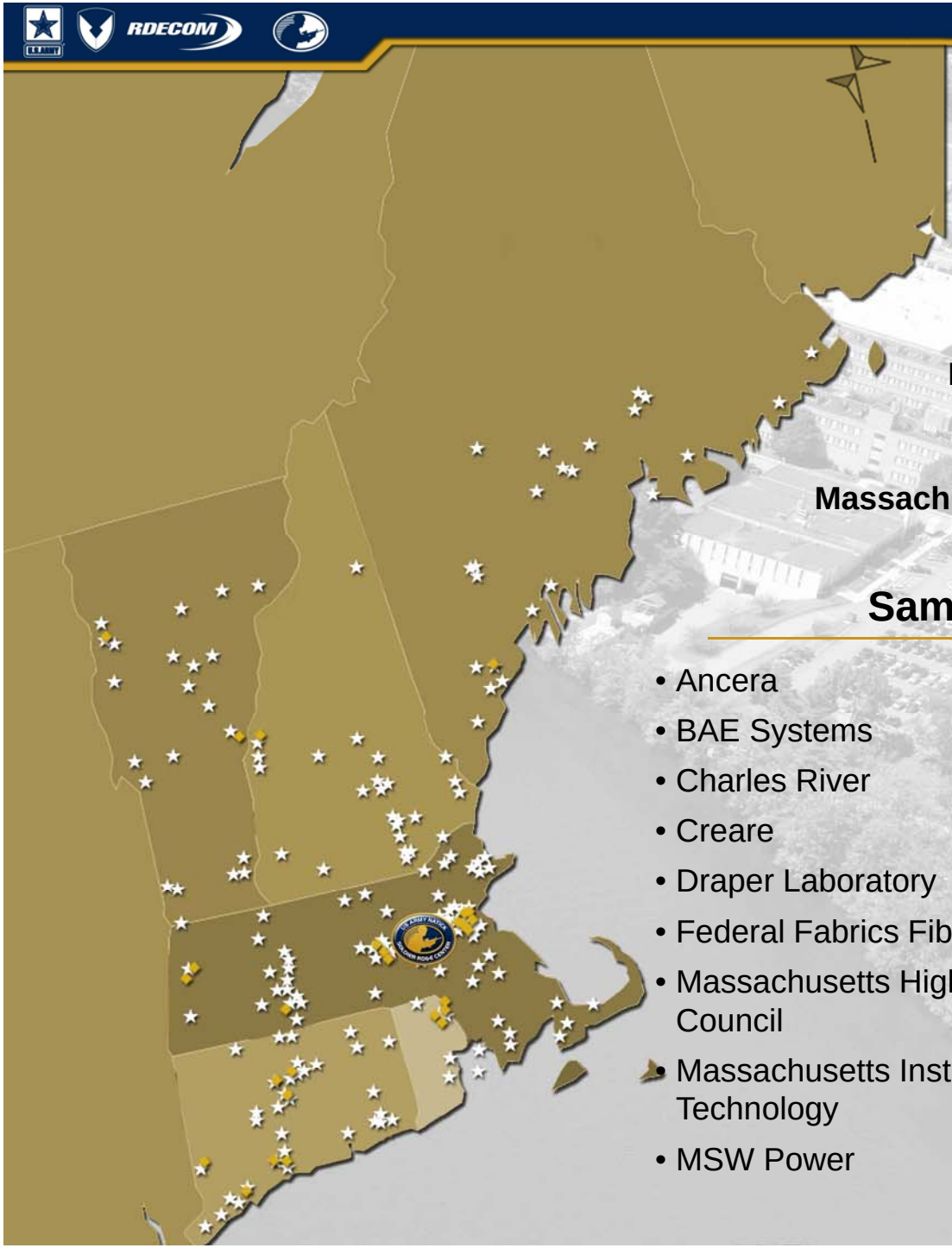
U.S. Army Natick Soldier Research, Development and Engineering Center

Science and Technology Challenges and Opportunities

Mr. Doug Tamilio

UNCLASSIFIED #U15-282



Technology

Massachusetts Ranked #1 for Science & Technology
2004, 2008, 2010, 2012, 2014
Milken Institute

Massachusetts Ranked #2 for Total R&D Expenditures
National Science Foundation

Massachusetts 1 of 6 Leading Technology States
US Census

Sample New England S&T Partners

- Ancera
- BAE Systems
- Charles River
- Creare
- Draper Laboratory
- Federal Fabrics Fibers
- Massachusetts High Technology Council
- Massachusetts Institute of Technology
- MSW Power
- Naval Undersea Warfare Center
- Novatio
- PCI
- Raytheon
- Technology Products, Inc.
- Technical Solutions Experts, Inc.
- TIAX
- Triton Systems, Inc.
- TSE
- Wizbe Innovations

Natick Soldier RD&E Center

The Leader in Empowering the World's Most Capable Soldiers

Adding Value Through:

- Basic Science
- Technology Generation, Application, and Rapid Fielding of the Right Equipment
- Soldier Systems Technology Integration and Transition
- Solving Field Problems Rapidly

RDECOM Organization

GEN David G. Perkins
CG TRADOC

GEN Dennis L. Via
CG AMC

Ms. Heidi Shyu
ASA(ALT) & AAE

U.S. ARMY RDECOM®

MG John F. Wharton
CG RDECOM

CSM James P. Snyder
CSM RDECOM

Mr. Jyuji D. Hewitt
Deputy Director RDECOM

BG Thomas H. Todd III
DCG RDECOM

- RFEC Atlantic
- RFEC Pacific
- RFEC Americas

AMRDEC
Aviation & Missile Research, Development & Engineering Center

ARDEC
Armaments Research, Development & Engineering Center

CERDEC
Communications-Electronics Research, Development & Engineering Center

ECBC
Edgewood Chemical Biological Center

NSRDEC
Natick Soldier Research, Development & Engineering Center

TARDEC
Tank Automotive Research, Development & Engineering Center

ARL
Army Research Laboratory

Technical Portfolio and Executing Structure

INVESTMENT PORTFOLIOS

Human Systems Integration & Performance	Individual Multi-Threat Protection	Force Projection & Sustainment

ORGANIZATIONAL UNITS

Joint Service Combat Feeding

Expeditionary Basing/Collective Protection

Soldier Systems Engineering Architecture (SSEA)

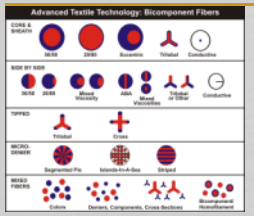
Warfighter
(Materials, Human Sciences, Mission Equipment, Clothing and Protective Equipment)

Airdrop/ Aerial Delivery

Unique Capabilities that Foster External Industrial/Academic Partnerships

Center for Military Biomechanics Research

Allows for 3D analysis of movement, measurement of external forces on the body, monitoring of muscle activity, assessment of O_2 consumption, and real-time mapping of pressure patterns



High Performance Fiber Facility

One of a kind bi/tri-component fiber extrusion capability that enables the exploration of lightweight and reactive/ responsive multi-functional fibers

Doriot Climatic Chambers

Tests the limits of human performance under extreme conditions. Primarily used for human research, where a dedicated group of Soldiers perform as human research volunteers.

Ouellette Thermal Test Facility

Includes a propane fire cell, flame & thermal lab, laser lab, and CO_2 laser

3D Laser Scanning Lab

Whole body & head/face laser scanning system that enables measurements for current and next generation armor and helmet systems

Cognitive Performance Lab

Virtual Reality & Mobile Cognitive Assessment Platform Capabilities

Polymer Film CoE

Enables R&D of new plastics and nanocomposites formulations at lab scale production level

Base Camp Integration Lab – PM Force Sustainment Systems

Based at Fort Devens - Team Effort (Active and Reserve)
Two 150 man Force Provider Expeditionary Base Camps
Test and Improve Current Component Systems Develop New Technologies for Future Use – Power & Water
Great Potential to Expand

Joint Research Innovation Collaboration

Harnessing Emerging Research Opportunities to Empower Soldiers (HEROES)

- **Overall Goal:** create a joint research center to catalyze new ideas and innovations to empower Warfighters. Partnering for S&T Horizon Forecasting.
- **Collaborative Research Projects** addressing Soldier survivability, sustainability, mobility, combat effectiveness and field quality of life funded by a variety of sources
- **Shared facilities** – 5,000 sq ft

Center for Applied Brain & Cognitive Sciences

- **Overall Goal:** Engage multidisciplinary scientists to advance state of the art brain and cognitive sciences.
- **Collaborative Research Projects** understand, monitor, predict, and optimize perceptual and cognitive performance of individuals and teams working in high-stakes environments
- **Shared facilities** – 2,800 sq ft currently & 3,200 more planned to include virtual reality space

Partnership Opportunities

How to do Unfunded Business with NSRDEC

http://nsrdec.natick.army.mil/media/print/DoingBusiness-Guidebook_Web.pdf

I. **Unfunded Collaboration Mechanisms**
- Cooperative Research and Development Agreement (CRADA)
- Testing Service Agreement (TSA)
- Patent License Agreement (PLA)
- Educational Partnership Agreement (EPA)
- Intergovernmental Personnel Agreement (IPA)

II. **Opportunities for Funding**
- Small Business Innovation Research (SBIR)
- Rapid Innovation Fund (RIF)
- Broad Agency Announcement (BAA)
- Unsolicited Proposal (UP)
- Open, Competitive Solicitations on fedbizops

Small Business Innovation Research

- Topics are announced on FedBizOps through the SBIR portal at https://sbir.defensebusiness.org/
- Phase 1 / Feasibility of Topic: Topics are released and small businesses submit 6 month, $150K proposals during open solicitation.
- Phase 2 / R&D of Effort: Phase I awardees submit subsequent 2 year, $1M proposals.
- FY16 topics will be released to small business today, December 2015.

Upcoming Solicitation

SBIR Pre-release Begins December 11, 2015
Solicitation Opens January 11, 2016
Solicitation Closes February 17, 2016 at 6:00 a.m. ET.

Small Business Innovation Research

FY15 Topics:

1. Aerial Delivery – Visual and Physical Footprint Reduction of Parachutes on the Ground

2. Combat Feeding – Continuous Mode Conveyor Cooking Appliance for Unitized Group Rations (UGR-A) for Military Field Feeding

3. Expeditionary Basing– High Pressure Resistant, Non-Powered, Flexible Chemical/Biological Protective Closure System

4. Expeditionary Basing – Adjustable Reusable Platform for Expeditionary Military Shelters

5. Warfighter – Biofidelic Headform for Evaluation of Head Protection Against Blast, Sound and Blunt Trauma Threats

6. Warfighter –Nanostructured Metal Alloy for Individual Armor

Rapid Innovation Funding

Established by Congress in 2011 to fund programs that facilitate the rapid insertion of innovative technologies into military systems or programs that meet critical national security needs.

Goal: Rapid, responsive acquisition and the engagement of small, innovative businesses in solving defense needs.

- Short-term (2 year) projects that demonstrate and deliver a capability thru S&T.
- Maximum funding per project is $3M.

$225M

Total OSD funding available in 2015

$50M

Army funding available in 2015

RIF BAA Results since 2011

16 proposals funded against NSRDEC requirements.
Total NSRDEC facilitated industry funding = $30,402,000.
5 funded projects were awarded to New England companies.

Broad Agency Announcement (BAA)

- NSRDEC funds extramural research programs via contracts, grants, or cooperative agreements.

  http://www.grants.gov

- The BAA is continuously open, and accept proposals on a rolling basis. Pre-proposals may be submitted and will be evaluated at any time throughout the year.

  http://www3.natick.army.mil/NSRDEC-Broad-Agency-Announcement.aspx

The BAA is Continuously Open

BAA For Basic and Applied Research

Solicitation Number: W911QY-15-R-0016

Effective from 1 March 2015 – 28 February 2020

A. Combat Feeding Equipment and Systems
B. Combat Ration Research and Development
C. Warfighter Systems Technologies
D. Expeditionary Basing, Collective Protection and Field Service Technologies
E. Airdrop – Advanced Personnel and Cargo Airdrop Systems
F. Textile Technologies
G. Modeling and Simulation
H. Warfighter Advanced Technologies
I. Sustainability Logistics-Basing, Science and Technology Objective - Demonstrations (SLB-STO-D)

Organizational Units' Challenges and Opportunities

INVESTMENT PORTFOLIOS

Human Systems Integration & Performance	Individual Multi-Threat Protection	Force Projection & Sustainment

ORGANIZATIONAL UNITS

Joint Service Combat Feeding

Expeditionary Basing/Collective Protection

Soldier Systems Engineering Architecture (SSEA)

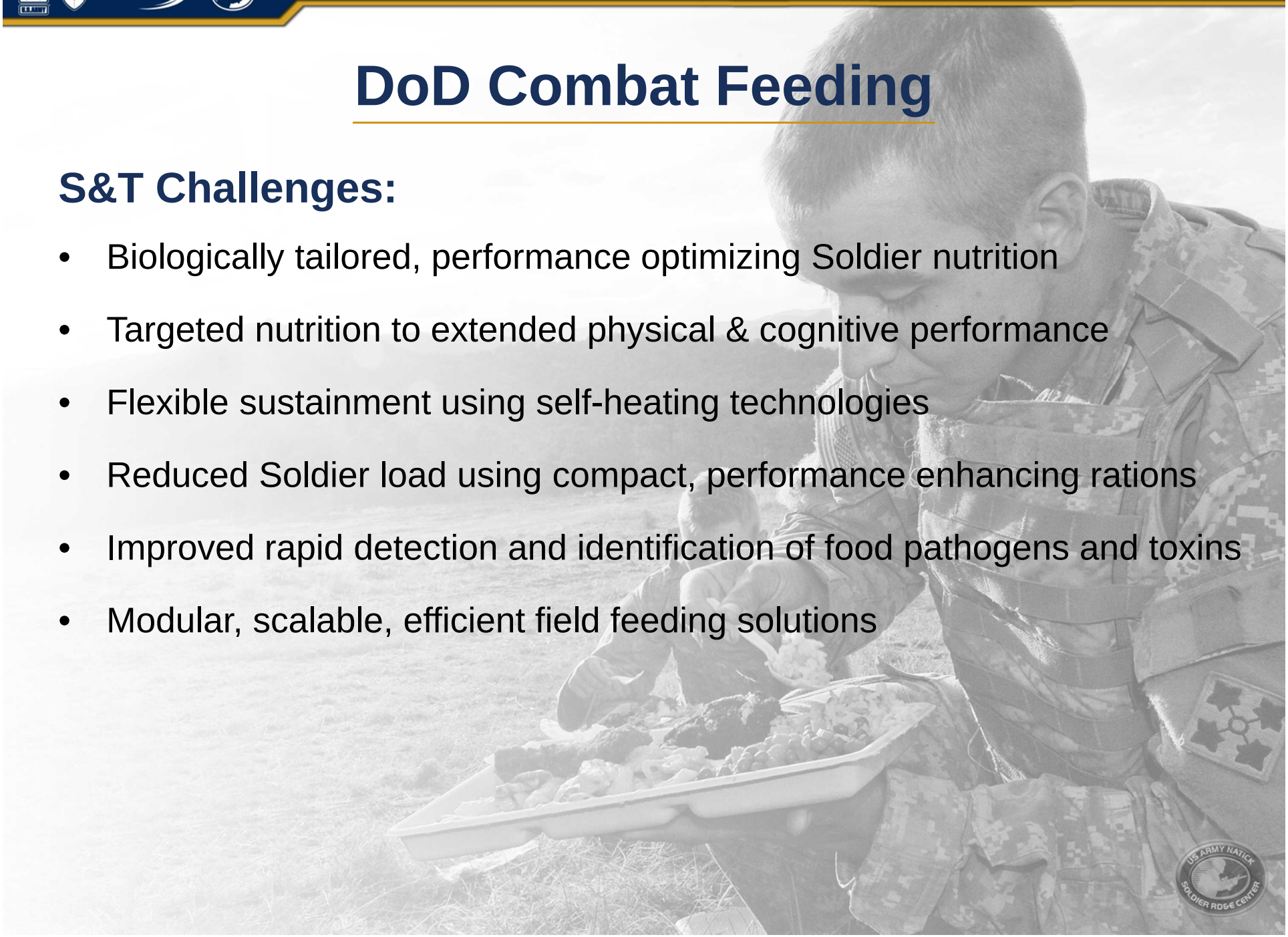
Warfighter
(Materials, Human Sciences, Mission Equipment, Clothing and Protective Equipment)

Airdrop/ Aerial Delivery

DoD Combat Feeding

S&T Challenges:

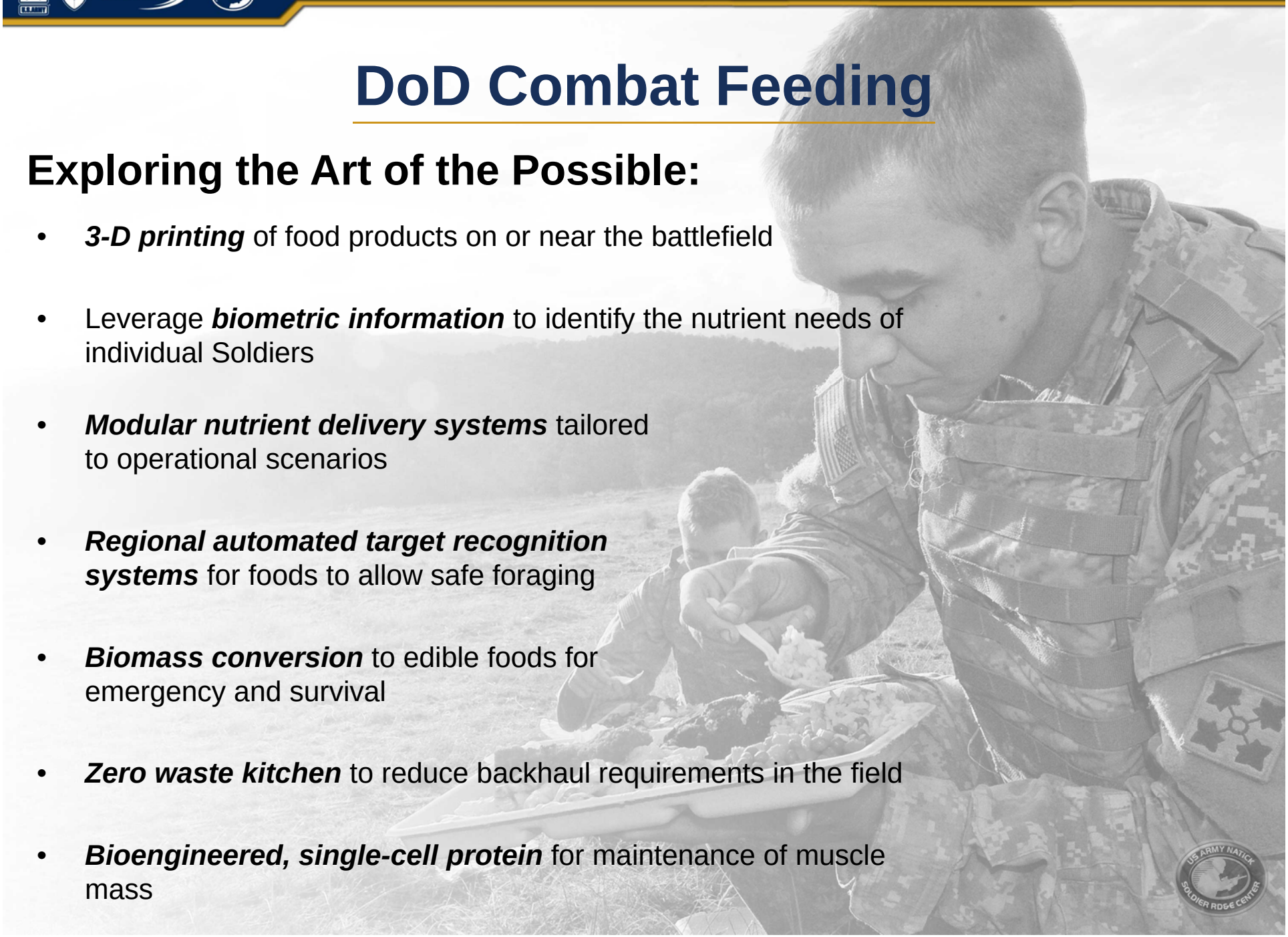
- Biologically tailored, performance optimizing Soldier nutrition
- Targeted nutrition to extended physical & cognitive performance
- Flexible sustainment using self-heating technologies
- Reduced Soldier load using compact, performance enhancing rations
- Improved rapid detection and identification of food pathogens and toxins
- Modular, scalable, efficient field feeding solutions



DoD Combat Feeding

Exploring the Art of the Possible:

- ***3-D printing*** of food products on or near the battlefield
- Leverage ***biometric information*** to identify the nutrient needs of individual Soldiers
- ***Modular nutrient delivery systems*** tailored to operational scenarios
- ***Regional automated target recognition systems*** for foods to allow safe foraging
- ***Biomass conversion*** to edible foods for emergency and survival
- ***Zero waste kitchen*** to reduce backhaul requirements in the field
- ***Bioengineered, single-cell protein*** for maintenance of muscle mass



Warfighter Directorate

- Combat Clothing & Individual Equipment
- Chemical/Biological Protective Ensembles
- Load Carriage Systems
- Camouflage & Concealment
- Soldier & Small Unit Power/Data Systems
- Mission Information & Planning Systems
- Situational Awareness Tools (micro-UAVs)
- Human Science and Engineering
- Prototyping & Testing

S&T Challenges:

- Develop and establish the Soldier (as a) System Reference Architecture.
- Develop improved hand, arm, and face protection from ballistic, blast, and flame / thermal threats.

Warfighter Directorate

S&T Challenges (cont.):

- Develop improved lightweight ballistic materials for flexible and hard armor, as well as transparent armor for eye protection.
- Develop new flame resistant fibers and textile treatments with improved performance, reduced cost (<$20/yd), domestic availability, and durability compared to FR-ACU.
- Improve protection against disease-carrying insects.
- Improve thermal regulation in cold climates while decreasing bulk and weight of clothing items.
- Decrease thermal burden in hot/humid climates.
- Demonstrate capabilities to conceal across the spectrum from visual through thermal.

Warfighter Directorate

S&T Challenges (cont.):

- Demonstrate protective eyewear (spectacles and goggles) capable of ballistic, blast, solar, sand/dust and laser protection in a single scratch- and fog-resistant lens.
- Protect Soldiers' hearing from blast overpressure and noises (steady state and impulse) with active hearing protection / enhancement fully integrated with other protection and communications equipment.
- Develop and integrate power, data and information systems on the Soldier to maximize situational awareness without cognitive overload.
- Expand availability of operationally relevant human performance evaluation tools to assess technology in both laboratory and field settings.
- Develop fundamental scientific principles underlying human augmentation for enhanced Soldier physical performance.

Expeditionary Basing / Collective Protection

- Soft Wall Shelter Systems
- Rigid Wall Shelter Systems
- Integrated Expeditionary Base Camp Systems for personal hygiene, sanitation, and mortuary affairs

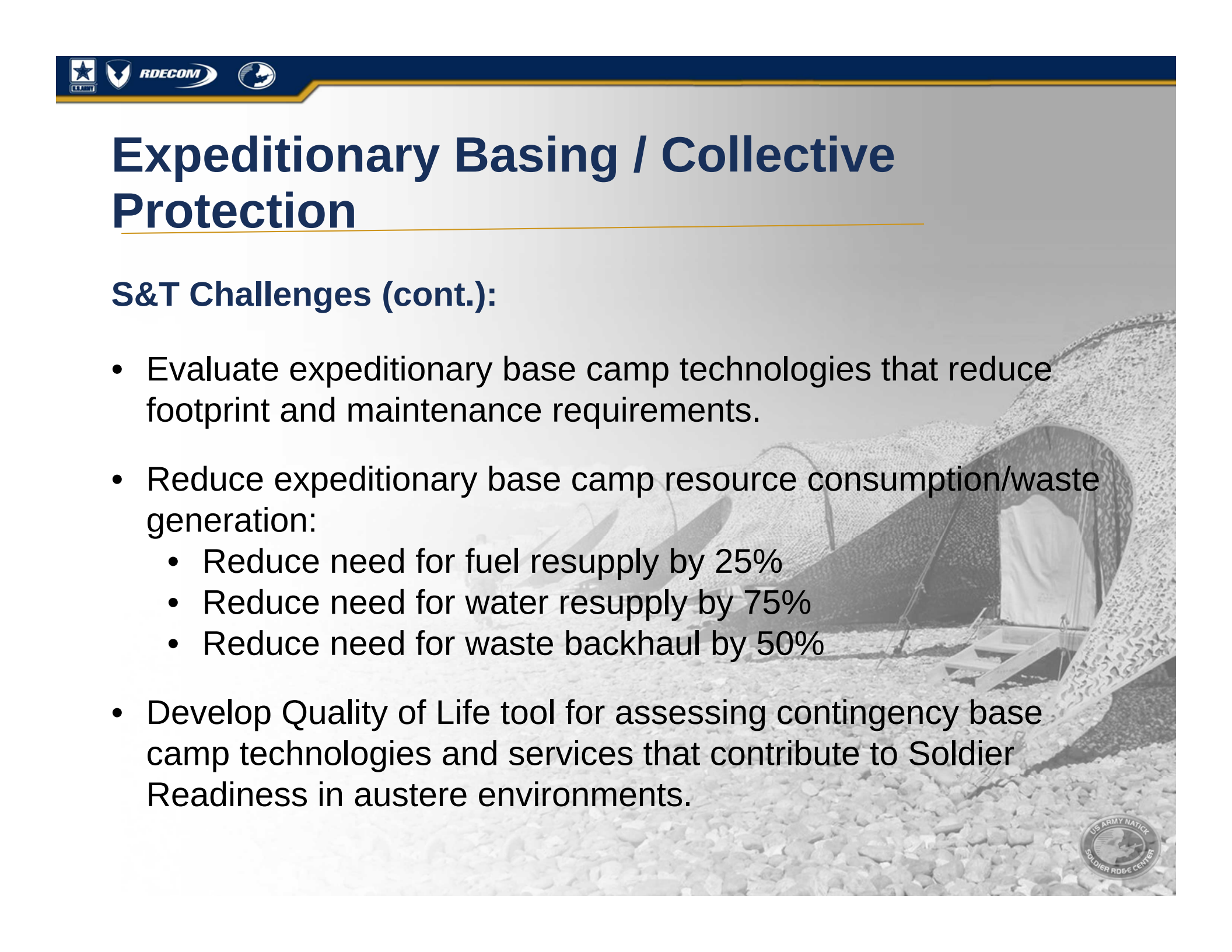
S&T Challenges:

- Advance designs and materials for multi-functional tactical habitats in diverse geographical climates and locations.
- Identify rapidly deployable base camp habitat and organizational equipment systems that enhance expeditionary maneuverability.
- Mature expeditionary base camp technologies that lead to independence from fuel/water resupply, offering operational flexibility to mission commanders.

Expeditionary Basing / Collective Protection

S&T Challenges (cont.):

- Evaluate expeditionary base camp technologies that reduce footprint and maintenance requirements.
- Reduce expeditionary base camp resource consumption/waste generation:
  - Reduce need for fuel resupply by 25%
  - Reduce need for water resupply by 75%
  - Reduce need for waste backhaul by 50%
- Develop Quality of Life tool for assessing contingency base camp technologies and services that contribute to Soldier Readiness in austere environments.



Airdrop/Aerial Delivery

- Personnel Parachuting Systems
- Cargo Airdrop Systems

S&T Challenges:

- New safety technologies for personnel insertion systems to include an automatic opening device for low altitude static line systems and advanced oxygen systems for military free fall systems.

- Enable on-demand tactical resupply to small unit/squads on the move. Payloads of 100-500lbs on request within 10m, with less than 10lb retrograde.

- Develop a high accuracy, low cost aerial delivery system. 1 ton system accuracy <25m, 35Kft altitude, 25+mile offset for 40% less cost than currently fielded capability.

Airdrop/Aerial Delivery

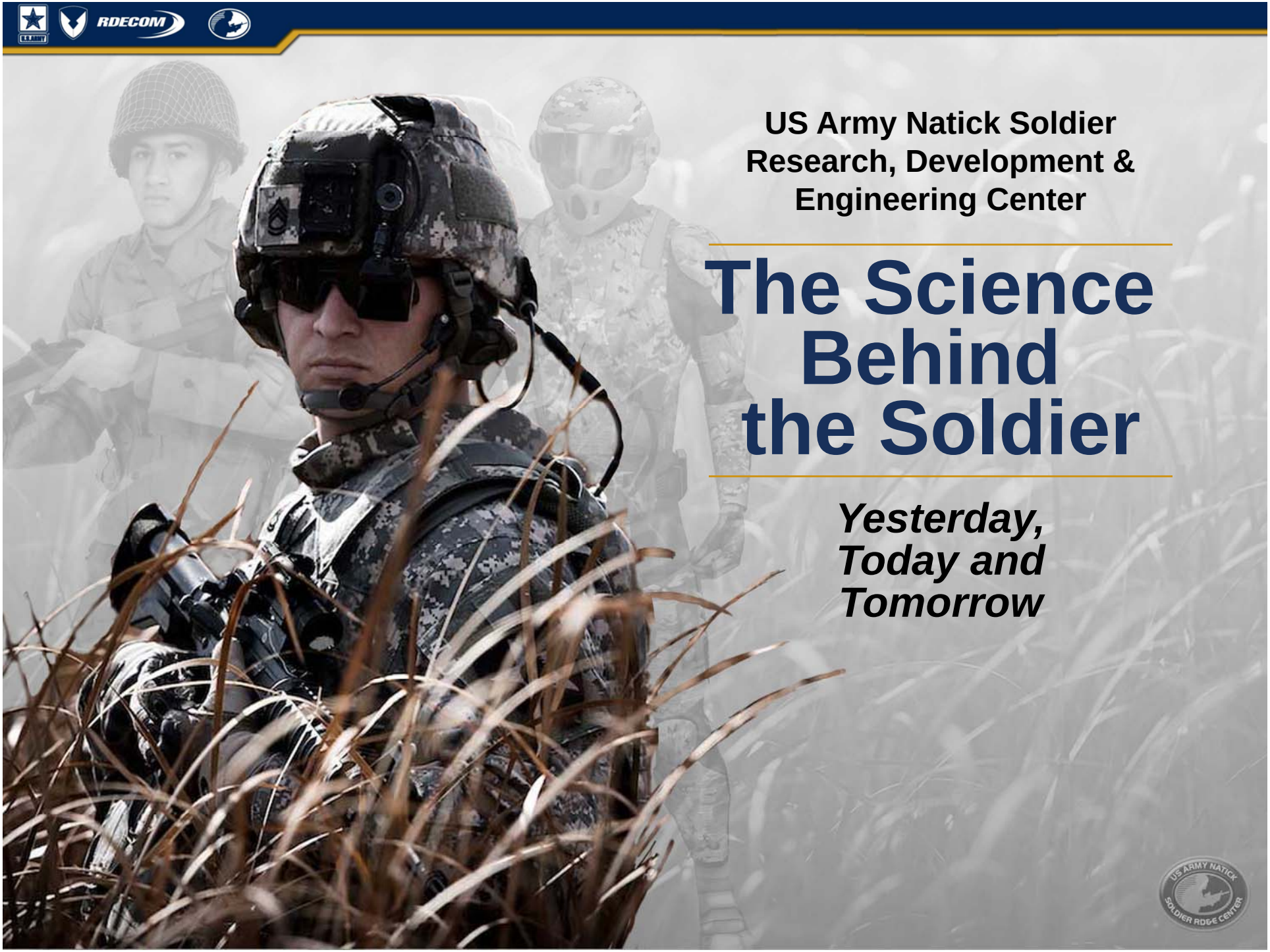
S&T Challenges (cont.):

- Reduce the signature of airdrop operations:
  - Lower IR/RADAR signatures
  - Dissolvable/camouflage canopies
  - Larger offset from target (Increase by 20%)

- Improve fidelity of airdrop modeling and simulation (M&S) capabilities. System optimization through fluid structure interaction M&S in advance of flight testing.

- Improve the speed and safety of helicopter sling load missions. Increase payload stability by 20% and develop/field auto-hook up capability.

- Mature and field a 42-80Klb forced entry capability for use on C-17 aircraft.



US Army Natick Soldier
Research, Development &
Engineering Center

The Science Behind the Soldier

Yesterday, Today and Tomorrow