the solution of complex problems in Center and DoD mission areas, bringing the benefits of computational science to military advantage. Fiber-optic links supporting distributed data interface/ATM/Synchronous Optical Network connections between Center-wide facilities are provided to enhance and enable global connectivity for state-of-the-art advances in information dissemination and integration.

Examples of recent SSC San Diego research include modeling contaminant chemistry in the environment; high-speed radar imaging for airborne target identification; active sonar adaptive beamformer performance; bistatic target strength prediction from limited data; scalable prototyping of embedded signal processing systems; and parallelization of NEC–BSC (Numerical Electromagnetic Code–Basic Scattering Code) for antenna performance prediction.

Environmental Sciences

SSC San Diego's environmental science programs assist the Fleet in meeting statutory requirements for environmental quality and minimizing the risk of environmental impact.

Site Characterization and Analysis Penetrometer System (SCAPS). Conventional methods of locating and delineating subsurface contamination at hazardous waste sites make cleanup of hazardous waste sites and turnover of closed military bases to the public expensive and time-consuming. SSC San Diego scientists adapted several optical-based chemical sensing techniques to a probe that provides real-time, nearly continuous, chemical information about underground contaminants. One of our major technology transfer successes, SCAPS technologies are now routinely used nationally and internationally for hazardous waste detection by both government and commercial providers.

QwikLite Bioassay System. Based on the ability of marine phytoplankton to produce bioluminescence, QwikLite bioassays are used as biological tools to gauge the extent of environmental contamination. When time and sensitivity are important, complicated and costly assays using fish or invertebrates may not be suitable. QwikLite can generate risk-based data in 1 day versus 7 to 9 days for more lengthy and complicated bioassays requiring special facilities. QwikLite is also being used as a rapid screening tool for identifying suspect contaminated marine sediment sites (QuikSed Test).

Marine Environmental Survey Capability (MESC). Housed on the 40-foot survey craft RV ECOS, MESC is a real-time data acquisition system designed, built, and maintained by SSC San Diego to provide integrated, rapid, continuous measurement and mapping of oceanographic and environmental parameters in coastal and estuarine environments. MESC measures physical, chemical, and biological characteristics from a moving vessel by using state-of-the-art sensors, computer systems, and navigation equipment. This approach allows Navy researchers to assist the Fleet by effectively mapping and assessing potential pollution sources in the highly dynamic coastal environment.

MESC has been used in numerous surveys to assess potential environmental impacts from Navy ships and facilities. For example, MESC was successfully used to document water quality improvements in San Diego Bay resulting from modifying bilge water operations made at Naval Station, San Diego.

MESC recently supported Navy and Regional Stakeholders of the Anacostia watershed by mapping water and sediment quality parameters on the Anacostia River in order to develop a synoptic regional assessment of the river. The effort also supports and enhances Navy (Naval District Washington) environmental cleanup/compliance programs.

Marine Mammal Program

SSC San Diego manages the Navy's Marine Mammal Program, maintaining a cutting-edge research program and managing four operational systems employing marine mammals: Pingered Object Recovery, Swimmer Defense, and two Mine Countermeasures systems.

Pingered Object Recovery. This system employs California sea lions for recovery of objects placed on the sea floor. Sea lions have exceptional underwater directional hearing and low-light-level vision. This capability employs a sound source (a pinger) in an object placed on the ocean bottom. To recover the object, the sea lion locates the object, attaches a grabber device, and returns to the surface, leaving a line attached for recovery.

Swimmer Defense. SSC San Diego also maintains a bottlenose dolphin system providing swimmer defense in a manner similar to the use of a guard dog at a land base, with the dolphin notifying his handlers of an intruder so they can apprehend the intruder.

Mine Countermeasures (MCM). Marine Mammal Systems provide the most effective capability for finding and recovering mines. SSC San Diego developed and now provides In-Service Engineering Agent, depot, and veterinary support to two mine hunting Fleet Marine Mammal Systems (MMS) assigned to Explosive Ordnance Disposal Mobile Unit Three. The Mk 4 MMS is a tethered mine hunting system and the Mk 7 MMS is a bottom mine hunting system that provides the only buried mine detection asset to the U.S. Navy. These MMS can be deployed worldwide by aircraft and have been enhanced to operate from amphibious ships.

Physical Security and Law Enforcement Technology

Waterfront Physical Security (WPS). The Navy's WPS program is an integrated, multi-sensor security system that automatically detects and tracks waterborne (both surface and subsurface) targets, identifies and alerts on all threats, and aids in threat assessment and response. SSC San Diego is the WPS Program Manager and Design Agent as well as In-Service Engineering Agent and Software Support Activity for systems transitioned to the Fleet. Recent fielded improvements have included a PC-based command, control, communications, and display element and a PC-based radar tracker. Ongoing efforts include identification, test, and evaluation of commercially available physical security equipment having application to force protection at waterside facilities worldwide.

Tigerwall System. Tigerwall is an air surveillance system currently used by the U.S. Treasury Department to ensure enhanced physical security at a high-value asset location by providing early warning of airborne threats. The Tigerwall program provides the Treasury Department with a geographic display of aircraft activity and provides security personnel long-range camera systems to classify and identify aircraft. Sensor data from several sources are fused to provide a unified sensor display. SSC San Diego has assisted the Treasury Department in implementing and maintaining the Tigerwall system by providing expertise gained from other SSC San Diego surveillance and physical security programs. SSC San Diego is currently redesigning the Tigerwall camera systems for better performance, and the Tigerwall Display System is being updated to run on commercial PC equipment. The U.S. Treasury Department sponsors the Tigerwall program.

Border Research and Technology Center (BRTC). BRTC is a partnership between SSC San Diego and the U.S. Department of Justice's National Institute of Justice (NIJ) Office of Science and Technology. This partnership fosters the development of capabilities needed for military operations other than war and law enforcement operations through the sharing and joint development of technology and systems applicable to both. SSC San Diego's technical areas of specialization areas within the BRTC include maritime operations, information integration, robotics, and communications interoperability. The Center participates in the full range of BRTC activities including the dissemination and administration of technical information, technical assistance and technology development, deployment, systems engineering, application, and transfer.

In-House Laboratory Independent Research (ILIR)

New and innovative ideas proposed by the scientists and engineers of SSC San Diego are supported and encouraged through the In-House Laboratory Independent Research (ILIR) program, administered by the Office of Naval Research (ONR). This program supports basic scientific research in several areas of interest to the Navy, including command and control, communications, surveillance, and navigation.

ILIR—Examples of Potential Fleet Impacts

The Nucleic Acid Transfection Technology Development in Marine Mammals project will benefit the Fleet by developing vaccines and immunomodulating plasmids to protect Navy marine mammals. This protection will reduce morbidity and mortality and enhance protection of deployed marine mammal systems, which, in turn, provide force protection for Navy missions.

The Adaptive Stochastic Mixture Processing for Hyperspectral Imaging project promises to improve target acquisition by increasing the usability of hyperspectral image data to identify concealed targets.

The Robust Waveform Design for Tactical Communications Channels project will provide the science to enable technology for covert communications fleet littoral warfare and Marine Corps expeditionary operations. It will also improve the technology for communications in the presence of strong interference.

The High-Linearity Broadband Fiber-Optic Link Using Electro-Absorption Modulation with Novel Dual-Wavelength Second-Harmonic Cancellation Scheme project will facilitate shipboard antenna placement by providing high-frequency, interference-immune analog links, and the project will improve phased-array antenna designs.

The Micro-Electro-Mechanical Systems Ultra-Sensitive Accelerometer (MEMS USA) project will improve Navy navigation systems through the development of low-cost, high-sensitivity MEMS accelerometers.

Capabilities

SSC San Diego has superb capabilities—physical and virtual facilities and laboratories, distributed test beds, high-performance computers and networks, worldwide communications connectivity—for conducting RDT&E and providing life-cycle support in C4ISR. SSC San Diego's unique capabilities allow our scientists and engineers to replicate an operational environment unachievable in the commercial world. SSC San Diego capabilities are described on the following pages, grouped by major areas of effort. Additional laboratories and facilities are described with related programs in the Programs section.

In San Diego, our facilities occupy more than 580 acres. Facilities are concentrated in four major areas: Topside, Bayside, Seaside, and Old Town. Topside facilities, located on the ridge of Point Loma, include the principal administrative and support sections, as well as facilities for communications, environmental testing, electronic materials, advanced electronics, laser technology, and ocean surveillance. Our Bayside facilities face San Diego Bay, which provides waterfront access and berthing capabilities vital to SSC San Diego activities in ocean surveillance, ocean engineering, navigation, and marine sciences. Seaside facilities are located on the west slope of Point Loma, which offers a protected, electromagnetically shielded site essential to RDT&E in C3I and ocean surveillance. The Old Town Campus houses work areas for the fabrication of electronic hardware supporting SSC San Diego's C4ISR programs. The Old Town Campus is also headquarters of the Space and Naval Warfare Systems Command.

Our Hawaii Activity and its two western facilities in Guam and Japan provide electronic systems engineering support to Navy and Marine Corps and Joint Service component forces in the Western Pacific and Indian Oceans.

Our communications connectivity allows most of the Navy's C4ISR systems to be interconnected to support developmental testing as well as to participate in live operations with the U.S. Fleet. SSC San Diego's total capability allows us to provide and manage rapid reconfiguration of our C4ISR capabilities and to provide national and international connectivity using commercial and military capabilities in support of primary mission areas.

Fleet Battle Experiments (FBEs)

FBEs are helping to shape the future of naval warfare. While the concepts and technologies supporting the experiments have numerous origins, the overriding purpose is to test innovations in real-time battle scenarios leading to improved warfighting capabilities in the Fleet. FBEs are the first step to streamlining warfare concept development, doctrine refinement, and the warfare innovation process.

The Navy Warfare Development Command (NWDC) was established to lead Navy FBEs and participate in Maritime Battle Center (MBC) joint experiments. SSC San Diego supports NWDC in developing new concepts to be tested in battle experiments. SSC San Diego is the MBC's planning and execution agent and is responsible for the systems engineering, installation, integration, and testing of all ashore and afloat technologies.

C4ISR

Command Center of the Future

SSC San Diego's Command Center of the Future was designed and built to demonstrate, in a realistic context, future C4ISR capabilities. The center demonstrates a vision of the distributed collaboration process as it might be used in dealing with military operations or civilian natural disaster crises, or, in dealing with both simultaneously. Unique to the Command Center is the 3-D Volumetric Display System, which allows true 3-D visualization of digitized data.

C4ISR Systems Integration Environment (C4ISR SIE)

The C4ISR SIE is the Navy's premier C4ISR integration and test facility. The C4ISR SIE exploits current technology to realize cost-effective and timely integrated systems development and implementation. A distributed environment consisting of existing laboratory facilities, systems, and core personnel, the C4ISR SIE supports life-cycle acquisition, supports system integration and testing, and assures cost-effective implementation of integrated, joint, and interop-

erable naval C4ISR systems. The C4ISR SIE pursues four main objectives:

- Support C4ISR from initial concept to end of life.
- Provide a collaborative engineering environment supporting technology insertion, concept development, architecture development, system-of-systems integration and test, systems interoperability, program manager's systems integration and test and experimentation/demonstration.
- Provide a reconfigurable and scalable C4ISR test capability by interconnecting existing SPAWAR facilities and labs and by interfacing with external facilities and labs.
- Serve as SPAWAR's technical interface to the Navy's Maritime Battle Center.

The importance of the C4ISR SIE to the maritime C4ISR community lies in its integration capabilities—by facilitating integration across product lines, the C4ISR SIE contributes to the maritime system-of-systems capability, in turn enhancing battlespace capabilities for the warfighter.

High Performance Computing Facilities

SSC San Diego's high performance computing facilities provide scalable, parallel computing and visualization resources with high bandwidth connectivity throughout the Center and external locations nationwide. Both secure and unclassified environments are available, with end-to-end encryption enabling links to external secure sites. These facilities offer SSC San Diego scientists and engineers access to world-class, state-of-the-technology high performance computational systems while enabling focused development of parallel computing algorithms for the Center's command control and surveillance mission areas through interactive access to local systems, an especially important feature for developing software for C4ISR and real-time, embedded applications.

Advanced Virtual Intelligence, Surveillance, and Reconnaissance (ADVISR) Laboratory

ADVISR is a distributed interactive simulation and future high-level-architecture compatible, physics-based simulator capable of modeling sensors, communications, and command and control systems. ISR system life-cycle costs can be minimized by evaluating system concepts and architectures in simulation and by testing complex systems in virtual environments prior to prototype development.

Reconfigurable Land-Based Test Site (RLBTS)

RLBTS supports the development of tactics and procedures for the employment of targeting systems and weapons, concept demonstrations of prototype systems, and the definition of architectures intended to facilitate future acquisition decisions. RLBTS, a versatile integration interoperability test center, takes advantage of the variety of systems available at SSC San Diego and provides connectivity to operational tactical networks as well as development laboratories to configure interoperability tests that accurately reflect real-world operations in a controlled environment. RLBTS personnel provide command, control, and communication systems expertise to ensure the technical and scientific excellence necessary to support operationally effective fleet warfare systems.

RLBTS participates in Joint Distributed Tests and Evaluations and conducts Over-the-Horizon Targeting (OTH-T) system integration tests and certifications in support of mandated interoperability testing.

Navigation

Global Positioning System (GPS) Central Engineering Activity (CEA)

The GPS CEA leads DoD's GPS testing with this premier facility for support of acquisition, development, integration, and testing of GPS user equipment and its applications. Through real-time simulation of both GPS satellite signals and host vehicle sensor and communications, the facility exercises GPS receiver hardware and software dynamically under precise and repeatable laboratory conditions.

The CEA facility supports multiple simultaneous Satellite Signal Simulator (SSS) control for all-in-view, attitude determination testing and differential testing. Laboratory accuracy under dynamic conditions has been certified to be less than 2 centimeters. The CEA includes a development laboratory used for developing new concepts before introduction to the tightly configuration-controlled CEA laboratory. In addition, the CEA laboratory is continuously undergoing enhancements to meet the future test needs of the navigation community, including modernization/navigation warfare and other research and development areas.

Navigation Systems and Ship's Motion Simulator Laboratory

The Navigation Systems and Ship's Motion Simulator Laboratory houses navigation equipment for developing and testing hardware and software for use in surface, subsurface, and airborne platforms. The laboratory supports RDT&E work for several types of equipment applicable to tactical, inertial, and strategic grade navigation. The laboratory's primary asset is the Ship's Motion Simulator (SMS). The SMS provides a dynamic environment for extensive testing of navigation equipment under realistic conditions before going out to the Fleet.

Fleet Support and In-Service Engineering

Production, Integration and Test Facility

SSC San Diego's Production, Integration and Test Facility provides real-time integration of commercial and government off-the-shelf equipment for implementation in the Fleet. This facility also provides engineering and technical services for integration design, rapid prototyping, pre-installation test and checkout, software validation, and environmental qualification. The Automated Digital Network System (ADNS), Secure Compartmented Information (SCI) ADNS (SCI ADNS is an ADNS subsystem), Tactical Switching System (TSS), Naval Integrated Tactical Environmental System (NITES 2000), and Link-16/Common Data Link Management System (CDLMS) are currently in production. Production support has been provided for projects such as TACINTEL, Navy EHF Communications Controller (NECC), Digital Modular Radio (DMR), Tactical Environmental Support System (TESS), NITES, and Link 16/CDLMS.

Environmental Test Facility

Established in the late 1940s, the SSC San Diego's Environmental Test Facility continues to support environmental testing of new fleet equipment. Test Facility personnel provide test planning and design advice for all equipment and projects that will encounter adverse environmental conditions during their projected life cycles.

In-house test capabilities include sine and random vibration, various types of mechanical shock, temperature, and humidity. Inclination (pitch and roll) is available, as is deep-ocean pressure testing simulating depths as deep as the Marianas Trench. Random vibration workmanship screening is also available; this is a

Distributed Engineering Plant

SSC San Diego works with SPAWAR and the Naval Sea Systems Command via a distributed engineering process to ensure that information systems are fully integrated across entire battle groups before deployment.

The process enables "real-world" testing—the ability to replicate testable battle group configurations ashore—and helps identify interoperability problems. The success of the Distributed Engineering Plant process has been recognized by the Department of Defense, resulting in a proposal for a similar process for all Joint forces.

brief exposure to a special type of vibration that confirms quality of fabrication, promoting consistent performance and freedom from intermittent malfunctions.

All tests can be instrumented with various transducers, such as accelerometers and strain gages, to gather information about the products being tested. Special test requirements can be created as necessary. For example, the behavior of whip antennas during shipboard shock is a significant factor in ship survivability. Such antennas up to 30+ feet tall can be tested.

RADIAC Test Facility

Radiation Indication Detection and Computation (RADIAC) instruments must be available to military personnel. Under the guidance of NAVSEA's Navy Nuclear Propulsion Program and the Radiological Affairs Safety Organization (RASO), RADIAC calibration laboratories provide the calibrated instruments needed for the protection of the Fleet. The RADIAC Calibration program at SSC San Diego is a "Face the Fleet" operation, dealing directly with the people who own and use the instruments. SSC San Diego's Radiac Test Facility has provided RADIAC instruments for the submarines at Ballast Point, the Surface Fleet at Naval Station, and the aircraft carriers at North Island as well as numerous shore establishments.

Integrated BG/ARG Installation

Successful Battle Group/Amphibious Ready Group (BG/ARG) installations require that we develop and implement a single management approach that will completely integrate the planning, execution, testing, and training phases for all afloat and shore C4ISR installations. After a system has been developed, we participate in the installation process for all BGs and ARGs. Additionally, the Center has installation responsibility for all shore-based C4ISR installation work across the Pacific.

SURTASS Support

SPAWAR Systems Activity Pacific provides technical and logistical support for the Surveillance Towed Array Sensor System (SURTASS) ships and facilities. SURTASS is a mobile, passive undersea surveillance system; the system acquires data with an acoustic sensor array towed by a dedicated Auxiliary General Ocean Surveillance Ship (T-AGOS). The Integrated Undersea Surveillance System Operations Support Detachment at SPAWAR Systems Activity Pacific in Hawaii provides intermediate maintenance, dockside technical assistance, configuration management, fleet engineering, supply support, and fleet training. Two other commands involved in the SURTASS operations are tenants in Hawaii: Naval Ocean Processing Facility Whidbey Island and Military Sealift Command.

Environmental and Biosciences

Ocean Sciences Laboratory. The Ocean Sciences Laboratory provides special facilities for work in marine biology and toxicology, environmental chemistry research, analytical instrumentation development, marine environmental quality assessment and monitoring, environmental biotechnology, radiation sensor development, stochastic resonance, biomedical research, lasers, and microelectronics.

Bioscience Facility. The Bioscience Facility provides facilities for acoustical and physiological research, training, and handling of marine animals to perform naval tasks in the open ocean.

Microelectronics

Integrated Circuit Fabrication Facility (ICFF)

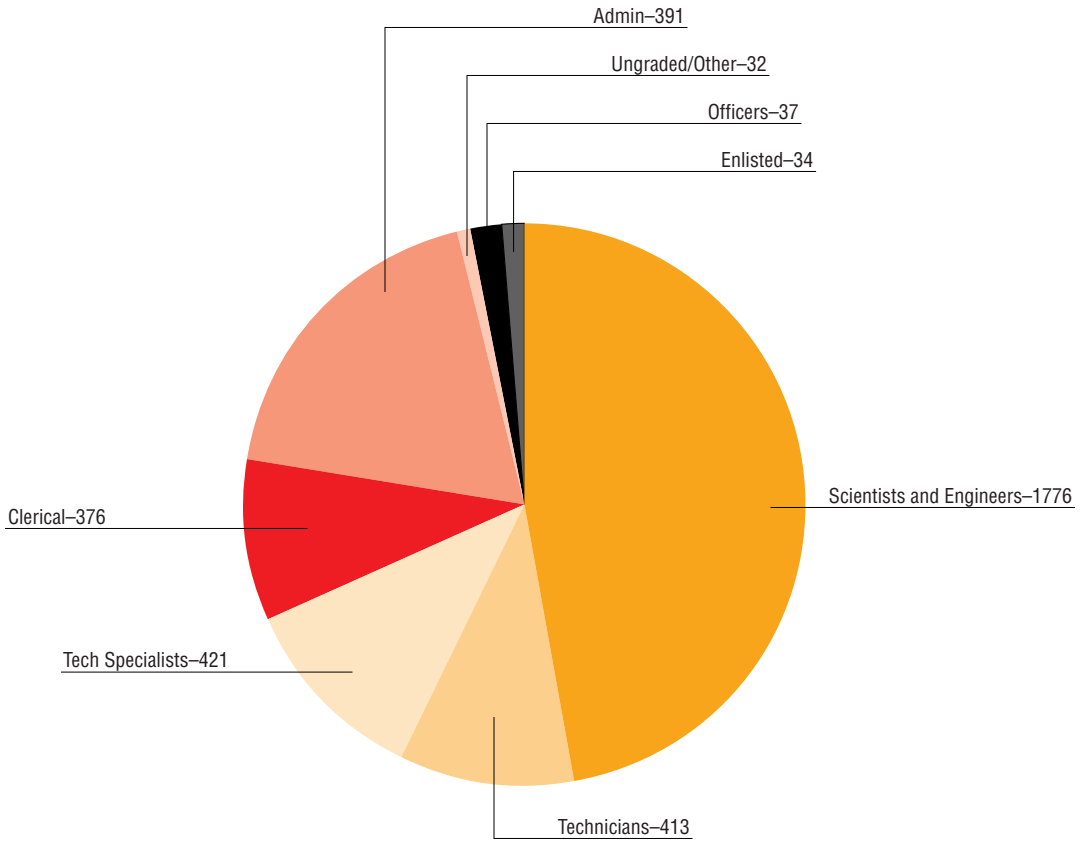
Since its inception in 1971, the ICFF has evolved into a unique facility complementing commercial industrial capabilities and fulfilling a unique role in the Department of Defense (DoD).

The ICFF serves as a life-cycle support environment for critical DoD functions (such as for the Trident Program). Supporting upper radiation-hardened processes, the ICFF provides access to functional circuits (that cannot be obtained from commercial sources) through its computer integrated manufacturing capability. This support capability is critical to strategic systems, such as Trident, since the system life is significantly longer than the component technology life. The ICFF has been designated as DoD's Contingency Lab for radiation-hardened microelectronic technology.

The ICFF has been the focal point for SSC San Diego participation in new microelectronic technology developments, such as flexible substrate techniques, micro-electro-mechanical sensors (MEMS) technology, and SiGe technology, serving as a technology transfer agent to commercial activities. The ICFF has established strategic partnering agreements with industry so that current technology can be effectively transitioned to long-term life-cycle support.

The ICFF maintains industry standard tools to promote long-term access to orphaned technologies that are no longer supported by industry and to retain technical capabilities that are no longer economically feasible in commercial markets. As DoD becomes a smaller segment of overall microelectronic market share, the ICFF becomes key to attaining and supporting DoD-unique requirements.

Personnel, Organization, and Funding

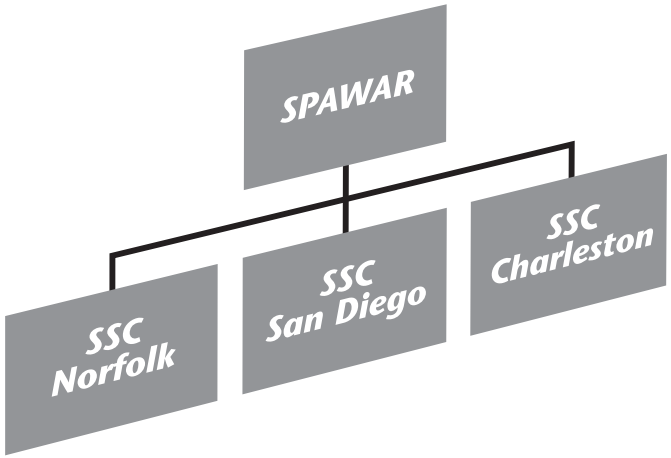


Personnel

People are critical to the successful achievement of our vision. The majority of our personnel are scientists and engineers, with numerous technical contributions to their credit. Many employees have decades of experience in the Navy acquisition community. Looking toward the future, SSC San Diego continues to actively recruit outstanding computer science, computer engineering, and electronic engineering candidates for our New Professionals program.

The chart shows FY 01 end strength.

FY 2001
Total 3480



Space and Naval Warfare Systems Command (SPAWAR)

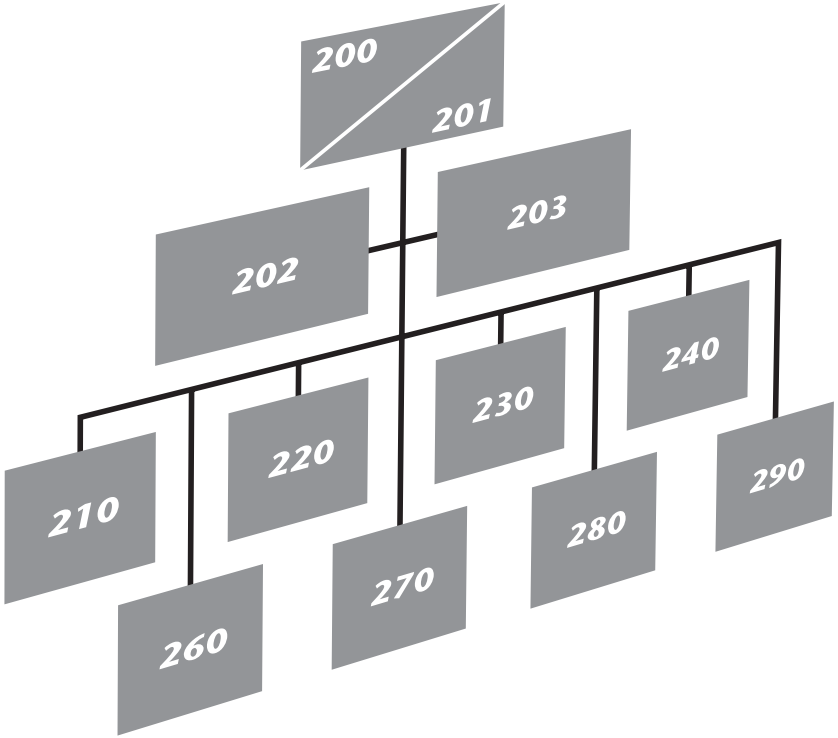
SPAWAR Systems Center Norfolk

SPAWAR Systems Center San Diego

SPAWAR Systems Center Charleston

Organization

SSC San Diego is one of three systems centers reporting to the Space and Naval Warfare Systems Command (SPAWAR).



200–Commanding Officer

201–Executive Director

202–Deputy Executive Director for Corporate Operations

203–Executive Officer

210–Deputy Executive Director Science, Technology, and Engineering

220–Supply

230–Navigation and Applied Sciences

240–Command and Control

260–Fleet Engineering

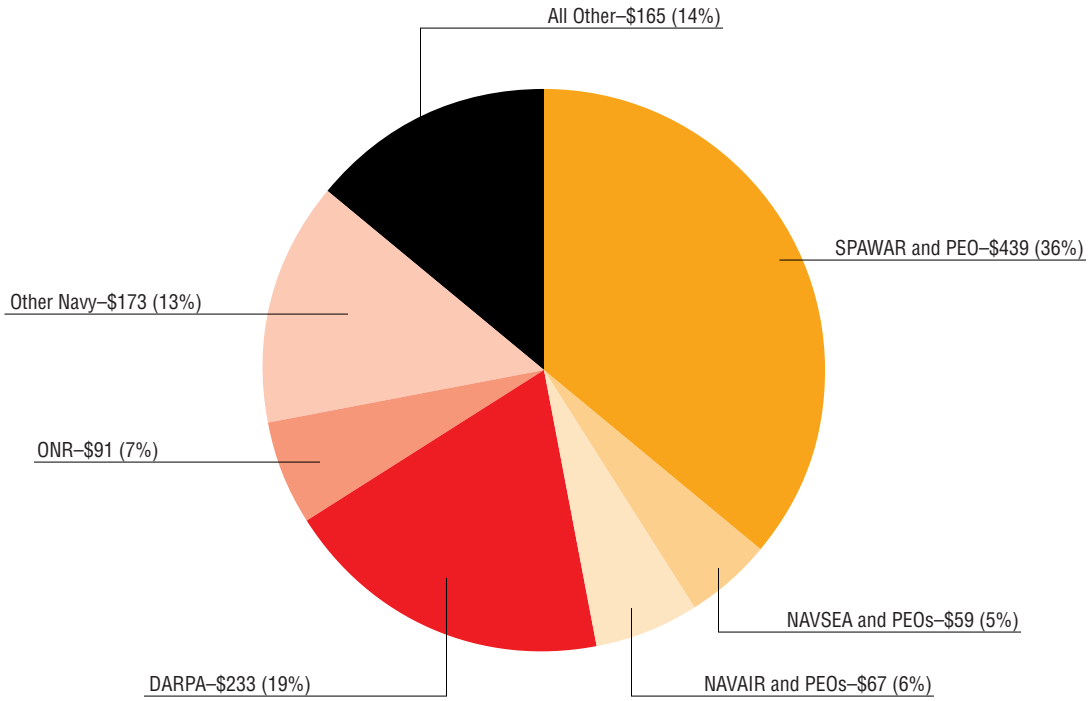
270–Intelligence, Surveillance, and Reconnaissance

280–Communication and Information Systems

290–SPAWAR Systems Activity, Pacific

SSC San Diego Organization

Our organization continues to evolve to support our work across the spectrum of C4ISR—cross-organizational teaming facilitates a responsive, flexible workforce.



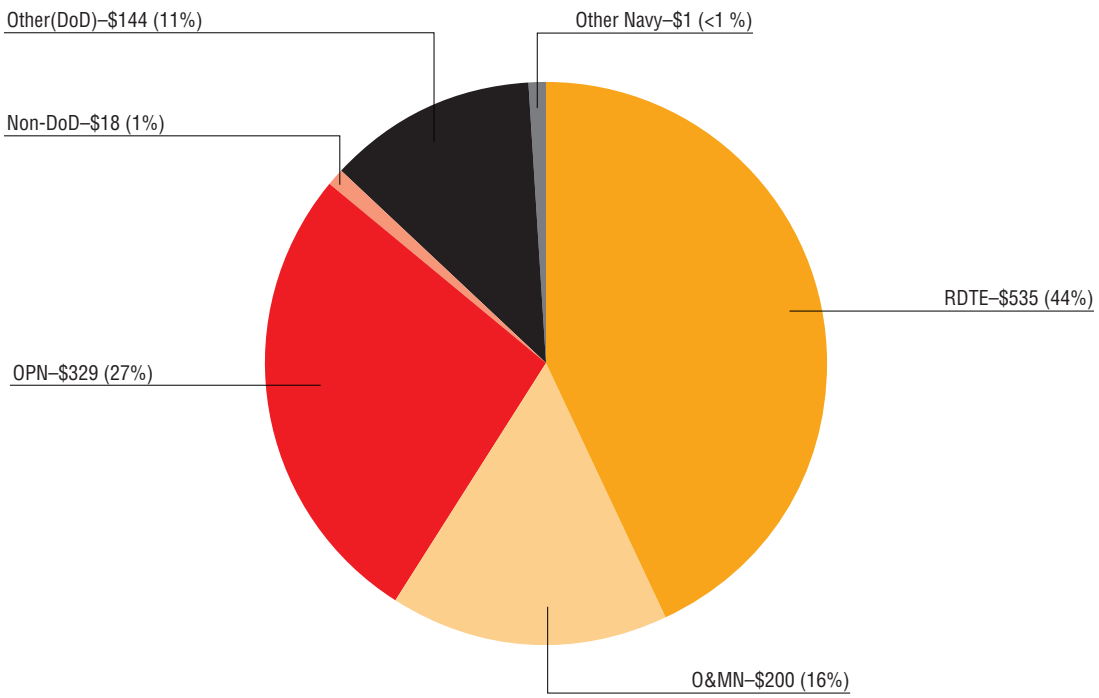
Funding

SSC San Diego Funding by Sponsor

Under the industrial funding concept, unique to Navy acquisition commands, SSC San Diego operates substantially like a private business, with customers—we use the term "resource sponsors"—to whom we provide goods and services in our C4ISR product line.

The chart shows funding for FY 01 (in millions).

FY 2001 Total $1,227M

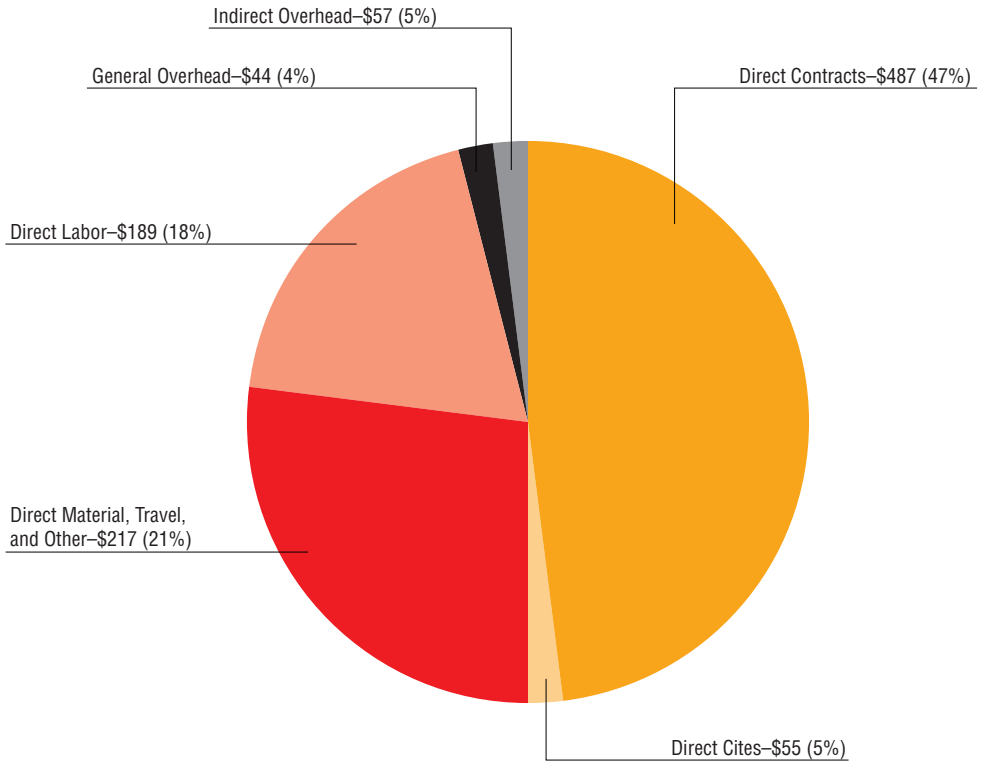


SSC San Diego Funding by Appropriation

Although research and development constitutes about a third of our work, the principal focus of our efforts, distributed throughout the appropriation categories shown on the chart, is systems engineering and integration in support of the Fleet.

The chart shows funding for FY 01 (in millions).

FY 2001 Total $1,227M



SSC San Diego Distribution of Costs

We have considerable industrial support for our efforts. A substantial part of our funding goes to our contractor partners; that includes the funding in both the "Direct Contracts" and "Direct Cites" categories.

The chart shows distribution of costs for FY 01 (in millions).

FY 2001 Total $1,049M

Reviewed and approved by

P. A. Miller, CAPT, USN
Commanding Officer

Space and Naval Warfare Systems Center
San Diego, CA 92152–5001

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San Diego, CA 92152–5001

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