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First Steps Toward Improving DoD STEM Workforce Diversity

Appendix C: Response to the 2012 Department of Defense STEM Diversity Summit

Nelson Lim, Abigail Haddad, Dwayne M. Butler, Kate Giglio
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This document is an appendix to *First Steps Toward Improving DoD STEM Workforce Diversity: Response to the 2012 Department of Defense STEM Diversity Summit*, by Nelson Lim, Abigail Haddad, Dwayne M. Butler, and Kate Giglio, Santa Monica, Calif.: RAND Corporation, RR-329-OSD, 2013, available at http://www.rand.org/pubs/research_reports/RR329.html. The following pages provide PDFs of the presentations given at the Summit representatives of the Navy, Air Force, Army, Reserve Affairs, the Department of Defense’s Office of Diversity Management and Equal Opportunity (ODMEO), and the Office of the Under Secretary of Defense for Personnel and Readiness.
A. Navy DoD STEM Diversity Summit Presentation

**STEM Roadmap**

**Meeting SECNAV Goals**

**Naval STEM Strategy Released – June 2011**
- Double investment in STEM by 2015
- Focus on high-engagement, long duration programs
- Focus on expanding participation of underrepresented populations
- Integrate Naval Relevance / Needs into programs
- Develop simple, practical and meaningful metrics
FY 11 Investment Profile

Fast Facts

- **$83.6 M Investment** in STEM, plus $108 M for ONR supported domestic and graduate students
- 215 Programs (400+ engagements)
- 31 Commands
- 85,000 Students (+200,000 via festivals/fairs)
- All 50 States

Investment Summary

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAVAR</td>
<td>$1,628,936.00</td>
</tr>
<tr>
<td>SPAWAR</td>
<td>$234,600.00</td>
</tr>
<tr>
<td>NAVSEA</td>
<td>$13,661,737.00</td>
</tr>
<tr>
<td>ONR/NRL</td>
<td>$34,095,506.00</td>
</tr>
<tr>
<td>OSD/NDIP</td>
<td>$33,750,697.00</td>
</tr>
<tr>
<td>Other</td>
<td>$151,500.00</td>
</tr>
</tbody>
</table>

Target Audience

- Teachers (K-12): $1,088,077.00
- University Faculty: $4,918,153.83
- Higher Education: $30,440,505.00

Higher Education, $50,440,505.00: 80%
K-12, $17,265,332.00: 21%
Teachers (K-12), $1,088,077.00: 1%

STEM Landscape

- **$18.3 M**
  - Underrepresented Family Science Fairs
  - Apps
  - Fun
  - Interesting
  - Hands-on
  - Real-world
  - Family Involvement
  - Use of Near-Peers

- **$50.4 M**
  - Interimships
  - Scholarships
  - Competitions
  - Cohorts
  - Exciting / Relevant
  - Competition
  - Mentoring
  - Social Networking
  - Funding / Support
  - Real-world Experience
  - Employment/Stability
  - Prestige
  - Relevance
  - Compelling Research
  - Opportunity to Publish

- **$14.9 M**
  - Faculty Research, Teacher Training & Professional Development
  - Young Investigator Summer Faculty

Inspire ➔ Engage ➔ Educate ➔ Employ
### Selected Programs

#### K-12

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
<th>Students / Teachers</th>
<th>Minority Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SeaPerch</td>
<td>Middle School robotics competition -- Nationwide</td>
<td>35,000 / 4,000</td>
<td>45%</td>
</tr>
<tr>
<td>Technovation</td>
<td>High School Girls App Development competition</td>
<td>730</td>
<td>40%</td>
</tr>
<tr>
<td>Iridescent Family Science</td>
<td>Elementary and Middle School hands-on after school program</td>
<td>7,270</td>
<td>95%</td>
</tr>
<tr>
<td>National Math and Science Initiative</td>
<td>High School AP courses for Military Dependents</td>
<td>800</td>
<td>26%</td>
</tr>
<tr>
<td>SEAP</td>
<td>High School internship program</td>
<td>215</td>
<td>21%</td>
</tr>
<tr>
<td>Sally Ride Science and ASM Teacher Training</td>
<td>Middle and High School Teacher Training Programs</td>
<td>200</td>
<td>From Rural AL, MS and LA</td>
</tr>
<tr>
<td>Summer Camps (CSI, NSBE)</td>
<td>Middle School hands-on camps</td>
<td>300</td>
<td>80%</td>
</tr>
</tbody>
</table>

Programs in Yellow – New since SECNAV Doubling Challenge

#### Higher Ed

<table>
<thead>
<tr>
<th>Program</th>
<th>Target</th>
<th>Students / Teachers</th>
<th>Minority Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NREIP</td>
<td>College Internship program at the Labs and Centers</td>
<td>155</td>
<td>15%</td>
</tr>
<tr>
<td>NRL STEM Academy</td>
<td>Minority Institution focused College Internships at NRL</td>
<td>45</td>
<td>100%</td>
</tr>
<tr>
<td>Florida International University</td>
<td>Reinventing Curriculum for basic STEM Courses</td>
<td>Development beginning in Fall</td>
<td>83%</td>
</tr>
<tr>
<td>UT Pan American</td>
<td>Developing 10-15 Navy Relevant STEM Courses</td>
<td>1700</td>
<td>97%</td>
</tr>
</tbody>
</table>

#### Tools

<table>
<thead>
<tr>
<th>Program</th>
<th>Target</th>
<th>Students / Teachers</th>
<th>Minority Participation</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHEF Higher Ed STEM Model</td>
<td>Developed Model of best practices for Higher Ed Retention Programs</td>
<td>To be used to select future Naval Programs</td>
<td>Launch Fall 2012</td>
<td></td>
</tr>
<tr>
<td>Digital Tutor Grand Challenge</td>
<td>Development of Middle School and new recruit STEM Tutor</td>
<td>4 Awards</td>
<td>Oct. 1 Start Date</td>
<td></td>
</tr>
<tr>
<td>Gooru</td>
<td>Online Student and Teacher Resource</td>
<td>4500 / 200</td>
<td>60%</td>
<td></td>
</tr>
</tbody>
</table>
SeaPerch

“Gateway” robotics program for middle and high school featuring a submersible remotely operated vehicle (ROV)
Through robotics and underwater ROVs, students learn about careers in naval architecture, and marine, ocean and naval engineering.
Curriculum mapped to national science standards
Partnerships with
  - Navy League in Mississippi
  - 4-H in Minnesota

Fast Facts:
• 42,000 Students since Fall of 2007
  - 39% Female / 61% Male
  - 45% Minority Participation
• Annually
  - $1,400,000 from ONR
  - $750,000 from SYSCOMS and NDEP
• 45% Minority Participation
• 43 States with at least one program
• 4,000 Teachers/Mentors Trained
• 13,000 SeaPerch kits issued

Overall Assessment
• Participating in SeaPerch increased interest in studying engineering in 25% of MS and 30% of HS students
• Program improved problem solving confidence in 34% of MS and 43% of HS students

Ongoing Metrics and Assessment
• Student understanding of Naval S&T Career options
• Student career goals/intention
• Student self efficacy in STEM
• Returning student and mentor/coach participation

Iridescent

Iridescent Family Science Program
• A hands-on, experiential learning after school program
• Customized 10 Navy-relevant learning modules
• Leverages near-peer mentors from USC, NYU-Poly, Cooper Union
• Aimed at 3rd-7th grade underserved, underprivileged children and their families
• Naval veterans involved through The Mission Continues program

Fast Facts:
• 7270 Students
  - 50% Female / 50% Male
  - 100% Minority Participation
  - $1,500,000 Annually
• 2 Urban Science Centers
  - Bronx, NY (serving all boroughs)
  - Los Angeles, CA
• After participating in program, 80%of students interested in pursuing STEM Education/Career

Ongoing Metrics and Assessment
• External Evaluation and longitudinal study of program impact funded through NSF will measure:
  - Student commitment to STEM education
  - Student attitude towards, pursuit of, and involvement in STEM/STEM career
  - Student increase in STEM concepts and content
  - Parent/family awareness and interest in STEM and STEM careers
  - Longitudinal student tracking for continued participation in STEM programs
Technovation Challenge

Iridescent Technovation Challenge
• Entrepreneurial team competition for App development for young women in HS
  • Teams pitch their App and business plan to panel of venture capitalists
  • Winning App is professionally developed and released
  • Each team paired with a female graduate or undergraduate student near-peer mentor
  • Partnership with Google, Microsoft, LinkedIn, Twitter, MIT, Stanford, Berkeley, UCSF

Fast Facts:
• 730 Students
  • 100% Female
  • 40% Minority Participation
  • $850,000 Annually
  • After participating in program, 80% of students interested in pursuing STEM Education/Career
  • Locations in San Francisco Bay Area, Boston, New York City

Ongoing Metrics and Assessment
• Longitudinal study of program impact will measure:
  • Student commitment to STEM education
  • Student attitude towards, pursuit of, and involvement in STEM/STEM career
  • Student increase in STEM concepts and content
  • Parent/family awareness and interest in STEM and STEM careers
  • Longitudinal student tracking for continued participation in STEM programs

YES! Program

Youth Exploring Science Program
• 4 year, HS program for St. Louis area teenagers, ages 14-18
• Partnership with St. Louis Science Center
• Focus on Minorities, disadvantaged and at-risk students
• Provides academic support and life skills development in a work-based, inquiry-learning science environment
• Creating roadmap for program distribution to other Science Centers

Fast Facts:
• 246 Students
  • 50% Female / 50% Male
  • 90% Minority Participation
  • $580,000 Annually
  • 84% interested in STEM Career
  • 91% pursuing STEM Education/Degree
  • Program involves retired Navy personnel, Navy League members, and Naval Reservists as mentors

Ongoing Metrics and Assessment
• High school graduation
• College enrollment
• Career choice
• External Evaluation funded by ONR
  • Track participants over 4 years
  • Evaluate program impact on college and career choices
  • Evaluate understanding of STEM concepts and content
  • Track student participation in other STEM activities
National Math and Science Initiative
- Part of Initiative for Military Families and First Lady’s Joining Forces Initiative
- Providing proven AP STEM curriculum to HS with high percentages of military-dependents
  - AP math and science passing scores increased by 57 percent (7X greater than the national average)
  - Students passing AP exam are 3X more likely to earn college degree

Fast Facts:
- 800 Students
  - 50% Female / 50% Male
  - 26% Minority Participation
  - Schools with 15%+ attendance of Military Dependent Children
- $375,000 Annually
- Currently funding 3 schools in VA and Hawaii, with plans to fund 5 more

Ongoing Metrics and Assessment
- Demographics
- Track students participation in AP courses
- Track student scores on AP tests
- Track student post-secondary choices

NAVY HBCU/MI PROGRAMS
Objective: Enhance defense–related research and education at HBCU/MSIs to assist the Department in defense-related research, development, testing, and evaluation activities through:

- Enhancing research and educational capabilities
- Encouraging participation in research, development, testing, and evaluation programs
- Increasing the number of faculty and graduates in disciplines important to national security
- Encouraging research and educational collaboration with government, academia, and industry defense-related organizations
The Chief of Naval Research ("CNR"), shall designate the Department of
the Navy HBCU/MSI Program Manager ("Navy PM") to provide policy
guidance and general oversight to the Navy HBCU/MSI Program. The
Navy PM is tasked with issuing administrative instructions, monitoring
their implementation and conferring with representatives from
participating organizations (Administering Offices and their subordinate
organizations) to assure sufficient understanding and accomplishment of
the Navy program planning, goals and objectives.

NRL STEM Academy for Minority Institutions

- Undergraduate and Graduate students from HBCUs and MIs
- Hands-on, experiential research internships at Labs and Warfare Centers alongside scientists and engineers
- Interns exposed to larger Naval S&T community through seminars, tours, and field trips

Fast Facts:
- Initiated FY11
- National applicant pool expected
- 45-50 Interns expected
- $330,000 FY11
  - $730,000 anticipated FY12
- Residential program

Planned Metrics and Assessment
- Demographics of applicants and interns
- Selectivity
- Returning as interns or participate in other Naval STEM programs
- Pursuing STEM Education/Degree
- Employment by Navy Labs
HBCU Tuskegee University MS Systems Engineering Program

Tuskegee University MS Systems Engineering
- Student awarded one-year scholarship for a MS Systems Engineering with a 3 year work commitment at NAVSEA
- Students exposed to a highly tailored MS of Science Systems Engineering curriculum developed by NPS
  - Emphasizes Navy-relevant technologies
  - Enhances Naval Lab workforce diversity through active engagement with HBCU / MI students and faculty

Fast Facts:
- 12 Students
- 47% female / 53% Male
- 100% Minority Participation
- Annually
  - $1,200,000 from Section 852 Funds
  - $600,000 (half from NAVSEA)

Overall Assessment
- 33 Graduates, now full time employees
- Employed by 6 Warfare Centers
- 97% completion rate (1 loss)

Ongoing Metrics and Assessment
- Demographics
- MS completion rate
- Work commitment completion rate
- Post-program student surveys
- Employee retention beyond obligated service

STEM Learning Center at UTPA

STEM Learning Center at University of Texas, Pan American
- Collaboration between 5 HSI Colleges & Universities in South Texas
- Center will support professional development for faculty to create 10-15 Navy-relevant STEM courses
- Center will support undergraduate research in Navy-relevant area
- Faculty will develop and standardize curriculum for Texas Pre-freshman STEM outreach program

Fast Facts:
- Initiated in Fall 2011
- $1,000,000 Annually (up to 4 years) from OSD
- DoD HBCU/MI Education and Research Funds
- Collaboration between 5 HSI Colleges/Universities
  - South Texas College
  - University of Texas-Brownsville
  - Texas A&M International University-Laredo
  - Texas A&M University-Corpus Christi
  - University of Texas-San Antonio

Ongoing Metrics and Assessment
- Demographics
- Track student
  - Retention in STEM
  - Graduation with STEM degree
  - Enrollment in graduate school
  - Employment by Navy/DoD Labs
  - Academic achievement (GPA)
- Tracking of all publications, presentations, and patents resulting from student participation
- Tracking of all fellowships, scholarships, and awards received by student participants
Graduates Ready for Tasking

- Objectives:
  - Increase the quantity and quality of HBCU/MI undergraduate and post graduates choosing civilian careers with the Navy (brand them early and often!)
  - Prepare HBCU/MI graduates for accelerated career development

- Approach
  - From freshman to Ph.D., on-campus seminars, Mentors, Warfare Center Internships, Capstone Projects, Information and Recruiting Trips
  - Leverage HBCU/MI Program into the Naval Engineering Education Center (NEEC), a 15 university consortium led by the University of Michigan.

APPLIED RESEARCH INITIATIVE

- Vision
  - Leverage successful Navy Warfare Center and UARC programs and basic research driven HBCU/MIs with mature STEM disciplines to establish and model competitive Navy-focused University Applied Research Initiatives (UARI) integrated with the HBCU/MIs

- Plan
  - Build the relationship between the HBCU and the Warfare Center
  - Map HBCU/MI research capability and Navy requirements
  - Identify Navy project sponsors
  - Establish the administrative, financial, and operational procedures for the Applied Research Team
  - Propose, execute, and close-out Navy applied research contracts
B. ODMEO DoD STEM Diversity Summit Presentation
Introduction

- Review of the status of STEM Occupational series in the Department of Defense (DoD) workforce
  - DoD Civilian
    - Total civilian workforce in DoD
    - Trend Analysis: End of FY 2006 (referred to as FY 2006) vs. End of FY 2012 (referred to as FY 2012)

- Data Source: DCPDS file extracts
In the DoD, STEM occupations are comprised of the following fields:

- Architects
- Computer Science and Information Technology
- Engineering
- Engineering Techs
- Health Practitioners
- Life Sciences
- Mathematics
- Physical Sciences
- Program Management
- Social Sciences

Compared to non-STEM occupations, there is less diversity in STEM occupations in the DoD.
Majority of the civilian workforce in STEM occupations reside in the military departments

- 36.8% of all civilian STEM workforce in the DoD is in the Army followed by 34.4% in the Navy
- National Guard and DoD agencies have the lowest percentage of DoD’s Civilian STEM workforce with 3% and 8.5%

Asians are the only minority group whose participation is higher in STEM occupations compared to non-STEM occupations

- Other than Asians the participation rate of all minority groups is lower in non-STEM occupations
  - Participation of Asians is 4.8% in non-STEM fields while it is 6.6% in STEM fields
  - African Americans comprise 17.4% in non-STEM occupations and are 10.4% in STEM occupations, a difference of 7%
  - Hispanics are 6.9% in Non-STEM occupations and are 5.1% in STEM occupations, a difference of 1.8%
  - The participation of Whites is higher by 7.8% in STEM occupations
- Females comprise 25.8% in STEM occupations compared to
Over the past six years, minority participation in STEM occupations has increased while female participation rates have largely remained constant.

- Minority participation in STEM occupations increased 13.2% from FY 2006 to FY 2012.
  - Compared to FY 2006, the participation of African Americans in STEM occupations in FY 2012 has increased by 14.8%.
  - Compared to FY 2006, the proportion of Hispanics in STEM occupations in FY 2012 increased by 9%.
- Even though female participation in the total DoD workforce decreased by 4.2%, female participation in STEM Occupations increased slightly from from 28.0% in FY 2006 to 28.5% in FY 2012.

Minority participation in STEM fields was the highest in DoD agencies followed by the Army.

- All components showed an increase in diversity among the STEM workforce, particularly the Navy and DoD agencies.
  - Minority participation in STEM occupations was the highest in DoD Agencies at 29.0% and increased by 21.4% compared to FY 2006.
  - The highest African American participation in STEM occupations was in the DoD agencies with 15.7%.
  - For Asians, the highest participation was seen in the Navy with 9.1%.
  - For Hispanics, the highest participation was seen in the Army with 5.7%.
Of all components, Army had the highest representation of females in STEM occupations

Female participation in the Army increased by 5.5% from 31.3% in FY 2006 to 33.0% in FY 2012

The Air Force was the only component where female participation in STEM occupations decreased

Air Force female participation decreased from 26.4% in FY 2006 to 24.4% in FY 2012

The representation of minority groups among those hired in FY 2012 into STEM occupations is lower than the pre-existing race/ethnicity participation of the DoD STEM workforce

The hiring of minority groups into STEM occupations was lower than the pre-existing workforce participation, thus not increasing diversity

- The hiring rate of Hispanics into STEM occupations in FY 2012 was 3.5%, which is lower than the existing representation (5.12%)
- The hiring rate of African Americans into STEM occupations in FY 2012 was 8.3%, which is lower than the existing representation (10.4%) of African Americans
- The hiring of Asians into STEM occupations in FY 2012 was 4.5%, which is lower than the existing representation of Asians (6.6%)

Females on the other hand were hired at a rate of 33.2%, which is higher than the existing representation of 28.5%
The least diverse STEM Fields are Life Sciences, Physical Sciences and Mathematics where Whites make up 85.8%, 84.9%, and 83.9%

The participation of African Americans is highest in Health Technicians with 23.2%, Program Management with 15.9%, 13.7% in Computer Science and Information Technology

For Asians, the highest participation is in Engineering with 11.3%, Architects with 9.4%

For Hispanics, the highest participation is seen among Health Technicians with 8% and Computer Science and Information Technology (5.5%)
C. Air Force DoD STEM Diversity Summit Presentation
Overview

• Air Force Activity to Address STEM Challenge
• Air Force STEM Outreach Coordination Office (AFSOCO)
• Air Force STEM Investments
• Air Force STEM Diversity Approach
• Air Force Scientist & Engineer Awards/Events - 2012
Recent Air Force Activities to Address STEM Challenge

• Commissioned National Research Council Study to evaluate and improve Air Force STEM – Fall 2010
• Established STEM Advisory Council
  ■ Published *Bright Horizons* - STEM Workforce Strategic Roadmap - Mar 2011
  ■ Directed establishment of AFSOCO
  ■ AFSOCO established – Sep 2011

AF STEM Outreach Coordination Office (AFSOCO)

• Created through *Bright Horizons, AF STEM Workforce Strategic Roadmap, Outreach Goal* – Mar 2011
• Mission: Single focal point, both inside and outside the Air Force, for STEM outreach
• Duties:
  – Create AF STEM Outreach Strategy
  – Develop Annual AF STEM Outreach Plan
  – Provide Annual AF STEM Outreach Assessment Report
  – Serve as central clearinghouse for AF STEM outreach lessons learned
  – Coordinate AF STEM outreach efforts: 20 AF Locations; Impacts 900 schools/4,000 teachers/106,000 students
  – Develop and maintain AF partnerships: 32 National & 51 Community-based; A1D, AF Recruiting Service, ROTC & JROTC; Civil Air Patrol and AFA; OSD; other Components
AFSOCO Early Accomplishments

- Single focal point for Air Force STEM activities
  - Increased network from 14 to 57 installations
  - Established monthly forum (info exchange, best practices)
  - Synergy with key AF organizations (AFROTC, AFJROTC, AF Diversity Office)
  - Leveraging efforts both internally and externally
  - Increasing awareness of numerous non-profits' capabilities
- Single POC for K-12 National Defense Education Program (NDEP)
  - Provide AF-wide requirements and oversight
- Created AF STEM website for internal/external communication
  - Will soon capture complete inventory of STEM outreach events/activities
  - Will allow data queries on Air Force-wide STEM outreach efforts
    - Grade levels, demographics, direct contact hours, effectiveness metrics, funding
- Executing outreach activities in National Capitol Region

Poised For Corporate Approach

AF STEM Investments

- Awards to Stimulate & Support undergraduate Research Experiences (ASSURE) - $4.5M *
- National Defense Science & Engineering Graduate (NDSEG) Fellowship Program - $38M*
- University NanoSatellite Program - $1.6M*
- Air Force Research Laboratory Section 219 funding for STEM outreach - $6.1M for FY13
- Other STEM Educational Opportunities

* Amount received from OMB in FY13
AF STEM Diversity
Approach

• Increase student interests in STEM fields through activities
  – Active recruitment in large diverse populations
  – Active recruitment in large S&E populations
• AF STEM Diversity Manager
  – Ms. Enjoli Ramsey, enjoli.ramsey@pentagon.af.mil
  – Shared resource between AFSOCO & AF STEM Diversity Office
  – Oversees AF STEM Outreach Diversity Initiatives
  – Oversees AF Sponsored National STEM Awards/Events
  – Tracks AF STEM Outreach Diversity Data
• AF STEM Workforce Diversity Data
• Recent AF STEM Diversity Initiative
• AF STEM Website Diversity Data

Recent AF Diversity Initiative
Teachers Materials Camp

• Targets H.S. teachers from under-represented communities
  – Leverages academia/universities who recruit teachers for camp
• Joint effort with AFSOCO & AF Diversity Office
• Provides AF S&Es as guest speakers from same under-represented communities
• Connected 6 Air Force installations with established Materials Camp program
  started by DoEd and NSF – 5 new camps established
• Locations include:
  – Cal State University- Long Beach / Edwards AFB CA / LA AFB CA (summer 2012)
  – Howard University / AF Pentagon (summer 2012)
  – University of Alabama / Maxwell AFB AL (summer 2012)
  – Weber State U / BYU / Hill AFB UT (summer 2013)
  – Mercer University / GA Tech / Robins AFB GA (summer 2013)
AF STEM Website
Diversity Data

- Diversity Categories
  - Gender - Female, Male
  - Race - American Indian or Native American, Asian or Pacific Islander, Black, White, Hispanic Origin, Not of Hispanic Origin
  - Socioeconomic Background
  - Physical Abilities
  - Language Abilities (English 2nd Language)
  - Other

- All data collected is voluntary
- AF STEM website: [www.afsoco.afciviliancareers.com](http://www.afsoco.afciviliancareers.com)

AF Scientist & Engineer
Awards/Events - 2012

[Images of people and awards]
D. Army DoD STEM Diversity Summit Presentation

Defining Army STEM Investments
November 01, 2012

Jeffrey D. Singleton
Director for Basic Research

Our Mission

Design, develop, deliver and sustain products and services to enable our Soldiers to dominate the battlefield today and tomorrow.

Image Source: US Army Flickr and Tom Clancy's Ghost Recon Future Soldier
Army Top Challenges

- Greater force protection (Soldier, vehicle, base) to ensure survivability across all operations
- Ease overburdened Soldiers in Small Units
- Timely mission command & tactical intelligence to provide situation awareness and communications in all environments
- Reduce expense of storing, transporting, distributing and waste handling of consumables
- Create operational overmatch (enhanced lethality and accuracy)
- Achieve operational maneuverability in all environments and at high operational tempo
- Enable ability to operate in CBNRE environment
- Improve early detection of Traumatic Brain Injury
- Improve operational energy

Today Every Soldier Needs to be a ...

- Warfighter – conducting offensive and defensive operations
- Peace Keeper – conducting stability and/or civil support operations
  - Builder/Rebuilder (military, political, & economic)
  - Friend
  - Diplomat
  - Protection
- Leader
  - Strategic thinker
  - Decision maker
  - Teacher
  - Economic advisor
  - Information manager
- Family Member
  - Member of a team
Basic Research Portfolio Structure

Basic Research Portfolio
6.1 Funding

Human Centric
Information Centric
Material Centric
Platform Centric
Enrichment Initiatives

Investment Areas
- Life Sciences
- Behavioral
- Training
- Neuroscience
- Medical

Investment Areas
- Computing
- Cyber
- Decision Making
- Network Sciences

Investment Areas
- Classical Sciences
- Materials Modeling
- Biotechnology
- Nanotechnology
- Environment

Investment Areas
- Simulation
- Autonomy
- Vehicles
  - Air
  - Ground

Investment Areas
- University Research Initiatives
- Innovative Lab Research
- Educational Outreach
- Foreign Technology

Outreach ~
MIT
1200 grants
340

Vertical Lift Research Centers
- Penn State, Georgia Tech, University of Maryland
  Improve tactical mobility, reduce logistics blueprint and increase survivability for rotary wing vehicles

Automotive Research Center
- University of Michigan
  Leverage commercial technology for Army vehicle systems

HBCU/MI Partnerships in Research Transitions
- Howard, Hampton, NC A&T, Delaware State
  Advanced algorithms, Bayesian imaging and signal processing for landmines and IED detection

University Affiliated Research Centers
Institute for Collaborative Biotechnology – UCIB, CalTech, MIT
Bio-inspired materials, sensing, energy-storage, networks, and neuroscience

Institute for Creative Technology – USC
Immersive simulation and training, Human-Virtual to Human interactions,
Post Traumatic Stress therapy

Institute for Soldier Nanotechnology – MIT
Nano materials, fibers, sensing, medical

Centers of Excellence for Enduring Army Needs

Multidisciplinary University Research Initiatives
- Defense University Research Instrumentation Program
- Presidential Early Career Award for Scientists and Engineers

University Single Investigator Program
- ~1200 grants, ~340 universities
  Basic Research in physical sciences, mathematics, life sciences, engineering
Collaborative Technology / Research Alliances

Robotics –
Expand technologies available for future unmanned systems with ability to team with Soldiers; Develop foundational manipulation/mobility behaviors

Micro Autonomous Systems Technology –
BAE, Jet Propulsion Lab, U. Maryland, U. Michigan, U. Penn
Microsystem mechanics, processing for autonomous operation, microelectronics and platform integration

Cognition and Neuroergonomics –
DCS Corp, Taiwan Brain Research Center, UC San Diego, U. Michigan, U. Texas
Understand how the brain works to optimize system design; understand soldier neurocognitive performance in operational environments

Network Science –
BBN, Penn State, U. Illinois-Urbana Champaign, Rensselaer Polytechnic Institute
Communications networks, interplay of social/cognitive info; affect of one network on another

Materials in Extreme Dynamic Environments –
JHU, CalTech, Rutgers, U. Delaware
Understanding material properties under high strain-rates

Network & Information Science International Technology Alliance –
US/UK alliance led by IBM
Network operations in Coalition environments

Multiscale Multidisciplinary Modeling of Electronic Materials –
U. Utah, Boston U., Rensselaer Polytechnic Institute
Microscale properties to design macroscale behavior for electronics

HBCU/MI Partnerships in Research Transitions
Howard, Hampton, NC A&T, Delaware State

Motivation
• Provide for and support a wide diversity of scientific research and idea generation
• Support basic research through the Partnership in Research Transition (PRT) program, the Army’s research initiative focused on partnerships with Historically Black Colleges and Universities and Minority Institutions (HBCU/MI)

Technical Ideas
– Lower Atmospheric Research Using Lidar Remote Sensing, Hampton University
– Nano to Continuum Multi-Scale Modeling Techniques and Analysis for Cementitious Materials Under Dynamic Loading, NCA&T State University
– Center for Advanced Algorithms, Delaware State University
– Bayesian Imaging and Advanced Signal Processing for Landmine and IED Detection Using GPR, Howard University
– Extracting Social Meaning From Linguistic Structures in African Languages, Howard University

Payoff
The PRT Centers:
• enhance programs and capabilities through Army-relevant, topic-focused, near-transition-ready innovative research;
• strengthen the capacity of the HBCUs to provide excellence in education;
• conduct research critical to the national security functions of the Army and DoD
**In-House Research**

**AMC/RDECOM**
- Armor & Energetic Materials
- Sensors and Electronics
- Neuroergonomics
- Human-Robotic Interaction
- Air and Ground Vehicle Technology
- Armaments
- Combat Feeding
- Chem/Bio Surface Science

**ERDC**
- Environmental Science
- Training Land
- Natural Resources and Sustainability

**MRMC**
- Infectious Diseases
- Operational Medicine
- Combat Casualty Care
- Traumatic Brain Injury
- Rehabilitative Medicine

**ARI**
- Personnel Measures
- Leader Development
- Training Effectiveness

**Army S&T Workforce Demographics**

Total Civilian Manpower: ~19,000
- ~11,000 Scientists & Engineers
- ~7,000 Technicians, Analysts, and Administrative support
- ~450 Military S&E
- ~6500 Contractor S&E and support

Degrees Held by Civilian S&E Workforce

- PhD
- Masters
- Bachelors

Diversity:

- Age
- Years of Experience
- Demographic

Locations:

Experience and Expertise:
- Deployed and Deployable Employees: ~2000
- Matrix support to JPEO/PEO offices—acquisition certification

As of Nov 2011
Army STEM Continuum

AEOP Goals

- Strengthen, deepen, broaden and diversify the pool of STEM talent to support Army Science and Technology and the Defense Industry Base (DIB) with a STEM literate citizenry

- Support and empower educators with unique Army Science and Technology Resources to foster STEM savvy teachers

- Develop and implement a cohesive, coordinated, and sustainable STEM educational outreach infrastructure across the Army

Get our Future Workforce
Excited, Engaged and Equipped in STEM Education!
Initiatives to Build Capacity

AEOP - Future Workforce Initiatives (K-12)
• Prepare the future workforce with STEM competencies to meet the rising demand for STEM capable workforce
• Diversify the STEM workforce by engaging underserved populations early and foster diverse competitiveness for scholarships and jobs
• Expose students to DoD research and careers

Current Workforce Initiatives (Recruit, Retain and Grow)
• Potential (17 and older) and current members of the workforce
• Increase value of human capital through STEM competency
• Foster an agile workforce
• Retain highly competent talent

*The Army uses a holistic approach to improve / maintain technical excellence in the workforce*
## Broadening the Future Talent Pool

### Motivation
- This effort builds the national pool of STEM literate students to enter higher education or the workforce that in turn supports the defense industry and the Army S&T needs.
- Contribute to the growing need to have an Army STEM capable and literate workforce.
- Provide a collaborative, cohesive and effective STEM education pipeline that provides a continuum of student opportunities to prepare them for our future STEM workforce careers.

### Technical Ideas
- Integrate Army Outreach programs to best utilize available resources, identify synergies and adopt best practices
- Look for and compliment tri-service collaborations
- Develop and implement meaningful education metrics
- Support the President’s initiative on Education
- Complete site survey of laboratories and Centers to determine the state of their resources and facilities to better determine revitalization needs
- Identify pervasive Army problems for the long-term and identify associated Basic Research challenges and opportunities

### Army Educational Outreach Program

<table>
<thead>
<tr>
<th>Supply</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12 Programs</td>
<td>University</td>
</tr>
<tr>
<td>Laboratory</td>
<td>Graduate</td>
</tr>
<tr>
<td>Apprenticeship</td>
<td>Internship</td>
</tr>
<tr>
<td>Mobile Discovery Center</td>
<td>JCYBERMISSION</td>
</tr>
<tr>
<td>STEM Competitions</td>
<td>Junior Science &amp; Humanities Symposium</td>
</tr>
<tr>
<td>Mobile Discovery Center</td>
<td>JCYBERMISSION</td>
</tr>
</tbody>
</table>

### Payoff
- Develop U.S. born STEM talent for the Army’s Science & Technology workforce development & recruitment activities
- Reduce risk of human capital shortage in science and technology fields
- Broadens the reach and depth of STEM education programs
- Enhances program capabilities by leveraging partners, funding and resources
- Provides a vehicle to establish metrics with the ability to measure return on investment
## Focus Near-Term Hires Through Research

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ensure our ability to attract highly-qualified technical talent to meet our critical, technical needs</td>
<td>• SEAP College Qualified Leaders (CQL)</td>
</tr>
<tr>
<td>• Allow us to hire new researchers in emergent areas of science and technology</td>
<td>• University Research Apprentice Program (URAP)</td>
</tr>
<tr>
<td>• Allow us to maintain expertise in critical areas of technology vital to the Army mission</td>
<td>• Science, Mathematics &amp; Research for Transformation (SMART)-RC</td>
</tr>
<tr>
<td></td>
<td>• National Defense Science &amp; Engineering Graduate Fellowship (NDSEG)</td>
</tr>
<tr>
<td></td>
<td>• Multidisciplinary University Research Initiative (MURI) and University based Centers</td>
</tr>
<tr>
<td></td>
<td>• Presidential Early Career Award (PECASE)</td>
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<td></td>
<td>• Single Investigator Program (includes YIP)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technical Ideas</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fund University research to encourage graduate students to engage in research of interest to the Army</td>
<td>• Highly-qualified and available STEM workforce ready to fill critical needs:</td>
</tr>
<tr>
<td>• Utilize available (and independent) workforce studies and assessments to focus outreach efforts on emergent areas of research</td>
<td>– In critical needs areas</td>
</tr>
<tr>
<td>• Develop a transitional program to take advantage of our most experienced researchers to mentor incoming, new, talent</td>
<td>– In emergent phenomena areas</td>
</tr>
</tbody>
</table>

**Focused funding and manpower to produce a highly qualified workforce that meets our technical needs!**
E. Reserve Affairs DoD STEM Diversity Summit Presentation
DoD STARBASE Program
Office of the Assistant Secretary of Defense for Reserve Affairs
Mr. Ernie Gonzales
November 2, 2012

Authority: 10 USC 2193b

Secretary of Defense is responsible for carrying out the DoD STARBASE Program

Assistant Secretary of Defense for Reserve Affairs (ASD(RA)) designated responsibility for exercising the of the Secretary of Defense. Establishes policies, oversees management, and develops annual budget.

Secretaries of the Military Departments are responsible to the ASD(RA) for the administering the program.
**Vision Statement:** To raise the interest and improve the knowledge and skills of at-risk youth in science, technology, engineering and mathematics, which will provide for a highly educated and skilled American workforce that can meet the advanced technological requirements of the Department of Defense.

**Mission Statement:** By exposing youth to the technological environments and positive role models found on military bases and installations, we will provide 20-25 hours of exemplary instruction, using a common core curriculum that meet or exceed the National Standards. We will nurture a winning network of collaborators and build mutual loyalty.

**Population Served**

- Historically under-represented in STEM careers
- Normally, students within a 50 mile radius of a DoD STARBASE location; such as Inner-city and/or rural; However approximately 25% of the locations serve students beyond the 50 mile radius.
- Racial or ethnic minorities
- Socio-economically disadvantage
- Schools with low academic performance scores
Student Experiences

• 4 or 5-day program
• 20-25 hour curriculum
• Exciting hands-on activities taught by military volunteers and certified teachers
• Only program that introduces 5th grade student to computer aided design engineering and 3D manufacturing

Core Curriculum Areas

A. Physics (3.5hrs):
   (1) Newton’s Three Laws of Motion
   (2) Fluid Mechanics and Aerodynamics

B. Chemistry Sciences (3.5hrs)
   (1) Building Blocks of Matter
   (2) Physical and Chemical Changes
   (3) Atmospheric Properties

C. Technology (4.0hrs)
   (1) Innovations
   (2) Navigation and Mapping

D. Engineering (4.0hrs):
   (1) Engineering Design Process
   (2) 3-D Computer Aided Design

E. Mathematics Operations and Applications (2.0hrs)
   (1) Numbers and Number Relationships
   (2) Measurement
   (3) Geometry
   (4) Data Analysis

F. STEM Careers (1.5hrs)
   (1) STEM Careers on Military Facilities
   (2) Personal Investigations
Program Efficacy

• Pre/post test show gain of 6.34 points

• Attitudes of all participants shift dramatically towards the positive

• Youth leave with feeling of empowerment

• Commanders have positive perception of the program

Program Outreach

• 76 Locations in 40 states, the District of Columbia, & Puerto Rico

• Reaching over 70,000 students annually, working with over 1200 schools in 380 school districts.

• 3 outreach programs to American Indians in SD, MS, & OK
Program Costs

• Academy cost: $330,000

• Number of students: over 75,000

• Average cost per student: $306

• Projected FY13 budget is sufficient to fund the existing operating programs
The DoD STARBASE mentoring program has been designed as a team mentoring model applying best practices from the mentoring field to the DoD STARBASE Program operating environment. In partnership with local school districts, the middle school and high school program is an afterschool STEM mentoring program that combines STEM activities with a relationship-rich, school-based environment to provide the missing link for at-risk youth making the transition from elementary to middle school, and from middle school to high school. It extends the positive impact of STARBASE through a team mentoring approach which solidifies students' attachment to, and engagement with, school. Mentoring clubs are expected to meet no less than four hours per month.

Outcomes for Participating Youth

- Increased STEM interest and knowledge
- Reduced high-risk behavior
- Increased engagement with school
- Increased career awareness

Outcomes for Participating Programs

- Increased visibility, stronger relationships within community
- Growth of program at the middle school level
- Increased opportunities for volunteer engagement
- Increased opportunity to measure program’s impact
STARBASE Mentoring Model

- School-based (after school program)
- Team mentoring
- Targeting middle school students who have participated in STARBASE
- Clubs meet 4 hours per month for 6-9 months
- 3-4 mentors, 10-15 students per club
- STEM Activity-based
- Mentors with STEM careers or strong STEM interest

STARBASE 2.0 (2012)
- 6th-12th Grade
- 230 Mentors
- 700 Students

STARBASE 2.0 Activities
- Scalextric4Schools
- Robotics
- Wind Energy
- First Legos
- Forensic Science

Mentors:
- Military personnel
- Teachers
- College professors
- College students
- Business leaders
- Radar specialist
- Police & Fire officers
- Airport personnel
- Engineers from industry
Our National Priorities:

- Enhance the overall quality of our program to better achieve our vision and mission statements
- Standardize and strengthen our Core Curriculum which encourages students to consider STEM careers
- Implement exemplary activities which adheres to the newly established STARBASE national Standards and Objectives
- Expand and strengthen our relationships with our collaborators to leverage resources
- Provide professional development to administer and teach the Core Curriculum effectively
- Expand the program to serve over 100,000 students
- Expand the program to middle school students by implementing a mentoring program
- Invest in leading edge technology to prepare American youth to be innovative and capable to compete in a global economy
Program Highlights

- Over 75,000 students served
- 50% boys; 50% girls
- Over 2500 classrooms
- Over 1200 schools participated
- Over 380 school districts involved
- $306 per student
- Significant increase in attitudes
- Significant increase in knowledge
- School teachers have positive attitudes
- About 290 staff members
- Over $800,000 provided by not-for-profits
- Over 9700 volunteers providing over 102,000 hours of service

Growing Existing Workforce Capabilities

<table>
<thead>
<tr>
<th>Motivation</th>
<th>Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide support to develop and grow our current technical capabilities</td>
<td>• West Point Cadet Program</td>
</tr>
<tr>
<td>• Efficiently and effectively use our current workforce resources</td>
<td>• Section 219 funded efforts</td>
</tr>
<tr>
<td>• Mature our existing talent</td>
<td>• SMART-Retention Students</td>
</tr>
<tr>
<td></td>
<td>• Army Civilian Training, Education and Development System (ACTED)-CP 16: non-construction S&amp;E</td>
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<tr>
<td></td>
<td>• Section 852 Funds for Acquisition Training</td>
</tr>
<tr>
<td></td>
<td>• In-House Laboratory Innovative Research (ILIR)</td>
</tr>
<tr>
<td></td>
<td>• Engineering and Scientist Exchange Program (ESEP)</td>
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</table>

<table>
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<tr>
<th>Technical Ideas</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide educational opportunities for our existing workforce to develop in the expertise and career</td>
<td>• Highly qualified and secure human capital</td>
</tr>
<tr>
<td>• Broaden workforce experience through exchange opportunities</td>
<td>• Maximize our previous human capital investments</td>
</tr>
<tr>
<td>• Increase use of mentoring from our senior researchers</td>
<td></td>
</tr>
</tbody>
</table>

Maintain a vibrant, agile, well-educated cadre of Scientist and Engineers!
Program Highlights

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Contact Information:
Ernie Gonzales
Office of the Assistant Secretary of Defense for Reserve Affairs
1500 Defense Pentagon
Washington, DC 20301-1500
(703) 693-8630
Ernie.Gonzales@osd.mil
www.DODSTARBASE.org
SMART Scholarship for Service for DoD Diversity STEM Summit

Dr. Laura Stubbs

02 November 2012
SMART Scholarship Agenda

- Science, Mathematics, and Research for Transformation (SMART) Scholarship for Service Overview
  - Eligibility Requirements
  - Program Benefits

- Historical SMART Program Demographics

- SMART by Service and STEM Disciplines

- SMART Information flow

- SMART Accomplishments & Future Plans
Governed by 10 U.S. Code 2192a:

- U.S citizen
- 18 years of age or older
- Pursuing an associate (rare), undergraduate, or graduate degree disciplines that are critical to DoD
  - 19 approved STEM disciplines with interest in research
- Minimum cumulative GPA of 3.0 (on a 4.0 scale)
- Two types of students:
  - both recruitment (new, non-DoD employees) and
  - retention (current DoD employees) as scholars
- Ability to obtain/maintain a security clearance
- Ability to complete summer internships
- Willing to accept post-graduation employment with DoD
SMART Scholarship Overview
Participant Benefits

- Full tuition and fees (up to five years) for AA (very rare), BS, MS, and PhD degrees at any accredited college or university in the U.S.
- Annual stipend from $25,000 to $38,000 (Prior to 2012: $25,000 to $41,000)
- Security clearance (SECRET)
- Paid Summer internships (average 10 weeks)
- Book and health insurance allowances
- Experienced Mentor at a DoD Facility
- Post-graduation employment

At least 1:1 Post-Graduation Service Commitment
SMART Awardees – Historical (including demographics, all phases)
SMART Awardees – Historical (including demographics, all phases)
SMART Awards to HBCU/MI Participants

SMART Awards to HBCU Participants

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>1.0</td>
</tr>
<tr>
<td>2006</td>
<td>1.0</td>
</tr>
<tr>
<td>2007</td>
<td>3.0</td>
</tr>
<tr>
<td>2008</td>
<td>2.0</td>
</tr>
<tr>
<td>2009</td>
<td>1.0</td>
</tr>
<tr>
<td>2010</td>
<td>4.5</td>
</tr>
<tr>
<td>2011</td>
<td>2.0</td>
</tr>
<tr>
<td>2012</td>
<td>3.0</td>
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</tbody>
</table>

SMART Awards to MI Participants

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Participants</th>
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</thead>
<tbody>
<tr>
<td>2005</td>
<td>2.0</td>
</tr>
<tr>
<td>2006</td>
<td>2.0</td>
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<tr>
<td>2007</td>
<td>6.0</td>
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<td>2008</td>
<td>5.0</td>
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<tr>
<td>2009</td>
<td>6.0</td>
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<tr>
<td>2010</td>
<td>8.0</td>
</tr>
<tr>
<td>2011</td>
<td>7.0</td>
</tr>
<tr>
<td>2012</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Cohort Year
2012 SMART Participants (all phases)

- Army: 33%
- Navy: 30%
- Air Force: 33%
- DoD Wide: 4%
2012 SMART Participants (all phases)

2012 SMART Participants by Service & Discipline

Number of SMART Participants

SMART Disciplines

Distribution Statement A: Approved for public release; distribution is unlimited
2012 SMART Cohort
Sources of Scholarship Information

- 27%: Internet website
- 18%: Informed by a faculty member
- 12%: Learned about it in a grants office
- 10%: Saw announcement on a bulletin board
- 7%: Career or Graduate School Fair
- 4%: Government newsletter or publication
- 1%: Heard about it at a conference
- 1%: Heard about it from a friend
- 1%: Other
- 3%: Government agency
- 1%: Campus Presentation
SMART Accomplishments

Graduated SMART Scholars*

- 430 DoD-Employed, Service Commitment
- 89 DoD-Employed, Post-Service Commitment
- 19 Working Elsewhere

82% of SMART scholars work BEYOND their service commitment

SMART - Degrees Awarded

- 258 Bachelor's
- 163 Master's
- 117 PhD*

*In progress: assessment of SMART PhD recipient quality compared to national
SMART Future Plans

- **SMART Program effectiveness evaluation (DoD STEM Strategic Plan)**
- **Assess SMART mentoring and the impact of the post-service payoff (determine best practices)**
- **Increase percentage of SMART participants enrolled at HBCU/MIs through Information and Outreach**
  - Include HBCU/MIs on information material
  - Participate in HBCU/MI workshops
  - Participate in affinity and resource group functions
- **Increase participation from HBCU/MI and Women on SMART Review panels**
  - Historically, composition 50/50 between Academic and DoD personnel
  - Faculty will be better able to assist students with applications
- **Take advantage to partnerships with DoD Laboratories and agencies**
Additional Information

For general program information
http://smart.asee.org/
Email: smart@nps.edu
Phone: (831) 656-287

Program Manager(s)
Dr. Laura Stubbs
Laura.Stubbs@osd.mil

Dr. Laura Adolfie
Laura.Adolfie@osd.mil
BACK-UP SLIDES
SMART Scholarship Overview
Target Participant

Clearance Eligible

Students Pursuing Degrees in STEM Disciplines
The SMART Scholarship Process

Aug - Dec
Application

Jan
Selection

Mar - May
Awards

July
Orientation (Virtual)

Within 30 days
Hiring

Summer/Fall
Graduation

10 - 12 Weeks
Internship

Aug - May
School
SMART Participants by Facility State

Distribution Statement A: Approved for public release; distribution is unlimited
DoD Science & Technology Priorities

- Data-to-Decisions
- Cyber Science and Technology
- Engineered Resilient Systems
- Counter Weapons of Mass Destruction
- Human Systems
- Autonomy
- Electronic Warfare / Electronic Protection
High Interest Basic Science Areas

- Synthetic Biology
- Modeling of Human Behavior
- Engineered Materials
- Cognitive Neuroscience
- Quantum Systems
- Nano Science and Engineering