



# U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND SOLDIER CENTER

Army Research and Development Programs

Dr. Richard J. Green

Director

Soldier Protection Survivability Directorate

10/29/2019 [U19-1617]



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## AGENDA



- **Up Front Key Takeaways**
- **Who Are We**
- **What Do We Do**
- **Current Research Program Priorities/Key Platforms**
- **How To Work With Us**
- **What's the Benefit**

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## KEY TAKEAWAYS



- **Combat Capabilities Development Command Soldier Center (CCDC-SC) is the Army focal point for (6.2-6.3):**
  - Organizational Clothing and Individual Equipment (OCIE)
  - Personal Protective Equipment (PPE)
- **Opportunities on development of actionable knowledge products, test methodologies, novel materials, components and systems**
  - Technology or product may be transitioned to PEO Soldier for continued development or adoption
- **<https://nsrdec.army.mil/#/workwithus> is the best website to go to for points of contact and information on how to work with CCDC-SC**
- **Thrust Area Managers (TAM)s are the best people to talk with about program opportunities and future technical gaps**

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# CCDC SOLDIER CENTER

## Natick Soldier Systems Center Natick, MA



**Mission**  
Optimize and modernize Soldier/squad performance, and increase combat readiness and lethality in order to ensure dominance in multi-domain operations.

## Central Florida Research Park Orlando, FL



**Vision**  
Use science and engineering expertise, combining collaboration with our industry, DoD, and academia partners in the innovation ecosystem to advance Soldier and squad performance optimization, readiness, lethality, and synthetic training environments.



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# ARMY FUTURES COMMAND (AFC)

**GEN John M. Murray**  
CG AFC

**CSM Michael A. Crosby**  
CSM AFC

Cross Functional Teams

AI Task Force ☆

Army Application Lab 🏆

System Integration ☆

**Director, Futures & Concepts** ☆☆☆

- Identifies and prioritizes capability development needs and opportunities
- Writes and integrates requirements
- Develops the threat OE
- Develops operating concepts including future organizational designs
- Establishes modernization strategy and provides top down mission guidance
- Conducts modeling, simulation & experimentation for concept refinement

**CG, Combat Capabilities Development Command** ☆☆☆

- Conceptualizes and develops solutions for identified materiel needs and opportunities
- Integrated and aligns Army S&T with modernization priorities
- Transitions knowledge products and materiel solutions to shape concepts and inform requirements
- Provides R&D, analysis and engineering support to capability development, PMs/PEOs and LCMCs

**Director, Combat Systems** ☆☆☆

- Refines and engineers developed materiel solutions
- Produces and delivers materiel solutions
- Administers post MDD Acquisition schedule and activities
- Manages production and deployment
- Handles other acquisition activities - 804 authority expert

**SECARMY Priorities**

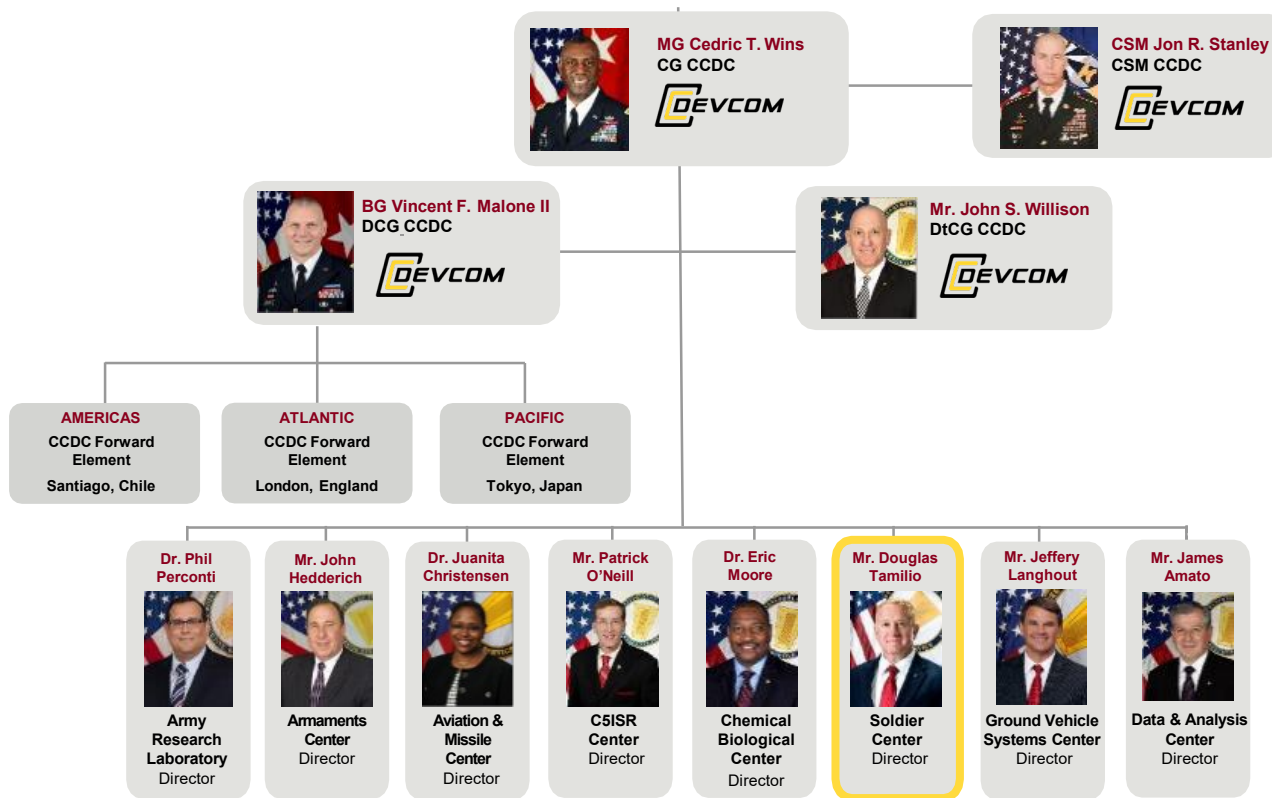
- Establish readiness for countering global threats to the US and our allies
- Support modernization with the best weapons and equipment available to guarantee clear overmatch in future conflicts
- Reform and streamline business practices to optimize use and effectiveness of funding and manpower, while maintaining agility

**CSA Priorities**

- Army Readiness
- Future Army (S&T, R&D)
- Take Care of the Troops



# COMBAT CAPABILITIES DEVELOPMENT COMMAND (CCDC)

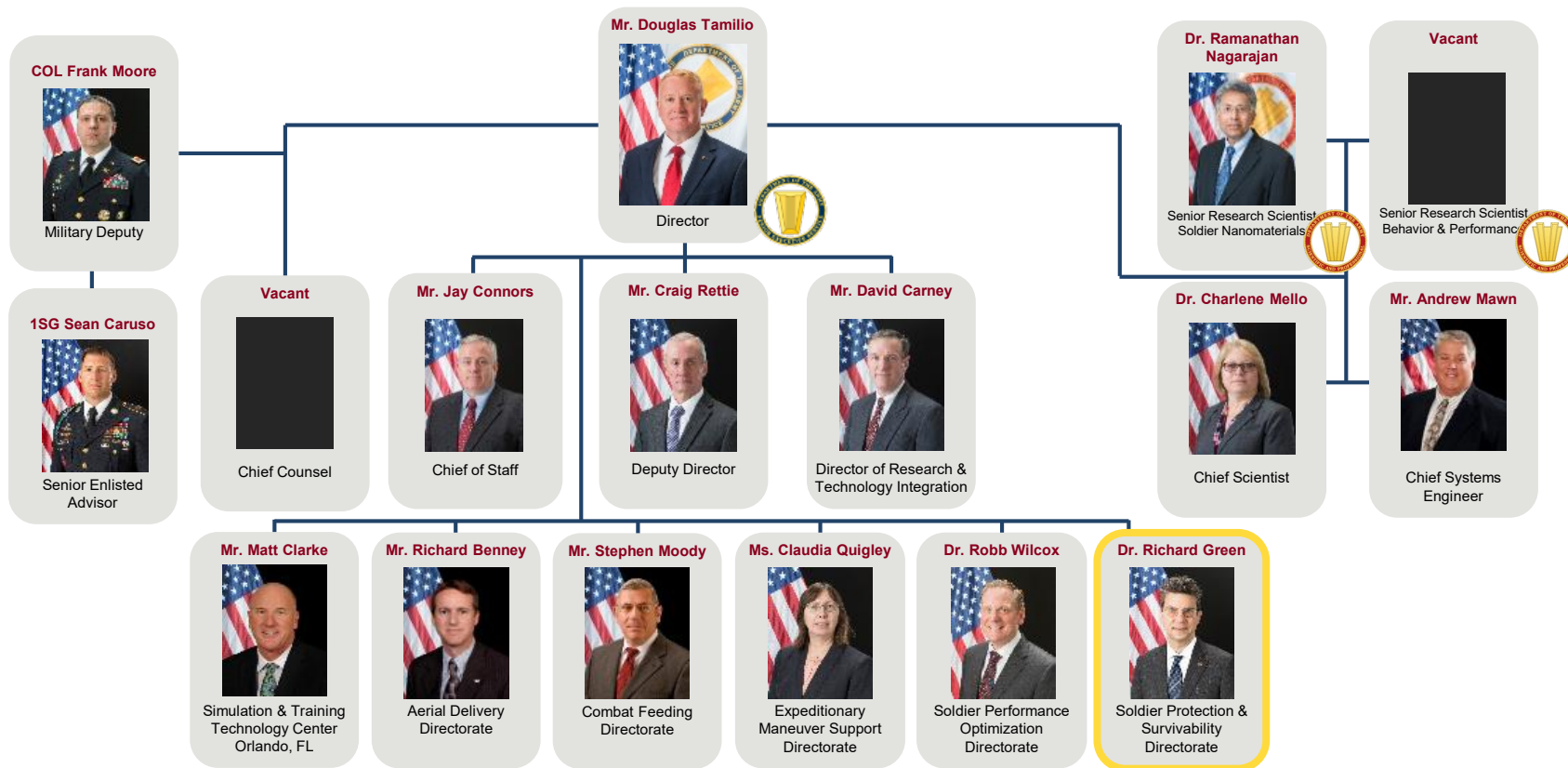


PREEMINENT LEADERS IN RESEARCH, DEVELOPMENT AND ENGINEERING

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# CCDC SOLDIER CENTER



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# CCDC SOLDIER CENTER DIRECTORATE MISSION AREAS



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Core Competencies

- Aerial Delivery Military Nutrition/ Food Service Log
- Individual/ Collective Protection
- Soldier Performance/ Integration
- Material Science – Fiber/Textile
- Army Training Tech

## AERIAL DELIVERY

- Parachutist Safety and Military Freefall
- Parachute Design and Aircraft Integration
- Airdrop Sensor Integration
- Precision Airdrop
- Airdrop Modeling, Simulation and Data Analytics
- Aerial Delivery Materials Research



AAIRDUCT OV-1

## DOD COMBAT FEEDING

- Reduction of Combat Load and Class 1 Logistics
- Nutritional Interventions for Warfighter Performance
- CBRN Protection of Food and Water
- Mechanical & Chemical Engineering for Field Feeding Systems



CCAR

## EXPEDITIONARY MANEUVER SUPPORT

- Composite Materials
- Command & Control Technologies
- Multifunctional Materials
- Collective Chemical Biological Protection
- Environmental Protection
- Camouflage, Concealment & Deception
- Ballistic Protection



CCD

## SOLDIER PERFORMANCE OPTIMIZATION

- Monitoring & Predicting Performance
- Optimizing/Enhancing Performance
- Human Augmentation
- Human Systems Integration
- Equipment Integration
- Soldier-borne Sensors
- Mission Information
- Power Integration
- Anthropology



MASTR-E

## SOLDIER PROTECTION & SURVIVABILITY

- Individual Equipment Design
- Ballistic Protection
- Sensory Protection
- Individual Hydration
- Multispectral Camouflage and Concealment
- Textile Technology
- Multifunctional Materials
- Environmental Protection
- Individual Chemical



CAPE & INSIGHT

## SIMULATION & TRAINING TECHNOLOGY

- Mixed and Augmented Reality
- Synthetic and Natural Environments
- Live Training
- Medical Technology
- Artificial Intelligence
- Adaptive Training
- Distributed Simulation
- Training Effectiveness
- Cyber Training



One World Terrain

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SOAR








# SPSD ORGANIZATION & LEADERSHIP


**Director**  
Dr. Richard Green




**USAF**  
Program Manager for  
Clothing & Textiles  
Ms. Debra McLean




**Strategic Engagements**  
Mr. Michael Codega




**Deputy Director**  
Dr. JB Wright




**Strategy Integrator**  
Mr. John Kirejczyk



**Program Integrator**  
Ms. Jaclyn Fontecchio




**Materials Science & Engineering Branch**  
Ms. Andra Kirsteins




**Warfighter Protection Branch**  
Mr. Kenneth Ryan


**Thrust Area Managers**




Detectability  
Mr. Jeff Dunn




Susceptibility  
Dr. Shaun Filocamo




Vulnerability  
Mr. Ben Fasel




**CB Innovative Material & Ensemble Development Team**  
Ms. Nazi El Samaloty




**Optical & Electromagnetic Materials Team**  
Ms. Diane Steeves




**Infantry Combat Equipment Team**  
Mr. Robert DiLalla




**Design, Pattern & Prototype Team**  
Ms. Annette LaFleur




**Disruptive Materials & Fibers Team**  
Mr. Donald Lee




**Textile Material Evaluation Team**  
Ms. Karen Buehler




**Soldier Clothing & Configuration Management Team**  
Mr. Al Adams (A)




**Fiber Project Team**  
Mr. Thomas Rohnstock



**Emerging Materials Development Team**  
Mr. Thomas Tiano (A)



**HEROES at UML**  
Dr. Chris Drew



**Soldier Protection & Individual Equipment Team**  
Mr. David Phelps

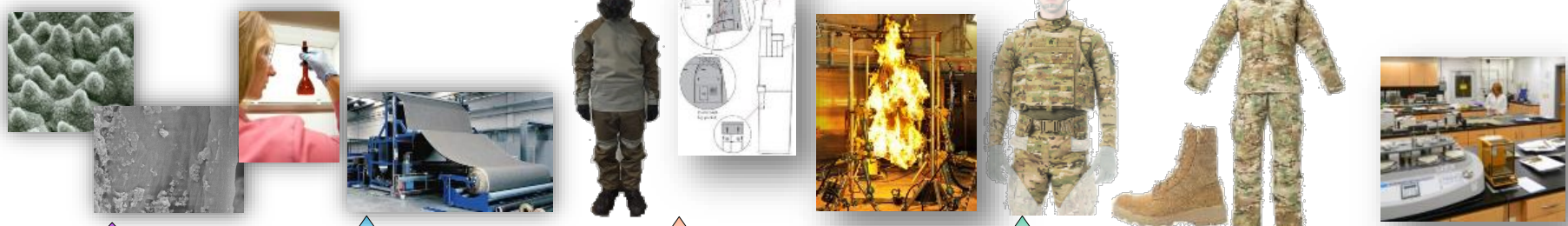
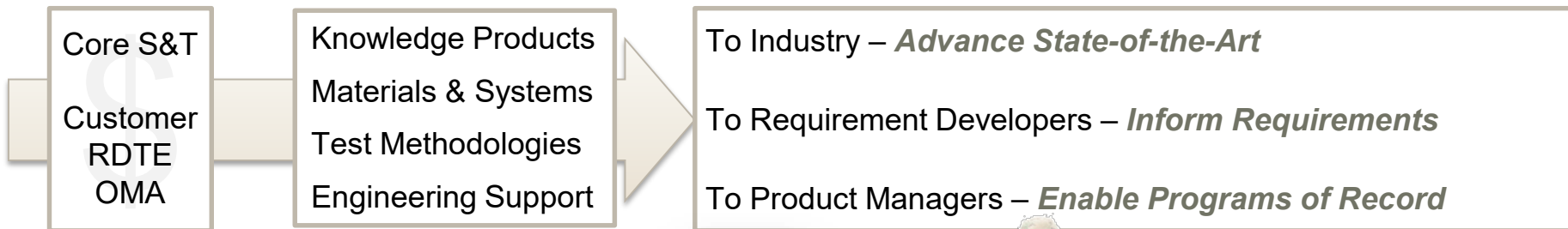
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# SPSD THROUGHOUT THE LIFE CYCLE



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# PARTNERSHIPS AND CUSTOMERS



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## SPSD Leads Communities of Practice in Ballistic & Blast Protection and Integrated Protection

S&T

Requirement Developers

Product Managers



## SPSD Chairs the Cross Service Warfighter Equipment Board And Multiple Work Groups, including:

- Flame Resistance
- Cold Weather
- Requirements



## SPSD Co-Leads Army Total Life-cycle Management for Organizational Clothing & Equipment



## SPSD Maintains Robust Partnerships with Chemical and Biological Defense Community



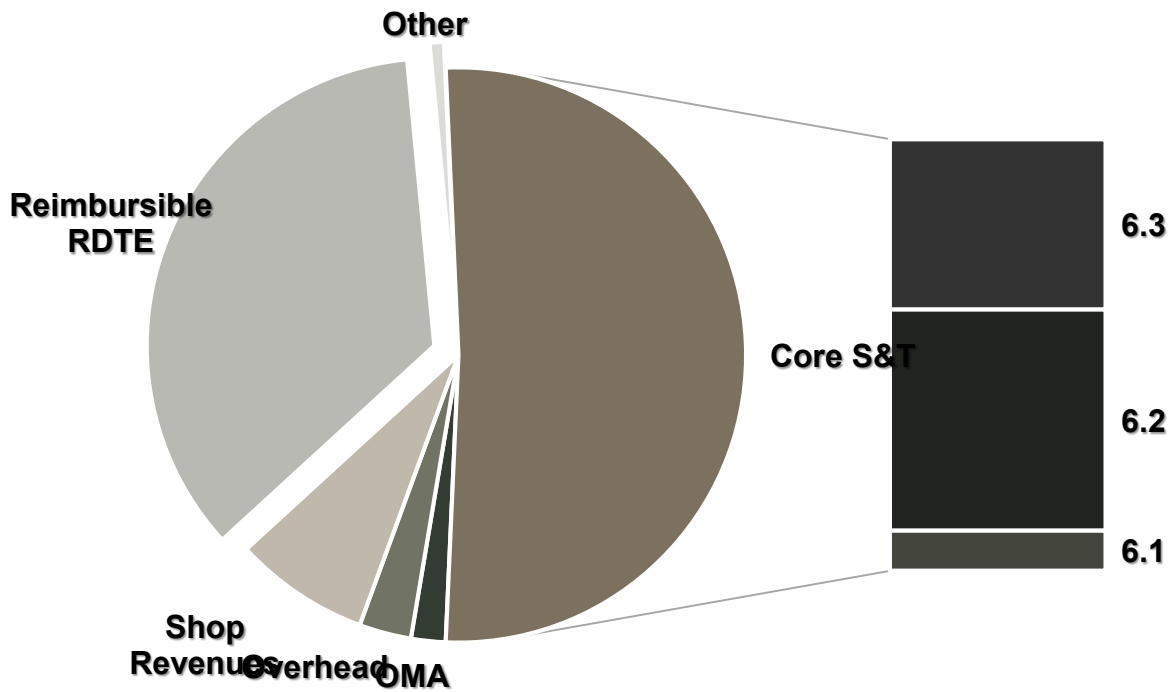
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# SPSD FUNDING PROFILE



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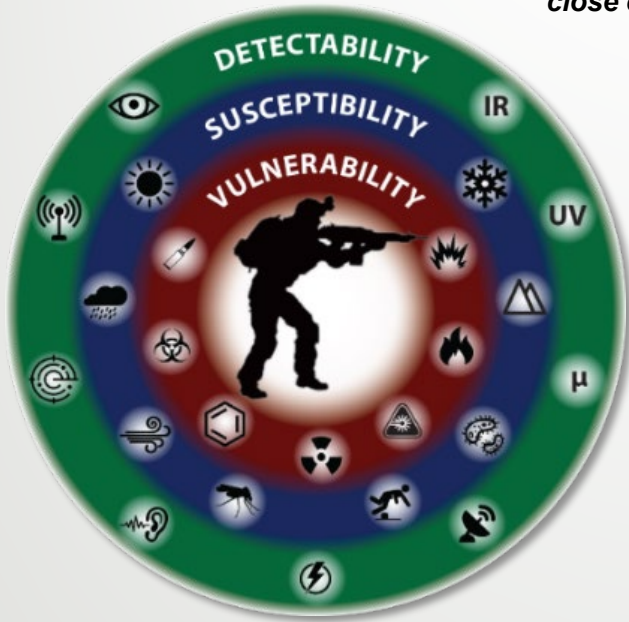


# UNDERSTANDING THREATS AND SURVIVABILITY



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*Developing Protection and Survivability-related technologies to disrupt the enemy's kill chain in close combat.*



- Identify the Threats
- Understand the Mechanisms
- Develop Defeats
- Integrate with Soldier
- Validate Results

*Actionable Knowledge Products that Inform Decisions*



*Novel Materials, Components and System Prototypes*



*Test Methods Tied to Operations and/or Injury Mechanisms*





# CURRENT RESEARCH PROGRAM PRIORITIES



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## Vulnerability

- **Head Protection** - State-of-the-art materials, manufacturing techniques & test methods
- **Torso Protection** – Improved small arms protection and improved test methods



## Susceptibility

- **Flexible Textile Protection** – Multi-functional materials and coatings for multi-threat protection
- **Individual Soldier Hydration** – Purification and desalination to support extended mission duration

## Detectability

- **Camouflage & Concealment** – Protection from multiple sensor threats across the electromagnetic spectrum

## Chemical & Biological Protection

- **Percutaneous protection:**
  - Novel materials and manufacturing Scale-up
  - CB garment design, prototyping and manufacturing scale-up
  - Swatch and whole garment system assessment
  - Joint funding through DTRA



## Engineering Support to Acquisition PMs

- **Development & Engineering Support** to PEO Soldier, Navy, Marine Corps, USAF, Joint PMs and DLA who field organizational clothing and individual equipment
- Customer-funded labor, development and test



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# PROTECTION & MOBILITY AS KEY ENABLERS OF SOLDIER LETHALITY



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## Army Modernization Priorities

**“Soldier lethality that spans all fundamentals – shooting, moving and communicating, protecting and sustaining. We will field not only next generation individual and squad combat weapons, but also improved body armor, sensors, radios, and load-bearing exoskeletons ...”**

US Army CSA & SEC ARMY  
03OCT2017

## Survivability Priorities and Enduring Challenges

- Self-hydration
- Camouflage, Concealment, and Deception
- Extreme and Austere Environments
- Ballistic and Blast protection
- Directed Energy Protection
- Chemical and Biological Protection

## Soldier Lethality ICD\*:

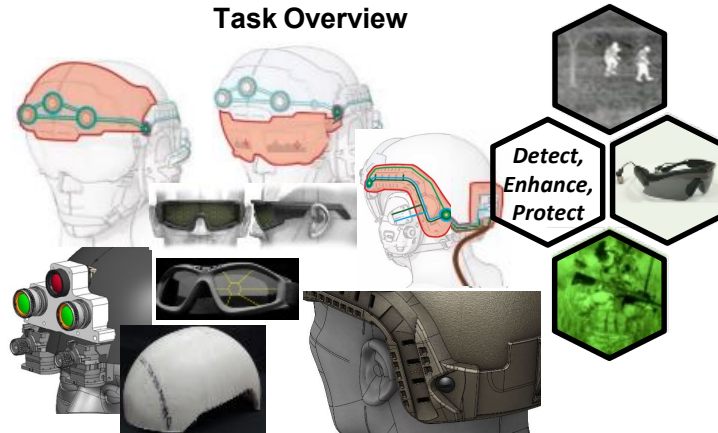
- Lethality
- Mobility
- Communication
- Situational Awareness
- Protection
- Survivability
- Training & Human Performance

\*CARDS No. 02146 11JUL2018

**Capability at reduced weight, bulk and stiffness**

# INTEGRATED SURVIVABILITY & DIGITAL HEADBORNE TECHNOLOGY (INSIGHT)

## Task Overview



## Progress

- **What was accomplished in the last 12 months?**
- Utilizing congressional funding, Soldier Center executed OTA contract vehicles with two primes for Alpha prototypes
- Completed PDR
- Demonstrated fused digital imagery of low light level and thermal cameras onto see-thru HUD
- Conducted power analysis
- Conducted data processing and visual pipeline analysis
- **What are the projected accomplishments in the next 12 months?**
- Conduct critical design review in November
- Delivery of 24 prototype systems 4QFY20

## Overall Task Design

- **Project Endstate:** What are you trying to accomplish?

Develop and transition a helmet-based platform that will streamline the systems engineering and integration of critical survivability, situational awareness, power & energy, and Soldier lethality headborne capabilities. Integrate critical technologies to demonstrate through user evaluations the performance increase in Soldier lethality and survivability as well as define technology and human factors integration gaps. Develop a foundational platform to support technology, and integration paths for advancement in headborne system technology focused on increasing Soldier survivability and lethality.

- Headborne system demonstrators
  - Helmet agnostic, physical external power and data rail
- Technology gap identification
  - Wireless data transfer
  - Human factors and HMD display requirements
  - Power and processing requirements

## Timeline

Critical Technologies	3	4	FY21	FY22	FY23	FY24	FY25	FY26
Alpha Prototype Development	K	K	K					
Human Systems Integration				4		6		
Power & Data Integration Bus					3			6
Hearing Protection & AR					3			6
Variable transmission display				5		6		
Small Arms Protective Shel Blast Protection (Overpressure and blunt impact)					3			6
Funding (BA 6.3) \$M								

- High-energy small arms protection and blast overpressure mitigation



# COMBAT PROTECTIVE ENSEMBLE (CAPE)

## Task Overview



## Progress

- **What was accomplished in the last 12 months?**
- Program reviews and capability workshops were held 4QFY19 to assess 6.2 project progress and capability integration for first CAPE demo platform.
- **What are the projected accomplishments in the next 12 months?**
- Consolidate and prioritize capabilities for integration based on feasibility and TRL assessment.
- Brief Soldier Lethality CFT and MCDID for guidance, input, validation and verification of next generation uniform capabilities.
- Finalize program plan for FY21 execution

## Overall Task Design

- Significantly reduce the weight of Soldier worn protective equipment system through integration of multi-functional materials.
- The CAPE Program will deliver and demonstrate Soldier worn protection and survivability technology for squad or larger demos.
- Material development efforts under signature management, environmental protection and ballistic protection are assessed for compatibility and integration at the lowest possible level (i.e. fiber, fabric, flexible substrates/membranes)
- Develop and integrate new body armor and load carriage subsystems to reduce Soldier physical burden and improve Soldier system integration of personal protective equipment.
- Conduct annual squad level demonstrations in multiple environments

## Timeline

Critical Technologies	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Body armor and load carriage frame, with integrated power & data hot shoes for e-textile integration			4				
Extended mission/sustainment load carriage system design with body armor integration			4				
Multi-spectral passive camouflage integration			4				
Ballistic fragmentation protection integration			5				
Extreme Cold Weather Integration			5				
Ultra-light Jungle configuration							
Funding (BA 6.3) \$M	-	-					



# TECHNOLOGY READINESS LEVELS (TRL)

- *TRLs are used to estimate the maturity of a technology, component or system*
- *Only funds from an appropriate Budget Activity (BA) may be expended on RDT&E efforts at a particular TRL*

TRL	Definition	Description	BA
<b>1</b>	Basic principles observed and reported.	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.	<b>6.1</b>
<b>2</b>	Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.	<b>6.2</b>
<b>3</b>	Analytical and experimental critical function and/or characteristic proof of concept.	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.	
<b>4</b>	Component and/or breadboard validation in laboratory environment.	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.	<b>6.3</b>
<b>5</b>	Component and/or breadboard validation in relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.	
<b>6</b>	System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment.	<b>6.4</b>
<b>7</b>	System prototype demonstration in an operational environment.	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.	
<b>8</b>	Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.	<b>6.5</b>
<b>9</b>	Actual system proven through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.	

Product Manager

CCDCs/Lab

Product Manager

CCDCs/Lab

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## TECHNOLOGY TRANSFER MECHANISMS



### Flexibility through *non-funded* federal partnering agreements

#### Cooperative Research and Development Agreements (CRADAs)

- One or more federal laboratories working with one or more non-federal partner(s) toward a common R&D objective.

#### Testing Service Agreements (TSA)

- Straight fee-for-service testing, not a collaborative effort.
- Customer owns all test data, Gov't release is prohibited

#### Patent License Agreements (PLAs)

- Non-exclusive, partially exclusive, or exclusive.

#### Educational Partnership Agreement (EPA)

- For the purpose of encouraging and enhancing study in scientific disciplines at all levels of education.

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# COOPERATIVE AGREEMENT FUNDING OPPORTUNITY



Under a Cooperative Agreement, a principal purpose is to transfer a thing of value to the recipient to carry out a public purpose of support or stimulation authorized by law of the U.S. instead of acquiring property or services for the direct benefit or use of the U.S. government

## Cooperative Agreement (CA)

- Public Benefit
- Substantial involvement is expected between the agency and the recipient
- Funding Agreement
- Rigid Patent Rights

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# OPPORTUNITIES FOR FUNDED CONTRACTS

BAA and Unsolicited Proposals must comply with the FAR but still provide the offeror with more flexibility than a typical contract solicitation.

- The BAA is an open solicitation for proposals.
- It is funded to fulfill requirements for scientific study and experimentation.
- The BAA does not focus on specific systems or hardware.
- The solicitation is divided into topic groups that are of **innovative** interest to the sponsor; that are **independently** originated and developed by the offeror; and that are **prepared** without Government endorsement or involvement;
- Include sufficient detail to permit a proper evaluation;
- Not be an advance proposal for a known agency requirement;

## Broad Agency Announcement (BAA)

## Unsolicited Proposals (UP)

BAA and UP are always subject to availability of appropriate agency research funds in a fiscal year. Funds are limited, and we typically plan spending 1-2 years in advance.

## Small Business Innovative Research Program

Small Business Innovative Research (SBIR) Program  
<https://sbir.defensebusiness.org/>

- For Independent Small Business (less than 500 employees)
- Phase I determines the scientific, technical and commercial merit and feasibility of the ideas submitted. Typically \$150,000 over a period of six months.
- Phase II is the major R&D effort, contracts are up to \$1 million and usually span 24 months.
- Phase III (commercialization) is the ultimate goal of the SBIR program.

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# CCDC-SC BROAD AGENCY ANNOUNCEMENT (BAA)



## C. Warfighter Systems Technologies

1. *Ballistic Protection for Individuals*
2. *Integrated Protective Headborne Equipment and Injury Diagnostic/Assessment Tools*
3. *Modular Personal Protection Equipment (MPPE) and Injury Diagnostic Assessment Tools*
4. *Chemical/Biological Protection for Individuals*
5. *Flame and Thermal Protection for the Individual Soldier*
6. *Biotechnology*
7. *Countersurveillance*
8. *Body Worn Interactive Materials*
9. *Body-Worn Systems, Hand Held Devices, and Smart-Lightweight Electronic Components/ Modules for Soldier Protection, Knowledge Management and Cognitive Improvement*
10. *Biomechanics*
11. *Materials Nanotechnology*
12. *Anthropometry*
13. *Advanced Protection, Integration Technologies/Systems and Assessment Methods*
14. *Warrior Performance*
15. *Soldier Power Sources, Power & Data Distribution and Management*
16. *Future Warrior Technology Integration*
17. *Technology Assessment and Simulation Tools*
18. *Ecological Approach to Warfighter Survivability; Perception-Action-Cognition*
19. *Tactical Medical Equipment and Systems*
20. *Integrated Sound, Light and Blast Management for the Ears and Eyes*
21. *Soldier Centric Information Portrayal & Management Technologies*

<https://nsrdec.army.mil/#/workwithus>



Additional Information and POCs  
for each area are listed in the BAA

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# BROAD OTHER TRANSACTIONS AUTHORITY ANNOUNCEMENT (BOTAA)



**What is considered a prototype project?** A prototype project can generally be described as a preliminary pilot, test, evaluation, demonstration, or agile development activity used to evaluate the technical or manufacturing feasibility or military utility of a particular technology, process, concept, end item, effect, or other discrete feature. Prototype projects may include systems, subsystems, components, materials, methodology, technology, or processes.

**What is a non-traditional defense contractor?** as per 10 USC 2302(9) this is an entity that is not currently performing and has not performed, for at least the one-year period preceding the solicitation of sources by the Department of Defense for the procurement or transaction, any contract or subcontract for the Department of Defense that is subject to full coverage under the cost accounting standards prescribed pursuant to section 1502 of title 41 and the regulations implementing such section.

**What does Non-FAR Based Agreement mean?** The resultant award of any OTA using the procedures under CCDC-SC BOTAA are NOT made or issued under the provisions of the Competition in Contracting Act of 1984 (P.L. 98-369), FAR Part 6 or any other FAR based regulation. However, the information provided in the BOTAA is intended to ensure competitive procedures are used to the maximum extent practicable when entering into agreements to carry out these prototype projects.

*“This Solicitation provides an opportunity for nontraditional defense contractors to work with the CCDC-SC on mission enhancing prototypes. This new form of contracting vehicle is Non-FAR Based and can be utilized for rapid prototype development.”*

<http://www3.natick.army.mil/NSRDEC-BOTAA.aspx>

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The screenshot shows a web browser window displaying the CCDC Soldier Center website. The address bar shows the URL <https://nsrdec.army.mil/#/workwithus>. The browser menu includes File, Edit, View, Favorites, Tools, and Help. The website header features navigation links for DOD, ARMY, AFC, and CCDC. The main heading is "CCDC Soldier Center" with the subtitle "Development Command Soldier Center". Below this is a "WORK WITH US" section with the text "Business and Outreach Team". The page content is divided into two columns. The left column provides contact information for three offices: Office of Research and Technology Applications (508-233-4184, DSN 256-4184; [usarmy.natick.rdecom-nsrdec.mbx.publicinquiry@mail.mil](mailto:usarmy.natick.rdecom-nsrdec.mbx.publicinquiry@mail.mil)), Office of the Small Business Advocate (508-233-4184, DSN 256-4184), and Small Business Innovation Research (508-233-5372, DSN 256-5372). The right column contains two call-to-action buttons: "DOWNLOAD THE BAA" and "DOWNLOAD THE GUIDEBOOK".

<https://nsrdec.army.mil/#/workwithus>

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## BENEFIT



- **Programs will improve Soldier Lethality and Survivability**
- **Programs will improve Soldier Quality of Life in the Field and After Deployment**
- **Programs are a source of Revenue with Potential for follow on Production Contracts**

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# SOLDIER PROTECTION & SURVIVABILITY POINTS OF CONTACT



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Engineering Center  
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## COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRADA)



### Presumes alignment of government and commercial/academic technical objectives

- Federal partners can provide personnel, services, facilities, equipment, but no funds to non-federal partners.
- Non-federal partners can provide personnel, services, facilities, equipment, and funds.
- Each party retains ownership of solely invented IP and joint inventions will be jointly owned.
- Federal government retains a non-exclusive license to all IP arising under the CRADA, for use by or on behalf of the government.
- Government agrees to negotiate a royalty bearing exclusive license to government owned IP arising under the CRADA.

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## TESTING SERVICE AGREEMENTS



Unique federal laboratory facilities/capabilities are available to the private sector for testing purposes

- A Testing Service Agreement (TSA) is a simple two party agreement that can be turned around in a few days.
- Cost to the purchaser is equal to the laboratory's cost to provide the service.
- The purchaser retains sole ownership of the test results and the government is prohibited from disclosing data to third parties.
- The government does not derive any rights in or to the purchaser's Intellectual Property.
- The government is ***prohibited from directly competing*** with private testing service companies.

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