# Engagement Guide
# Department of Defense
# University Affiliated Research Centers (UARCs)

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## Purpose

The purpose of this Engagement Guide is to inform members of the Department of Defense (DoD) community about the Department's special strategic relationship with DoD-sponsored University Affiliated Research Center (UARC) laboratories that conduct science, technology, and engineering (ST&E) work on their behalf. The Guide provides information about the capabilities of the 13 DoD UARCs and points of contact to facilitate communication about exploring the potential for leveraging the capabilities of these valuable resources.

## Points of contact for DoD UARCs and for Defense Laboratories

The Deputy Director, OSD Studies and FFRDC Management, Office of the Director, Acquisition Resources Analysis, Office of the Under Secretary of Defense (Acquisition, Technology and Logistics) (OUSD(AT&L)) is responsible for supporting the Assistant Secretary of Defense (Research and Engineering ) (ASD(R&E)) on DoD policy for UARCs. Questions concerning this Engagement Guide can be directed to Dr. Mona Lush, Deputy Director, OSD Studies and FFRDC Management at mona.lush@osd.mil.

The Director, Defense Laboratories, Office of the Assistant Secretary of Defense (Research and Engineering) (OASD(R&E)) (OUSD(AT&L)) is responsible for DoD policy for DoD laboratories. Questions concerning DoD UARC laboratories can be directed to Dr. John Fischer, Director, Defense Laboratories at john.fischer@osd.mil.

Appendix A contains a list of points of contact for each UARC and for the DoD Primary Sponsor. Appendix B contains the core competencies for each UARC. Although changes are infrequent, prospective DoD task sponsors should contact the UARC, or the DoD Primary Sponsor point of contact identified in Appendix A, to obtain possible update of the DoD-approved core competencies. All UARC contracts must be consistent with the UARC's DoD approved core competencies.

## Overview of DoD UARCs

UARCs are research organizations within a university or college that are established to provide or maintain essential engineering, research, and/or development capabilities through a long-term, strategic relationship with DoD. Each UARC has areas of expertise that are identified as core competencies that it must provide in support of its mission to support DoD.

The original DoD-sponsored UARC laboratories evolved from World War II era research programs, and they proved to be very effective in executing national security research initiatives. This capability continues today, with UARCs operating as strategic partners with their DoD sponsors, serving in the public interest, and combining technical excellence with objectivity. They serve as subject matter experts that function as independent, trusted advisors and honest brokers, answerable only to their DoD customers.

The ASD(R&E) approves and designates the research organizations as UARCs and formally designates a DoD Primary Sponsor for each UARC to assist in policy and contractual oversight. UARCs are established to develop and maintain government-defined research, development or engineering capabilities designated as essential and to provide those essential capabilities to DoD through a long-term strategic relationship.

Each UARC is required to operate in the public interest, rather than in the interest of corporate shareholders, and conduct its business in a manner befitting its special relationship with DoD. Because the organizations operate in the public interest, they can provide independent and objective advice to government, unencumbered by the obligations to prioritize shareholder value. UARCs are expected to maintain freedom from conflicts of interest. Each UARC must have a comprehensive conflict of interest policy covering both organizational and personal conflicts of interest to ensure that the integrity and objectivity of UARC work is not compromised and does not appear to be compromised because of the presence of competing financial or personal interests. The absence of any conflicts of interest, real or perceived, allows the UARC to have access to government and contractor data including sensitive and proprietary information, and to employees and facilities, beyond that which is common to a DoD contractual relationship.

In recognition of the value of a long-term strategic relationship, the obligation to maintain essential capabilities, and the prohibition to compete with industry, DoD permits the award of sole-source contracts to UARCs under the authority of 10 U.S.C. 2304(c)(3)(B). This authority permits the awarding of sole-source contracts “to establish or maintain an essential engineering, research, or development capability to be provided by an educational or other

nonprofit institution or a federally funded research and development center." This authority is applicable to UARCs because of their establishment as part of an educational institution. This statutory authority is implemented via the Federal Acquisition Regulation (FAR) in Part 6.302-3.

The Primary Sponsor must perform a comprehensive review of the UARC every 5 years. This review will examine and evaluate the core competencies with the sponsor's mission areas for relevance, ensure that all assigned tasks are consistent with the UARC's mission and core competencies, evaluate the UARC's performance, cost reasonableness, and adherence to requirements to remain free from conflicts of interest. The specific oversight responsibilities of the Primary Sponsor are defined in the DoD UARC Management Plan, issued by the ASD(R&E).

## DoD UARCs and their Primary Sponsors

DoD has established 13 UARCs, each of which is a research organization within a university. Table 1 lists the 13 DoD UARCs along with their university affiliation and primary sponsor.

The DoD UARCs are operated by these universities through long-term Government contracts under the authority of 10 U.S.C. 2304(c)(3)(B).

| Primary Sponsor | University | UARC |
|---|---|---|
| Army | Georgia Institute of Technology | Georgia Tech Research Institute (GTRI) Applied Systems Laboratory (ASL) |
| | Massachusetts Institute of Technology | Institute for Soldier Nanotechnologies |
| | University of California, Santa Barbara | Institute for Collaborative Biotechnologies |
| | University of Southern California | Institute for Creative Technologies |
| Navy | The Johns Hopkins University | Applied Physics Laboratory |
| | Penn State University | Applied Research Laboratory |
| | University of Hawaii | Applied Research Laboratory |
| | University of Texas at Austin | Applied Research Laboratory |
| | University of Washington | Applied Physics Laboratory |
| Missile Defense Agency (MDA) | Utah State University | Space Dynamics Laboratory |
| DASD (Systems Engineering) | Stevens Institute of Technology | Systems Engineering Research Center |
| National Security Agency (NSA) | University of Maryland, College Park | Center for Advanced Study of Language |
| Strategic Command (STRATCOM) | University of Nebraska | National Strategic Research Institute |

**Table 1: Sponsors, Universities and DoD UARCS**

## Characteristics of DoD UARCs

UARCs are defined in the DoD UARC Management Plan as college and university research organizations that receive sole source funds, on average, exceeding $6 million annually under authority of 10 U.S.C. 2304(c)(3)(B); establish or maintain an essential engineering, research, or development capability; maintain a long-term, strategic relationship with DoD; and are designated by USD(AT&L) as UARCs. The characteristics of the UARC strategic relationship with DoD are:

- Responsiveness to evolving sponsorship requirements
- Comprehensive knowledge of sponsors requirements and problems
- Broad access to information, including proprietary data
- Broad corporate knowledge
- Independence and objectivity
- Quick response capability
- Current operational experience
- Freedom from real and/or perceived conflicts of interest

The DoD UARCs conduct work across the full spectrum of research development phases denoted as 6.1 – 6.7 activities, as defined in Table 2.

| R&D Phase | Description |
|---|---|
| 6.1 Basic Research | Systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. It is farsighted high payoff research that provides the basis for technological progress. |
| 6.2 Applied Research | Systematic study to understand the means to meet a recognized and specific need. It is a systematic expansion and application of knowledge to develop useful materials, devices, and systems or methods. Directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters. |
| 6.3 Advanced Technology Development | Development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Proof of technological feasibility and assessment of component operability and producibility rather than the development of hardware for service use. |
| 6.4 Demonstration and Validation | Evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment. Expedite technology transition from the laboratory to operational use. Emphasis is on proving subsystem maturity prior to integration in major and complex systems. |
| 6.5 System Development and Demonstration | Conduct engineering and manufacturing development tasks aimed at meeting validated requirements prior to full-rate production. Prototype performance is near or at planned operational system levels. Involves live fire test and evaluation and initial operational test and evaluation of production representative articles. |
| 6.6 RDT&E Management Support | Efforts and funds to sustain and/or modernize the installations or operations required for general research, development, test and evaluation. Includes test ranges, military construction, maintenance support of laboratories, operation and maintenance of test aircraft and ships, and studies and analyses in support of the RDT&E program. |
| 6.7 Operational System Development | Includes development efforts to upgrade systems that have been fielded or have received approval for full rate production in the current or subsequent fiscal year. All items are major line item projects that appear as RDT&E Costs of Weapon System Elements in other programs. |

**Table 2: UARC Research and Development Activities**

## DoD Component Use of DoD-Sponsored UARCs

If a DoD component is interested in examining the capabilities of a DoD UARC, it can look at the core competencies of each UARC. The component could also contact the UARC and/or DoD point of contact for the UARC to determine if it can provide the research or analytic support.

Appendix A contains the point of contact for each UARC and its DoD sponsor. Appendix B contains a list of the core competencies for each DoD UARC.

## Scope of Work for DoD UARCs

UARCs may compete for science and technology work unless precluded from doing so by their DoD contracts. Generally, UARCs may not compete against industry in response to competitive Request for Proposals (RFPs) for development or production that involve engineering expertise developed or sustained through contracts awarded under 10 U.S.C. 2304(c)(3)(B). The Primary Sponsor's contract defines the limits of competition. If there are other contracts with the UARC, these other contracts must be consistent with the Primary Sponsor's contract. If special circumstances require a waiver of the competition provisions, a waiver request must be submitted to ASD(R&E) for approval. The UARC must not accept work that would introduce an actual or apparent conflict of interest and jeopardize its ability to perform work for DoD. The UARC must ensure that no unauthorized use shall be made of proprietary or privileged information gained from activities of the UARC. If UARC capabilities are made available to one industry partner, the UARC capabilities must be made equally available to all potential industrial partners.

## Protocol for UARC Engagement

The UARC Management Plan identifies the entities involved in contracting and tasking and their respective responsibilities, as shown in Table 3. A prospective contract or task sponsor seeking to engage a UARC will need to interface with one or more of these entities.

| | |
|---|---|
| **Primary Sponsor** | One DoD Service or Agency is formally designated as Primary Sponsor by OSD/ASD(R&E) for each UARC. The Primary Sponsor works with the Contracting Activity(ies) to implement DoD's UARC management policies and procedures. |
| **Contracting Activity** | A Contracting Activity is a DoD component that awards a contract or contracts to a UARC. Multiple Contracting Activities for a single UARC are possible. |
| **Tasking Activity** | A Tasking Activity is the DoD entity that requires and funds the services of a UARC through the Contracting Activity for performance of DoD specific work. |

**Table 3: UARC Contracting Entities**

**EXAMPLE**: Notional (not actual) sponsor and activities for a contract with a UARC.

- **Primary Sponsor**: Navy
  - Oversee UARC management and disseminate guidance
  - Review UARC contractual relationships
  - Collect and report funding and staffing data annually
- **Contracting Activity**: NAVSEA
  - Contracts developed and executed in accordance with UARC mission and core competencies
- **Tasking Activity**: N81, Assessment Branch
  - Define tasks for which the UARC is performer of choice

The instrument(s) under which the UARC performs DoD work are a contract or contracts between the UARC and the Contracting Activity(ies). These contracts are typically Indefinite Delivery Indefinite Quantity (IDIQ) Cost Plus Fixed Fee (CPFF) contracts with Task Orders defining the statement of work, deliverable products, schedule, and funding. The IDIQ contracts must include the following:

- A statement of the essential engineering, research, and/or development capability required

- A description of the UARC's core competencies (or essential capabilities). Contracting activities must notify the Primary Sponsor of any differences with the UARC's DoD-approved core competencies
- A description of the procedures used to evaluate performance in the areas of technical quality, responsiveness, value, cost and timeliness
- Other requirements as appropriate (i.e., when cost-type contracts are used, the contract sponsors will identify any cost elements that require advance agreement and/or approval)
- The appropriate organizational conflict of interest documentation in accordance with policy set forth by the Contracting Activity

All DoD agencies are eligible to contract UARCs for work consistent with their core competencies and the requirements of the Primary Sponsor. Task Orders may be created as a result of Statements of Work and transferred funding to the Primary Sponsor or via separate awards from the non-Primary Sponsor. UARC contract awards made by the non-Primary Sponsor should be coordinated prior to award with the Primary Sponsor.

## Conflict of Interest Consideration

UARCs are required to conduct business in a manner befitting their special, strategic relationship with the Government, to operate in the public interest with objectivity and independence, and to be free from actual or perceived conflict of interest. Each Primary sponsor is required to establish and implement a policy for the UARC and its personnel to address conflict of interest as defined below:

- **Conflict of Interest**: the existence of conflicting roles that might bias a contractor's judgment in providing independent and objective advice to a federal agency, or the existence of circumstances that give one contractor an unfair competitive advantage in the conduct of a federal procurement.
- **Organizational Conflict of Interest (OCOI)**: conflict of interest that arises from the business relationships maintained by a federal contractor.
- **Personal Conflict of Interest (PCOI)**: a conflict between the private interests and the official responsibilities of a person in a position of trust. PCOI may arise from personal and/or business relationships of individual employees, consultants, or advisors of a federal contractor.

While there is no prohibition against UARCs conducting work for industry, each UARC must screen and document all such proposed work to avoid the appearance of any impropriety or conflict of interest.

## Work Assignment Related to Inherently Governmental Functions

Office of Federal Procurement Policy (OFPP) Policy Letter 11-01, Performance of Inherently Governmental and Critical Functions, dated October 12, 2011 defines work that is inherently governmental and must be performed by federal employees. The policy letter also defines work that is closely associated with inherently governmental functions and states that UARCs may perform this type of work provided that the sponsor provides adequate oversight of performance (section 5-1 (c)). The following are examples of work that are closely associated with inherently governmental functions as described by the OFPP Policy Letter; the examples that are most frequently conducted by DoD UARCs are described in paragraphs 1 and 2:

1. Services in support of inherently governmental functions, including, but not limited to the following:
   (a) performing budget preparation activities, such as workload modeling, fact finding, efficiency studies, and should-cost analyses.
   (b) undertaking activities to support agency planning and reorganization.
   (c) providing support for developing policies, including drafting documents, and conducting analyses, feasibility studies, and strategy options.
   (d) providing services to support the development of regulations and legislative proposals pursuant to specific policy direction.
   (e) supporting acquisition, including in the areas of:
      i) acquisition planning, such as by –
         I) conducting market research,
         II) developing inputs for government cost estimates, and
         III) drafting statements of work and other pre-award documents;
      ii) source selection, such as by –
         I) preparing a technical evaluation and associated documentation;
         II) participating as a technical advisor to a source selection board or as a nonvoting member of a source selection evaluation board; and
         III) drafting the price negotiations memorandum; and
      iii) contract management, such as by –
         I) assisting in the evaluation of a contractor's performance (e.g., by collecting information performing an analysis, or making a recommendation for a proposed performance rating), and

II) providing support for assessing contract claims and preparing termination settlement documents.

(f) preparation of responses to Freedom of Information Act requests.

2. Work in a situation that permits or might permit access to confidential business information or other sensitive information (other than situations covered by the National Industrial Security Program described in FAR 4.402(b)).
3. Dissemination of information regarding agency policies or regulations, such as conducting community relations campaigns, or conducting agency training courses.
4. Participation in a situation where it might be assumed that participants are agency employees or representatives, such as attending conferences on behalf of an agency.
5. Service as arbitrators or provision of alternative dispute resolution (ADR) services.
6. Construction of buildings or structures intended to be secure from electronic eavesdropping or other penetration by foreign governments.
7. Provision of inspection services.
8. Provision of legal advice and interpretations of regulations and statutes to government officials.
9. Provision of non-law-enforcement security activities that do not directly involve criminal investigations, such as prisoner detention or transport and non-military national security details.

## APPENDIX A

| DoD-sponsored University Affiliated Research Center (UARC) POCs<br>as of April 24, 2013 | | | |
|---|---|---|---|
| *UARC* | *UARC POC* | *Primary Sponsor* | *Sponsor POC* |
| | | | |
| Navy-sponsored UARCs | | | |
| Johns Hopkins Univ (JHU)<br>Applied Physics Lab (APL) | Mr. Timothy Galpin<br>Assistant Dir, Programs<br>443-778-1141<br>Timothy.Galpin@jhuapl.edu | Navy | Mr. Anthony Rodriguez<br>Dep Dir, Navy UARC Office (SEA00U)<br>202-781-3752<br>anthony.t.rodriguez@navy.mil |
| Pennsylvania State Univ (PSU)<br>Applied Research Lab (ARL) | Dr. Edward Liszka<br>Dir, Applied Research Lab<br>814-865-6343<br>egl4@arl.psu.edu | Navy | Mr. Anthony Rodriguez<br>Dep Dir, Navy UARC Office (SEA00U)<br>202-781-3752<br>anthony.t.rodriguez@navy.mil |
| University of Texas (UT)<br>Applied Research Lab (ARL) | Dr. Clark Penrod<br>Exec Dir, ARL<br>512-835-3478<br>penrod@arlut.utexas.edu | Navy | Mr. Anthony Rodriguez<br>Dep Dir, Navy UARC Office (SEA00U)<br>202-781-3752<br>anthony.t.rodriguez@navy.mil |
| University of Washington (UW)<br>Applied Physics Lab (APL) | Dr. Jeffrey Simmen<br>Dir, Applied Physics Lab<br>206-543-1310<br>simmen@apl.washington.edu | Navy | Mr. Anthony Rodriguez<br>Dep Dir, Navy UARC Office (SEA00U)<br>202-781-3752<br>anthony.t.rodriguez@navy.mil |
| University of Hawaii (UH)<br>Applied Research Lab (ARL) | VADM (Ret) Michael Vitale<br>Executive Director<br>808-956-0424<br>mvitale@arl.hawaii.edu | Navy | Mr. Anthony Rodriguez<br>Dep Dir, Navy UARC Office (SEA00U)<br>202-781-3752<br>anthony.t.rodriguez@navy.mil |
| | | | |
| Army-sponsored UARCs | | | |
| | | Sponsor POC for all Army UARCs | Mr. Jeffrey Singleton<br>Dir, Basic Research (OASA(ALT))<br>703-617-0315<br>jeffrey.d.singleton.civ@mail.mil |
| University of Southern California<br>Institute for Creative Technologies (USC ICT) | Dr. Randall Hill<br>Executive Director<br>310-448-0332<br>hill@ict.usc.edu | Army | Mr. John Hart<br>ICT PM (RDECOM/STTC)<br>407-208-3012<br>john.hartiii@us.army.mil |

| | | | |
|---|---|---|---|
| Georgia Tech Research Institute (GTRI)<br>Applied Systems Lab (ASL) | Dr. Barry Bullard<br>Director, ASL<br>256-716-2150<br>barry.bullard@gtri.gatech.edu | Army | Mr. Eric Edwards<br>Dir, AMRDEC<br>256-876-3322<br>eric.f.edwards@us.army.mil |
| Massachusetts Institute of Technology (MIT)<br>Institute for Soldier Nanotechnologies (ISN) | Dr. William Peters<br>Executive Director<br>617-253-3433<br>peters@mit.edu | Army | Dr. Bob Kokoska<br>ISN PM (Army Research Office)<br>919-549-4342<br>robert.j.kokoska2.civ@mail.mil |
| University of California, Santa Barbara (UCSB)Institute for Collaborative Biotechnologies (ICB) | Dr. David Gay<br>Director of Technology<br>805-893-4675<br>david.gay@icb.ucsb.edu | Army | Dr. Bob Kokoska<br>ICB PM (Army Research Office)<br>919-549-4342<br>robert.j.kokoska2.civ@mail.mil |
| | | | |
| MDA-sponsored UARC | | | |
| Utah State Univ (USU)<br>Space Dynamics Lab (SDL) | Mr. Bruce Guilmain<br>Associate Director, SDL<br>703-608-7576<br>bruce.guilmain@sdl.usu.edu | MDA | Mr. Keith Englander<br>Director for Engineering<br>571-231-8019<br>keith.englander@mda.mil |
| | | | |
| NSA-sponsored UARC | | | |
| University of Maryland (UM)<br>Center for Advanced Study of Language (CASL) | Dr. Amy Weinberg<br>Executive Director, CASL<br>301-226-9055<br>aweinberg@casl.umd.edu | NSA | Ms. Ellen Walsh<br>Government Director at CASL<br>301-226-8867<br>ewalsh@casl.umd.edu |
| | | | |
| AT&L-sponsored UARC | | | |
| Stevens Institute of Technology (SIT)<br>Systems Engineering Research Center (SERC) | Dr. Art Pyster<br>Dep Exec Director, SERC<br>703-717-8110<br>art.pyster@stevens.edu | DASD(SE)/<br>OASD(R&E)/<br>OUSD(AT&L) | Mr. Scott Lucero<br>Dep Dir, Strategic Initiatives<br>571-372-6452<br>don.s.lucero.civ@mail.mil |
| | | | |
| STRATCOM-sponsored UARC | | | |
| University of Nebraska<br>National Strategic Research Institute | Mr. Robert Hinson<br>Executive Director, NSRI<br>402-559-1842<br>rhinson@nsri.nebraska.edu | STRATCOM | Mr. Charles Hutchison<br>S&T Branch Chief<br>402-294-1152<br>hutchisc@stratcom.mil |

# APPENDIX B

## DoD University Affiliated Research Center (Uarc) Core Competencies

**Navy Sponsored**

- **The Johns Hopkins University Applied Physics Laboratory (JHU/APL)**

(1) Strategic Systems Test and Evaluation. Independent quantitative performance evaluations of complex operational systems including ballistic and guided missile systems, strategic and tactical C3 systems, and other related combat and weapon systems; evaluation of alternative and modified systems; collection of requisite data; and development of instrumentation, as appropriate.
(2) Submarine Security and Survivability. Investigation and assessment of anti-submarine warfare, unmanned undersea vehicles, mine countermeasure technologies, and other aspects of undersea warfare with emphasis on the security, survivability, and operational effectiveness of submarines; instrumentation and oceanographic sensor development; and the execution of experiments and oceanographic research.
(3) Space Science and Engineering. Design, development, and prototyping of space systems and instruments; conduct of critical space experiments; analysis and evaluation of space systems and space-related data; and research and development of systems that provide precision tracking, location, navigation, remote sensing, communication, characterization of the space environment, situational awareness, accurate discrimination, and targeting of threat objects.
(4) Combat Systems and Guided Missiles. Detailed understanding of tactical combat system and guided missile (including air defense and strike missiles) system design necessary for the independent evaluation of current and future systems, and the research and development of concepts and techniques for system improvements; development and maintenance of unique evaluation and development facilities; design and prototyping of systems; relating systems design to operational factors (e.g., targeting and mission planning); and conducting related analyses and tests, including full-scale experiments.
(5) Theater Air Defense and Power Projection. Research, development, and assessment of effective methods of coordinating warfare systems at the theater level by exploring system concepts, developing demonstration models, and conducting experiments; systems engineering and evaluation of electronic warfare and defense suppression systems; and assistance in planning and evaluation of C3 systems for attaining an integrated tactical and strategic system capability.
(6) Information Technology (C4ISR/IO). Research, development, and assessment of defense command, control, communications, computer, intelligence, surveillance,

reconnaissance, information operations, cyber operations, and information technologies; application of these technologies to battlefield information management, intelligence systems and information warfare systems; operational evaluations and vulnerability assessments of current and planned systems; development of system architectures to improve intelligence systems and to improve the effectiveness and coordination and reduce vulnerability among forces; and demonstrations and testing of these systems.

(7) Simulation, Modeling, and Operations Analysis. Development, verification, validation and application of simulations, models, and operations analysis techniques to determine mission effectiveness and performance assessment of current, planned, and proposed systems; and coordination of employment of these systems.

(8) Mission-related and public-service oriented research, technology development, test, evaluation, and system analysis (e.g., biomedicine, special operations capabilities, defeat of CBRNE weapons, environment and other topics of importance to DOD) through the application of the above core competencies, along with the complementary capabilities of other divisions of the University.

- **The Applied Research Laboratory of The Pennsylvania State University (ARL/PSU)**

(1) Guidance, navigation and control of undersea systems, including simulation and modeling for design and performance prediction of undersea platform guidance and control systems.

(2) Advanced thermal propulsion concepts and systems for undersea vehicles, including systems modeling and dynamic simulation for torpedo propulsion systems.

(3) Advanced propulsors and other fluid machinery for marine systems, and submarine/surface platforms, including the hydrodynamic, hydroacoustic and structural acoustic analysis, performance prediction, noise prediction, testing and evaluation, and specification of such devices.

(4) Materials technology and manufacturing technology to meet unique requirements of Naval systems and components.

(5) Atmosphere and defense communications systems research that supports and complements maintained capabilities.

(6) Mission related and public service oriented research, technology development, test evaluation and systems analysis required to provide a quick response to rapidly evolving DOD and other government agency requirements through the application of the above core competencies, along with the complementary capabilities of the other divisions of the Pennsylvania State University.

- **The Applied Research Laboratories of The University of Texas at Austin (ARL:UT)**

(1) Characteristics of the medium relative to the ocean acoustic environment and its effects on undersea warfare systems, and relative to electromagnetic propagation in

the atmospheric, tropospheric, and ionospheric environment and its effects on electromagnetic information warfare systems.

(2) High frequency sonar as applied to warfighting applications including mine hunting/obstacle avoidance, reconnaissance, classification, swimmer detection, precision bathymetry, environmental characterization, under ice and ocean bottom navigation, and intelligence collection.

(3) Acoustic and electromagnetic properties as related to target characteristics, including countermeasures, sensors and signal processing.

(4) Signal and information processing and display as applied to acoustic, electromagnetic and electro-optical systems including advanced display/format technology, source and array technology, spatial and temporal processing, and high order spectral methods.

(5) Navigation and precise location in space, air, water, and on land, including geodetic, acoustic, seismic, and electromagnetic applications.

(6) Command, control, communications, computers, and intelligence (C4I) as applied to information warfare, modeling and simulation, electromagnetic instrumentation, development of scientific tools for information content analysis and management to enable machine identification of specific information within large datasets, and innovative computer hardware and software development.

(7) Mission related and public service oriented research, technology development, test evaluation and systems analysis required to provide a quick response to rapidly evolving DOD and other government agency requirements through the application of the above core competencies, along with the complementary capabilities of the other divisions of the University of Texas.

- **The Applied Physics Laboratory of The University of Washington (APL/UW)**

(1) Fundamental research to understand the physics of ocean processes and the dynamics of oceanic motions. Investigation of the physics of air-sea-ice interaction and ice mass balance in polar regions. Investigation of the fundamental nature of the propagation of sound in the ocean. Almost entirely funded by competitively awarded grants, this activity provides the foundation for understanding and predicting the performance of Navy sensors, weapons and other systems which operate in the marine environment.

(2) Determination of the effects of the ocean environment, its surface (including the Arctic ice cover), bottom and volume, on acoustic propagation, and the implications for operation and performance of Navy systems. This capability includes the very low frequencies associated with long range ASW surveillance and low frequency active sonars, the low-to-mid frequencies where submarine and surface ship sonars operate, the higher frequencies of torpedo sonars, the ultra-high frequency range of mine hunting sonars, diver-held sonars and sonar imaging systems for unmanned, underwater vehicles.

(3) Development of specialized underwater instrumentation and equipment for undersea warfare, mine countermeasures, and general data acquisition, including unmanned underwater vehicles and supporting technologies; acoustic tracking ranges; fixed and mobile underwater targets; special purpose acoustic transducers and acoustic systems; oceanographic and acoustic data gathering systems; and Arctic system RDT&E support.
(4) Corrosion studies to improve the reliability of submarine and surface ship sonar systems, and bottom fixed and rapidly deployable surveillance systems. Included are transducer manufacture, connector reliability, mounting and structural integrity, including sonar dome survivability, and underwater cable longevity.
(5) Design and development of acoustic, photonic, electro-optic and other related systems for intelligence collection, self-noise integrity, ship/submarine systems monitoring; and acoustic, photonic, electro-optic and related systems for reconnaissance and for fleet needs, including medical acoustic and electro-optic systems.
(6) Development of simulations, advanced signal and image processing techniques, and specialized processing systems for automatic target recognition, decision tree classifiers, morphological signal processing, and low-intensity and obscured-image extraction. Development of torpedo guidance and control algorithms to combat performance limitations imposed by adverse acoustic environments.
(7) Mission related and public service oriented research, technology development, test evaluation and systems analysis required to provide a quick response to rapidly evolving DOD and other government agency requirements through the application of the above core competencies, along with the complementary capabilities of the other divisions of the University of Washington.

- **The Applied Research Laboratory of The University of Hawaii (ARL/UH)**

(1) Basic and applied research in the areas of ocean environmental effects and the interaction of natural and man-made underwater noise sources on littoral anti-submarine warfare, marine life, mammals, and other Naval experiments. Associated competencies are bathymetry, autonomous underwater vehicles, acoustic mapping and littoral topography, buried mine detection, advanced sonar and bio-sonar signal processing, and tropical atmospherics and oceanography.
(2) Astronomical research utilizing existing unique facilities and development of world-class state of the art optics and sensors for defense applications. This research has been applied to advanced satellite tracking systems, development of adaptive optics, and space observations coordination, such as the Hubble Space Telescope and the Pan-STARRS program to detect and characterize Earth-approaching objects, asteroids and comets that may pose a danger to earth.
(3) Advanced electro-optical systems, detection systems, arrays and instrumentation. This competency had been applied to virtually all the astronomical research as well

as other electro-optic devices including LIDAR, laser, and remote sensing technologies.

(4) Fundamental research and applied engineering supporting improvements in the utilization of various regions of the electromagnetic spectrum, advancements in communications, networks and protocols, C4I systems hardware and signal processing. This capability has been applied to advanced radar technology, distributed processing, sensor network integration, design tradeoff studies especially in the areas of RF arrays, passive remote sensing, command and control integration and wave propagation.

**Army Sponsored**

- **Georgia Tech Research Institute Applied Systems Laboratory**

(1) Basic/applied research, exploratory, and advanced development of RF, MMW, IR, EO missile sensors, ultraviolet and acoustical airborne and ground sensors, guidance and control systems
(2) Basic/applied research, exploratory, and advanced development of phenomenology analysis tools, measurement methodologies, and instrumentation implementation techniques related to natural and man-made environments
(3) Materials and electronics manufacturing technology to meet the unique requirements of missile system environments
(4) Advanced electronics design and packaging for very compact, high performance signal processing, automatic target recognition, and guidance and control subsystems
(5) Next generation photonics components and subsystems for radar control
(6) Computer and physical modeling and analysis of threat systems/subsystems
(7) Performance analysis, simulation and modeling of weapon and sensor interactions
(8) System accessibility, susceptibility, and vulnerability analysis, modeling and counter-countermeasure development
(9) Missile endgame modeling and analysis
(10) Hardware-in-the-loop, hybrid, and real-time simulation and analysis of major Army missile systems
(11) Independent evaluation, modeling, and testing of ballistic missile defense phased-array radar systems
(12) Analysis, modeling, and development of adaptive digital beamforming techniques and technologies for missile defense applications
(13) Prototype and proof-of-principle hardware design and development for missile defense systems
(14) Basic/applied research, exploratory and advanced development in generic databases, networks, software engineering, telecommunications, and information infrastructure

(15) Developmental activities associated with the Digital Infrared Seeker and Missile Simulation of IR missile and systems models
(16) Analysis, systems engineering, integration, and rapid cyber tool development to address defensive/offensive cyber operations and cyber mission assurance requirements.

- **University of Southern California Institute for Creative Technology**

(1) Immersion: Basic, applied, and advanced research, exploratory, and advanced development and systems integration of hardware and software for virtual reality immersion
(2) Scenario Generation: Basic, applied, and advanced research, exploratory, and advanced development of hardware and software that supports the setup and configuration of simulations, the creation of the simulation environment, terrain, and entity models, the development of agent characters and their behaviors, and the definition of scenarios.
(3) Content Creation: Research and development and production of video, television, film and static and interactive media as well as concept development and visualization
(4) Graphics: Basic, applied, and advanced research, exploratory, and advanced development of hardware and software for computer graphics
(5) Sound: Basic, applied, and advanced research, exploratory, and advanced development of tools and techniques for immersive audio, three-dimensional sound acquisition and adaptive rendering
(6) Knowledge Integration: Basic, applied, and advanced research in methods to integrate knowledge from the above research disciplines to support new concepts for training individual, leader, and team decision making
(7) Creative Technologies: Basic, applied, and advanced research in methods to synthesize creative content with simulation technologies to make immersive learning environments more engaging and effective. Applied research in concepts of human perception, entertainment theory, and game theory in support of customized and feedback based self-directed learning environments
(8) Evaluation: The development and use of techniques and systems for instrumentation, data collection, measurement and analysis of the effects of various sensory inputs on learning, performance and behavior. Evaluation of the learning and performance effectiveness of simulations and other computer-based environments for training and education

- **MIT Institute for Soldier Nanotechnology**

(1) Conducts long term, comprehensive, basic and applied research addressing:
o nanomaterials synthesis, structural characterization, device fabrication, and integration;

- o performance characterization and analysis of nanoscale-based systems; and
- o modeling, simulation and prediction of nanoscale phenomena and macroscopic properties

(2) Exploits nanotechnology developments to perform basic and applied research, and exploratory and advanced development of systems and subsystems intended to improve the survivability and mobility of the soldier in the battlespace while decreasing the logistical footprint
(3) Exploits nanotechnology to develop prototype and proof-of-principal hardware for Soldier Systems
(4) Conducts a theoretical and experimental program utilizing various nanomaterials systems and processing technologies to understand critical issues determining the efficiency and lifetime of Soldier Protection and Performance Augmentation/Enhancement Systems
(5) Performs technical, software, and information technology development activities associated with Soldier Systems
(6) Performs independent evaluation, modeling, and testing of Soldier systems and components in cooperation with industrial partners, or Army personnel, or both

- **University of California-Santa Barbara Institute for Collaborative Biotechnology. Affiliate Universities to this UARC are MIT and Caltech**

(1) Conducts long term, comprehensive, basic and applied research addressing: biotechnology, biomolecular science, engineering and materials, and bionanotechnology, and their applications to the development of sensors, electronic, optical and magnetic materials and new routes to information processing; performance characterization and analysis of biological, biomolecular and biologically inspired systems; multi-scale modeling, systems analysis, simulation and prediction of the performance and properties of biological, biomolecular and biologically inspired materials, components and networks
(2) Exploits developments in biotechnology, biomolecular science engineering and materials and bionanotechnology to perform basic and applied research combining biotechnology and engineering, and exploratory development of systems and subsystems intended to improve the mission effectiveness of the Army and its elements
(3) Exploits biological sciences, biotechnology, bionanotechnology, and biomolecular materials science and engineering, in conjunction with multi-scale modeling and systems analyses, to develop and iteratively refine proof-of-principle materials and devices embodying the above developments
(4) In collaboration with the Army Research laboratories and ICB's industrial partners, transfers the above-described technologies and proofs of principle for prototype development and practical applications of direct importance to the Army

**Missile Defense Agency**

- **Utah State University Space Dynamics Laboratory**

  (1) Perform engineering and development work related to state-of-the-art, proof-of-concept, sensor systems for space-based platforms
  (2) Perform sensor experiment data collection and analysis
  (3) Investigate new sensor systems and participate in the early stages of future MDA sensor technology initiatives as approved by MDA
  (4) Transition scientific data and technology to Government and non-Government agencies

**National Security Agency**

- **University of Maryland Center for Advanced Study of Language**

  (1) Provides the following core research, development, and engineering in foreign language and dialects: There are more than 6700 languages in the world. Each language may have recognized dialects, forms of the language that are mutually intelligible but with phonological, lexical, or grammatical variations. National security interests will define staffing requirements for foreign language and dialect experts
  (2) Provides the following core research, development, and engineering in Linguistics, including the following sub-fields: phonology, morphology, syntax, discourse analysis, semantics, pragmatics sociolinguistics, applied linguistics, computational linguistics, corpus linguistics, historical linguistics, psycholinguistics
  (3) Provides the following core research, development, and engineering in disciplines related to analysis and critical thinking, including cognitive science, cognitive psychology, industrial psychology, neurolinguistics, philosophy, English, communication
  (4) Provides the following core research, development, and engineering in disciplines related to the manipulation, use, and sharing of information of varying quantities and diverse forms, including artificial intelligence, knowledge acquisition, knowledge representation and reasoning, knowledge discovery and data mining, knowledge management, organizational learning, organizational behavior, machine learning, human-computer interaction

**Deputy Assistance Secretary of Defense for Systems Engineering (DASD(SE))/ OASD(R&E)/OUSD(AT&L)**

- **Stevens Institute of Technology Systems Engineering Research Laboratory**

  (1) Conduct long-term, comprehensive systems engineering (SE) research focused on Department of Defense (DoD) acquisition

(2) Leverage developments in systems architecting, complex systems theory, systems thinking, systems science, knowledge management, and software engineering to perform research to advance the design and development of complex systems across all DoD domains
(3) Leverage developments in open systems standards, organizational theory, program management, systems engineering management, and information technology to provide needed integration of program /technical management MPTs

**United States Strategic Command**

- **University of Nebraska National Strategic Research Institute**

(1) Nuclear Detection and Forensics, including development of novel and field-deployable interrogation sources to detect special nuclear materials, radiation detectors with improved sensitivity and noise characteristics, standoff detection of nuclear debris, rapid in situ forensics analysis of nuclear material, and in situ non-destructive testing of nuclear pits.
(2) Detection of Chemical and Biological Weapons, including rapid, accurate, and highly efficient bioagent identification; sensors incorporating nanotechnology that measure chemical agents at the molecular level; autonomous and adaptive sensor networks for various applications; next generation respiratory protection equipment; genetic, immunological, and materials approaches to develop and deliver vaccine antigens in a manner to enhance their cellular uptake, protect them from degradation, and trigger the immune response.
(3) Passive Defense against Weapons of Mass Destruction, including countermeasures to central nervous system disorders, rapid production of vaccines for bioagents, regulation of the metabolic process for warfighters in extreme environments, an innovative nanoscience approaches to drug delivery.
(4) Consequence Management, including visualization and simulation of critical infrastructure vulnerabilities, disaster preparation, and human behavior patterns; computer-based surrogates of real world systems for training, analysis of alternatives, experimentation and exploration of systems vulnerabilities; and decision-making support tools to analyze complex data, assess risk, analyze exposure, and visualize impacts.
(5) Space, Cyber, Telecom Law, including space traffic management, security and risk management of space assets, and development of protocols based on international space and cyber law.