

# Update on Military Applications of Exoskeletons – US Army Natick Soldier RDEC

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- US Army NSRDEC Introduction
- Exoskeleton Proliferation
- Unique Aspects of Military Exoskeletons
- US Army NSRDEC Exoskeleton Efforts
- Upcoming Military Exoskeleton Events & Activities

## Natick Soldier RD&E Center

# The Soldier's RDEC – Ensuring dominance through superior scientific and engineering expertise

Providing the Army with innovative science and technology solutions to optimize the performance of our Soldiers.





# RDECOM Organization



GEN David G. Perkins  
CG TRADOC



GEN Gustave F Perna  
CG AMC



Ms. Steffanie B. Easter  
Senior Official  
Performing the Duties of  
ASA(ALT) & AAE



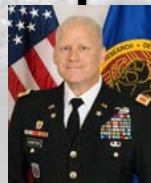
MG Cedric T. Wins  
CG RDECOM



CSM James P. Snyder  
CSM RDECOM



Mr. John Willison  
Deputy Director (A) RDECOM

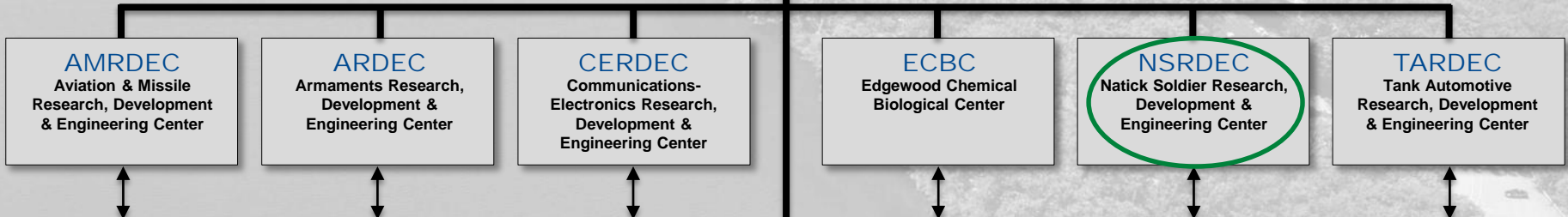


COL Raymond K. Compton  
Chief of Staff, RDECOM



BG Anthony Potts  
DCG RDECOM

- RFEC Atlantic
- RFEC Pacific
- RFEC Americas



ARL  
Army Research Laboratory





U.S. ARMY



US ARMY  
**RDECOM**

# NSRDEC Mission Areas



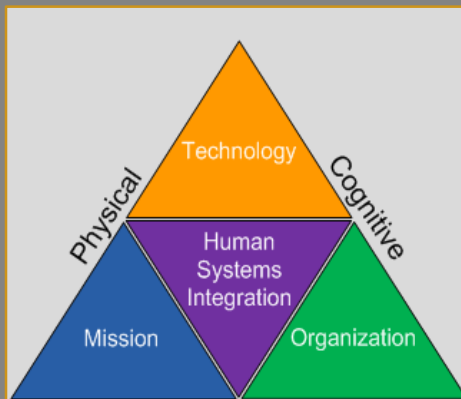
- Performance Nutrition
- Joint Foodservice Equipment
- Mission-tailored rations
- Small Unit Sustainment System
- Airbeam Shelters
- Force Provider Subsystems
- Mortuary Affairs



**Joint Service  
Combat Feeding**



**Expeditionary  
Basing/Collective  
Protection**



**Soldier and Squad  
Performance Optimization**



**Warfighter Protection,  
Survivability, and  
Optimization**



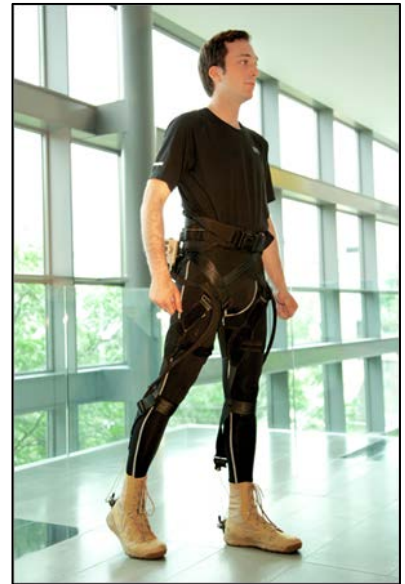
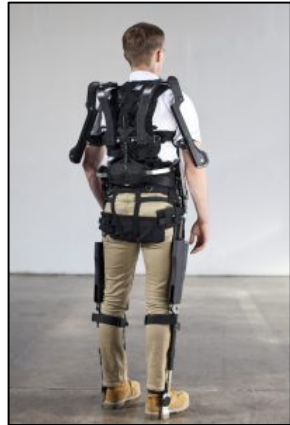
**Aerial Delivery**

- Body Armor
- Helmets
- Uniforms
- Boots
- LEAP-A
- Knowledge to Schoolhouses
- JPADS
- Helicopter Sling Load
- T-11 Engineering Support



# Technology Proliferation

**Goal:** Enable user to more safely and effectively perform their everyday tasks





# Military vs Industrial vs Medical

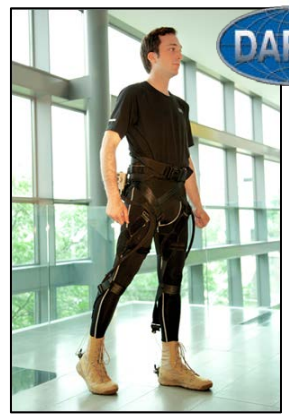


- **Common to All (Military, Industrial, and Medical):** Terminology, Taxonomy (e.g. anatomy-based and task-based), Lab-based Test Methods and Performance Metrics
- **Significant Differences:** Environments, Field/Operational Test Methods and Performance Metrics, Stakeholders (below)

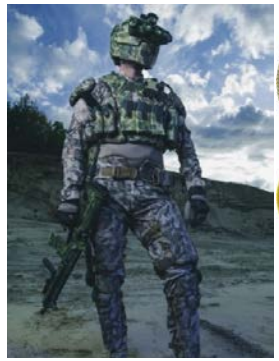
Military (MIL)	Industrial (IND)	Medical (MED)
Army:	OSHA	FDA
-NSRDEC	NIOSH	Industry
-ARL-HRED	Commerce Department:	Patients
-PEO-Soldier	- NIST	Standards Development Organizations
-US Army MCoE	- ITA	Other government agencies
-US Army MSCoE	- NTIA	Patient Advocacy Groups
-US Army SCoE	- BIS	Clinicians
-MEDCOM	DHS	Payers
Navy	DOJ	
USMC	DOE	
Air Force	Standards Development Organizations	
USSOCOM	Industry Associations and Unions	
DARPA	- MHIA	
Industry	Academia	
Academia	Manufacturers	
Standards Development Organizations	International	
International	Insurance Industry	
	SAE standards	

# Military User Exoskeleton Applications

## Mobility



## Capability Platform (e.g. TALOS) (Protection/Armor, Cooling, Visual Augment, Weapons)



## EOD (TBD)



## CB (TBD)



## Tool Operation (Static)



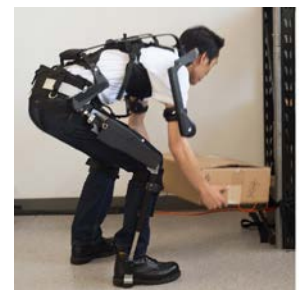
## Chair-less Chair (Static)



## Shock/Vibration Dampening (Static)



## Lift & Carry (Mobile, e.g. logistics/sustainment, ammo)



**Different User Application → Different Performance Metrics & Definition of Success!**

All technology images public and do not imply endorsement.

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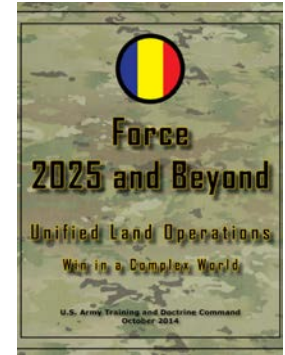




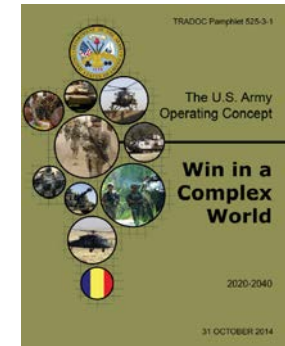
# NSRDEC Exoskeleton Approach



- Address CSA Vision Force 2025, AOC, Movement & Maneuver Functional Concept, Annex 1 Soldiers and Squads portion "Maneuver Force Modernization Strategy, and US Army RAS Strategy
- **Operational Goals:**
  - **Enhance Soldier and Squad Readiness**
  - Enhanced Mobility
  - **Force Multiplier** – less people, same warfighting power or better
  - Capability will extend the battle space
  - Musculoskeletal Injury Mitigation
  - Extending warfighter reach and lethality of a squad
  - **Optimize soldier performance**
  - Ability for each soldier to carry additional ammo-food-water load allows them to go for **7 days**
  - Overall Manpower Reduction – CONUS & OCONUS
- **Address Army Challenge to Ease the Overburdened Soldier by exploring and advancing:**
  - Fundamental Science (6.2) (e.g. Multi-joint Emulator)
  - Test Methods and Performance Metrics/Standards (6.2/6.3)
  - Enabling Components (e.g. sensing) and Systems (6.3)



Vision Force 2025



Army Operating Concept



Autonomy / 3<sup>rd</sup> Offset 9

- **Purpose:** Begin to standardize (across the Army RDECOM) terminology, test methods and performance metrics to assess exoskeleton systems

- **Approach:**

- Historically, vendor claims have driven evaluations
- Comprehensive system evaluation spreadsheet
- Jointly developing standardized testing methods/metrics to assess the effects of systems on Soldier physical performance and ensure data/findings compatibility.
- Engage broader community (Government, Industry, Academia)
- Produce public-releasable document (*in-progress*)

- **Payoff:**

- Unified Army (and potentially broader adoption of) standards for assessment of systems designed to assist specific tasks
- Suite of testing methods and performance metrics that can be used by evaluators and/or developers of exoskeletons to best assess and benchmark as they mature



<https://www.flickr.com>

## Upcoming Military Exoskeleton Events open to “Community” of Government, Industry, and Academia:

- November 2017 (Tentative) – DoD Exo Workshop with OSD, Army, USSOCOM
- Early 2018 (Tentative) – “Military” Follow-on to NIST/NSRDEC Standards Technical Interchange Meeting held January 26-27 2017



## NSRDEC to Continue to Support:

- NIST & ARL Partnership – Standards and Test Methods for Exoskeleton Technologies for the military and industrial base
- DoE and Broader Industrial Community
- Leverage Ongoing Exo Efforts across Government/DoD, Industry, & Academia



**US Army Natick Soldier  
Research, Development &  
Engineering Center**

# **The Science Behind the Soldier**

***Yesterday,  
Today and  
Tomorrow***