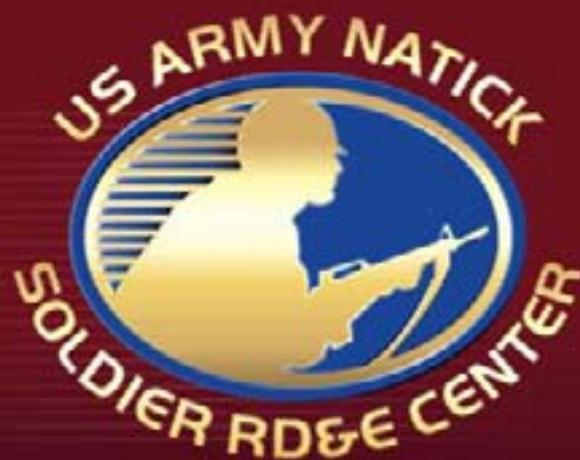




RDECOM



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

**Natick Soldier Research,
Development and
Engineering Center**

**Dr. Marilyn M. Freeman
Director**

28 November 2007

UNCLASSIFIED

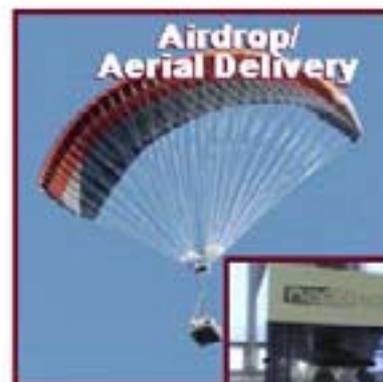
Our Mission:

- RDT&E to maximize the Warfighter's Survivability, Sustainability, Mobility, **Combat Effectiveness** and Field Quality of Life by **treating the Warfighter as a System**
- **Adding Value Through:**
 - Technology Generation, Application, and Transition Enabling Rapid Fielding of the Right Equipment
 - Soldier Systems Technology Integration and Transition
 - Solving Field Problems Rapidly

Our Vision:

- To be the **Recognized Center** and **Partner of Choice** for Warfighter and Homeland Defender Related Research, Technologies and Systems

**Transformation to the Future Force
with the Warfighter as the Centerpiece
of the Formation**



Core Competencies

Warfighter/Human Systems Related Technology Generation, Application & Transition

Warfighter/Human Systems Technology Integration & Transition

Solving Warfighter & Warfighter Support Related Field Problems Rapidly

Customer

Demonstrate & Rapidly Transition Technologies & Integrated Technology Suites

Focus Efforts on Satisfying Customer/User Defined Needs and Solving Field Problems

Ensure Alignment with DOD & Army Transformation Objectives

Internal Processes

Partner with Other Services, OGAs, Academia, Industry and International to Generate, Accelerate & Harvest Technologies

Partner with PEO/PMs, TRADOC, RDECs, LCMCs & Test/Evaluation Agencies to Support the Life Cycle

Continuous Improvement & Best Practices

Encourage Innovation & Entrepreneurial Activity

Communicate with Internal & External Stakeholders

Human Capital

Recruit & Retain High Quality Workforce

Develop Workforce

Provide a Quality Work Environment (Facilities, Personnel Practices, Collaborative Culture)

Financial

Leverage Army, Other Services, OGA, Customers, and Partners' Investments to Benefit the Warrior

Ensure the Execution of Direct Mission Funded Programs Meet or Exceed Financial Goals

Workforce Demographics (30 Sep 07)

- 654 Civilians, includes 383 scientists and engineers
- 32 Military, primarily research volunteers
- 60 On Site Contractors

S&E Workforce

	Years of Service			
	0 to 10	11 to 20	21 to 30	>30
1998	17%	49%	26%	8%
2007	44%	20%	31%	5%

	Average Age	Average Years of Service
NSRDEC S&Es	43.5	14.7
DA Civilian Employment	46.9	16.3
Federal Civilian Employment	46.8	16.6

383 Scientists & Engineers

62 PhDs

115 Masters Degrees

33 S&E Interns (9%)

12 CREST Students (3%)



2 Senior Scientists

RDECOM survey result:
90% of survey respondents agree/strongly agree that they work for a great organization and are proud to be a part of it

3 Fellows

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Biological Sciences

Anthropology
Applied Kinesiology/Biomechanics
Biological Anthropology
Biology
Biomedical Engineering
Biotechnology
Microbiology
Orthopedic Biomechanics
Physical Anthropology

Materials

Materials Science & Engineering
Plastics Engineering
Polymer Science/Engineering
Nanotechnology
Packaging Science
Textile Science

Engineering & Technology

Aerospace
Applied Mechanics
Biomedical
Chemical
Civil
Computer Science
Electrical
Environmental
Human Factors
Industrial
Materials
Mechanical
Textile Engineering
Textile Technology
Food Technology

Behavioral Sciences

Biopsychology
Cognitive Science
Experimental Psych
Health and Social Behavior
Industrial Psychology
Physiological & Comparative Psychology
Psychology

Chemical Sciences

Analytical Chemistry
Biochemistry
Chemistry
Food Science & Nutrition
Inorganic Chemistry
Physical Organic Chemistry
Polymer Chemistry

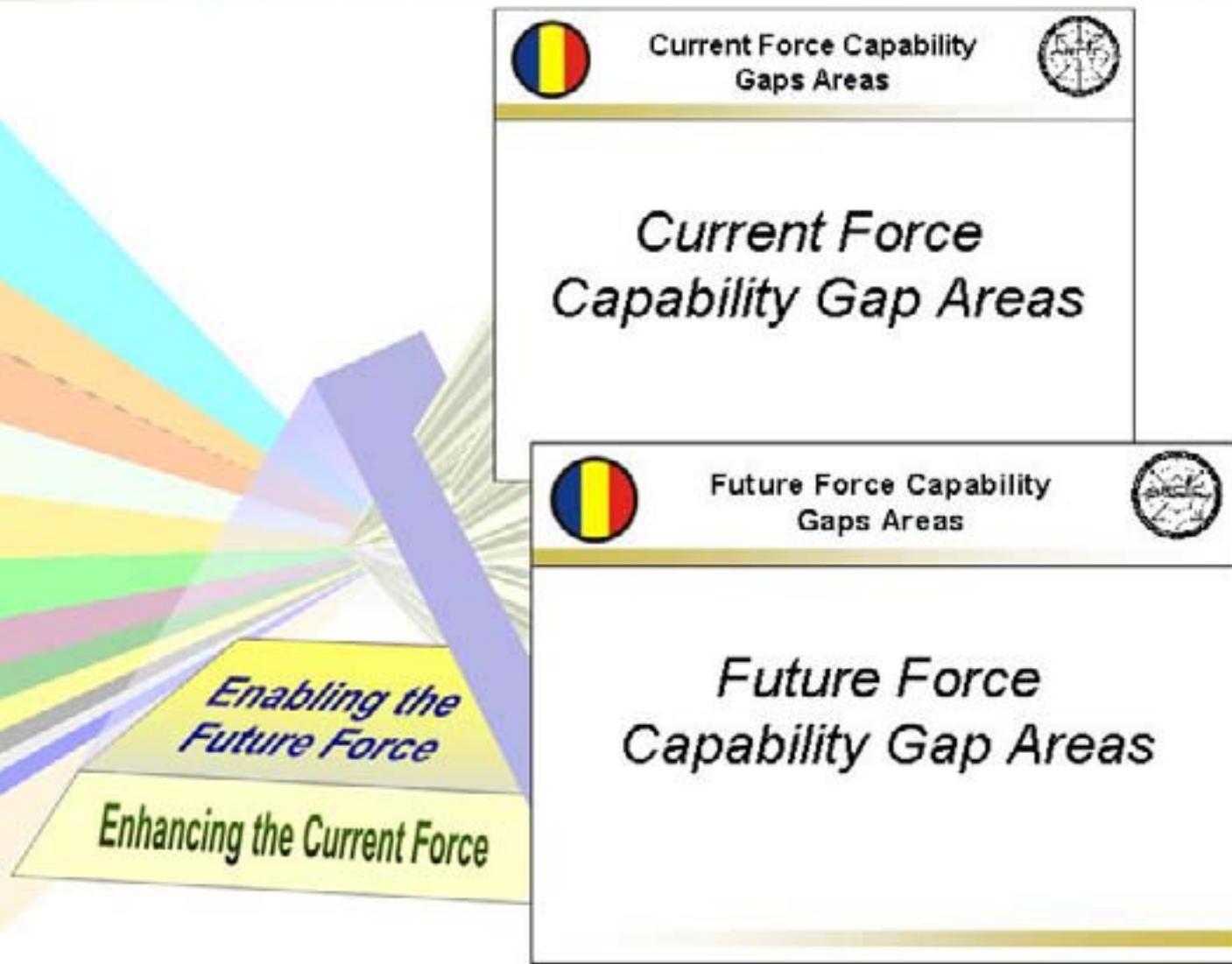
Vision

An exceptional workforce ready and committed to meeting current and future Warfighter needs.

Challenges

- **Project and plan for future skills (breadth of disciplines/ interdisciplinary)**
- **Securing the best hires (across all levels)**
 - National Supply of S&Es/Highly Competitive Recruitment Area
 - Increase demand for military experience (tactics and equipment)
 - Restrictions of 5 U.S.C. and higher headquarters' policies
- **Concerns about knowledge drain (leadership; extensive soldier system experience; and singular knowledge areas)**
- **Creating a legacy: Develop and retain quality recent hires**

Leadership	Talent Pipeline	Agile Workforce
<ul style="list-style-type: none"> •Embed NSRDEC Core Values •Leadership Talent Pool <ul style="list-style-type: none"> -Leadership Forum -Leadership Book Club •Knowledge Transfer <ul style="list-style-type: none"> -Mentoring as a Core Competency •Structured Panel Interviews <ul style="list-style-type: none"> -Focus on Leadership competencies •Leadership Development Program <ul style="list-style-type: none"> -Core-curriculum 	<ul style="list-style-type: none"> •Every employee is a recruiter •Recruitment Sources <ul style="list-style-type: none"> -Professional Journals/Web Sites -Academic Partnerships -STEP, CREST, Intern Programs -National Research Council Fellowships -Adjunct Professors •Military Career Fair •New Employee Orientation •Intern Program 	<ul style="list-style-type: none"> •Define & communicate skill needs •Career Guidance <ul style="list-style-type: none"> -Sr. Scientist's "Career Planning" Presentation -Supervisor as Coach -Career Guides •Build Competency <ul style="list-style-type: none"> -On-site Masters in Systems Engineering -Developmental assignments -Silo Knowledge Transfer •Align Education/Training Investment with priority skill needs





Survivability*

- Ballistic and blast protection
- Protection for head, face and extremities
- Vision Protection
- Individual Cooling
- Passive thermal sensor protection
- Flame Retardant materials
- Chem/Bio Protection
- Soldier Modeling

Mobility

- Exoskeleton Systems
- Lower extremity load carriage
- Optimized load distribution
- Human/ Robotic Interfaces

Personnel/Training Technologies

- Embedded training, mission planning, mission rehearsal
- Live, constructive & virtual training
- Leader development & adaptability
- Leader level command & control

Battle Command/ Situation Awareness*

- Soldier level comms
- Integrated Soldier information and knowledge with tactical networks
- Role-based tactical information
- Situational Awareness, Route Planning & Navigation
- Tactical Network & Communication Antennas
- Soldier borne antennas



Sustainability – Combat Rations

- Cognitive & physical performance
- Nutrition; nutrient delivery
- Operational efficiency of field feeding
- Food safety

Sustainability – Power*

- Lightweight Soldier power
- Hybrid power systems
- Power generation & management
- Fuel Cells
- MEMS based systems
- Recharging technologies

Lethality

- Tactical fire control
- Soldier and small unit targeting capability
- Small unit cooperative engagement
- Lightweight ammunition

Medical

- Physiological Status Monitoring
- Combat Casualty Care
- Nutritionally Optimized Rations

Sustainability – Aerial Delivery

- GPS Guidance
- Soft Landing
- 2nd generation Guidance, Navigation & Control

Soldier ATOs:

Soldier Blast and Ballistic Protective System Assessment and Analysis Tools (New)
 Soldier and Small Unit Lethality Integration (New)
 Power Sources for the Dismounted Soldier (New)
 Nutritionally Optimized First Strike Ration
 Improved Warfighter Protection
 Flexible Displays
 Color 1280x1024 Microdisplay (New)
 High Power HED Li Ion Batteries
 Vision Protection
 Advanced Lethal Armament Technologies for Small Arms (New)
 Advanced Fire Control Technologies for Small Arms (New)
 STAY--Strategies to Enhance Retention
 Soldier Protection Technologies
 Soldier and Small Unit Modeling (New)
 Enhanced Performance – Personnel Armor Technology (New)

15 ATOs directly support

Of 99 Army ATOs, 35 support Soldier S&T



Contributing ATOs:

Learning with Adaptive Simulation and Training
 Networked Enabled C2
 Tactical Network & Communications Antennas
 Tactical Information Technologies for Assured Network Ops (New)
 Suite of Sense Through the Wall Sensors
 MOUT/Urban Lethal Technologies
 Precision Airdrop—Medium
 Soldier Mobility Vision System
 Silicone Carbide Electronics
 Breakthrough Antenna Technology
 Solid State Laser
 Mobile Power
 Optimization of PAX41 Form and Load (New)
 Biomedical Enablers of Operational Health and Performance
 Leader Adaptability
 Mounted/Dismounted Soldier Power
 Low Cost High Res IR Focal Plane Array Technologies
 Flexible Display Technology for Soldier and Vehicles (New)
 Soldier Sensor Component and Image Processing
 Affordable ManTech for Structural Armor and Body Armor

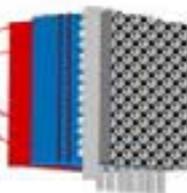
20 ATOs contribute





Capability Gaps:

- **Protect the Soldiers torso from incapacitating injury from kinetic energy round hits from threat assault rifles class 7.62x39 ball rounds and crew-served 7.62x54 ball rounds, at all ranges**
- **Protect from incapacitating wounds and from the effects of Toxic Industrial Chemicals (TIC) and Toxic Industrial Materials**
- **Protect against a variety of threats (e.g., ballistic, explosive, etc) to the maxillofacial region**
- **Mitigate blast injury**



S&T Thrusts:

- **Ballistic and blast protection**
- **Multiple-impact survivability concepts**
- **Integrated Vision Protection**
- **Individual Cooling System**
- **Enhanced protection against TICs/TIMs**
- **Textile-embedded neutralizers of chemical/biological warfare threats**
- **Passive thermal sensor protection**
- **Flame Retardant materials**

Capability Gaps:

- **Distributed, noncontiguous operations for extended periods**
- **Transmission of voice and data information to support situational awareness, increase lethality, assist with fratricide avoidance, and increase operational effectiveness**



S&T Thrusts:

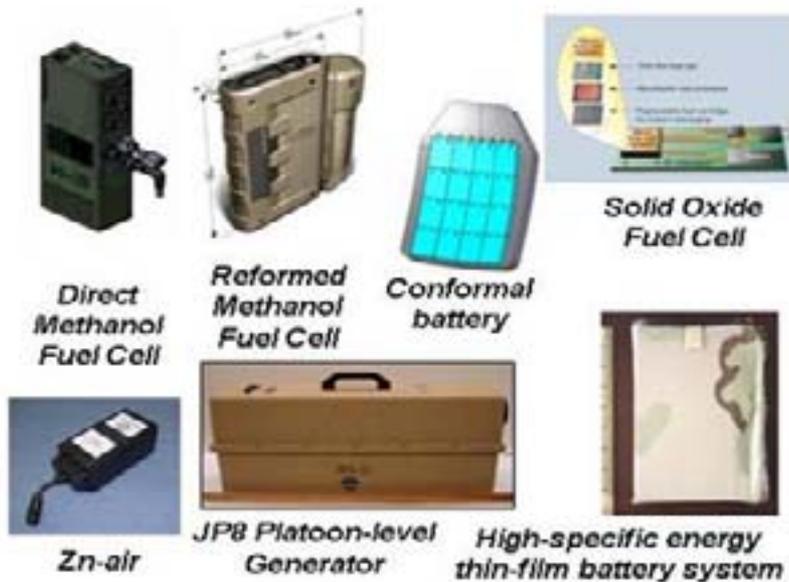
- **Soldier level communication systems**
- **Networked lethality; networked sensors**
- **Role-based tactical information**
- **Network interoperability**
- **Human/machine interface**
- **Network Centric capability**
- **See-through/ flexible displays**
- **Advanced communication headsets with ear protection**
- **Personal area networking**
- **Soldier Borne Antennas**



Collaborative
Networked
Situational
Awareness

Capability Gaps:

- Ability to operate for extended periods away from platforms and/or supply source
- Single power source to support autonomous operations for at least 24 mission hours
- Single lightweight battery to power all Soldier equipment

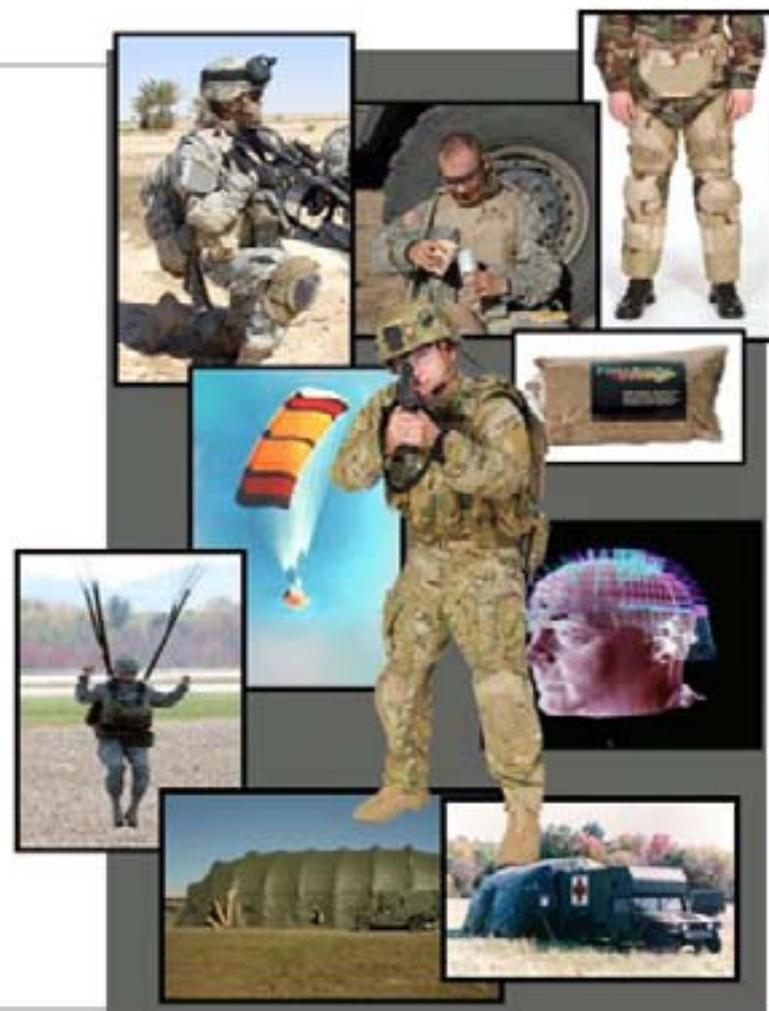


S&T Thrusts:

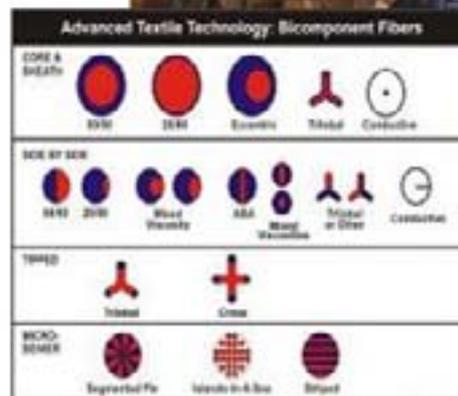
- Higher energy density power sources
- Power generation, management & storage
- Improved rechargeable batteries
- Hybrid power source systems
- Man-portable field battery charger
- Reduced weight & cost
- Extended operational capability



- Individual Protection
- DOD Combat Feeding
- Collective Protection
- Airdrop/Aerial Delivery
- Supporting Science and Technology
- Warrior Systems
Technology Integration



- Doriot Climatic Chambers
- Thermal Test Facility
- Fiber Center of Excellence
- Polymer Film Center of Excellence
- Center of Excellence for Inflatable Composite Structures
- 3D Laser Scanning Laboratory
- Soldier Cognitive Performance Laboratory



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Doriot Climatic Chambers – A Unique Asset

- Designed specifically to test the limits of Human Performance under extreme conditions
- Critical to Army's ability to design equipment that both optimizes Soldier performance and accommodates the extreme environmental conditions experienced by Soldiers and Marines.
- Primarily used for Human Research – where a dedicated group of Soldiers perform as Human Research Volunteers

– Academia/Industry Links

- Advertised to academia or industry for equipment testing/ human studies (IRB approval)
- Contracted to several private companies for unique testing conditions unavailable at other facilities

– \$23 Military Construction Project for enhanced capabilities.



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

3D Laser Scanning Laboratory

- State-of-the-art whole body and head/face laser scanning systems
- Provides information about body shape critical for design and evaluation of clothing/equipment systems
- Enables measurement of body surface area and area of coverage for current and next generation armor and helmet systems

Academia/Industry Links

- Support to creation of anthropometrically accurate human avatars for biomechanical models; Virtual Soldier Research, Un. Of Iowa
- Head and helmet models for helmet-mounted sensors; MIT Aeronautics and Astronautics Department



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Thermal Test Facility

- Propane Fire Cell – testing of clothing systems, tents, kitchen burners.
- Flame and Thermal Lab – bench scale test equipment to test and evaluate novel polymers through finished textile materials.
- Laser Lab – test and evaluate materials for laser eye protection

– Academia/Industry Links

- Establishing Joint-Service Flame & Thermal Working Group
- Working with UMass Center for Research on Polymers to establish a regional FR Materials Research Collaborative

– **Use and Occupancy Dec 07 leading to full operation in Sep 08**



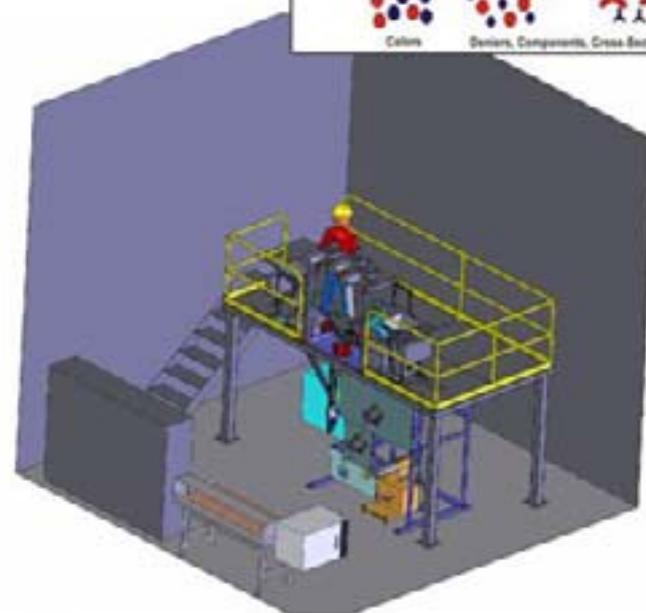
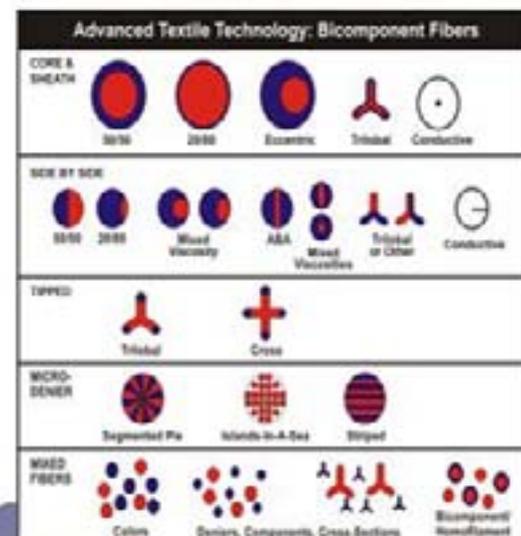
Fiber Center of Excellence

- One-of-a-kind bi/tri-component fiber extrusion capability that will enable the exploration of multi-functional fibers that are lightweight and reactive/responsive.
- State-of-the-art analytical capabilities
 - thermal analysis
 - transmission and scanning electron microscopy
 - nuclear magnetic resonance
 - spectroscopy, liquid chromatography/ mass spectrometry, and X-ray diffractometry

– Academia/Industry Links

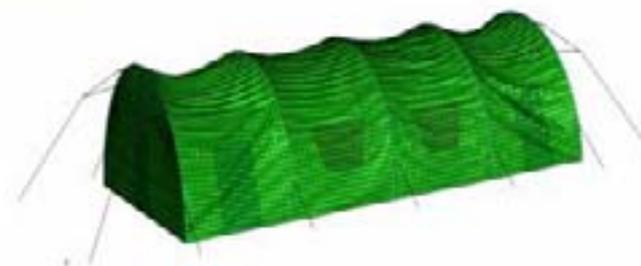
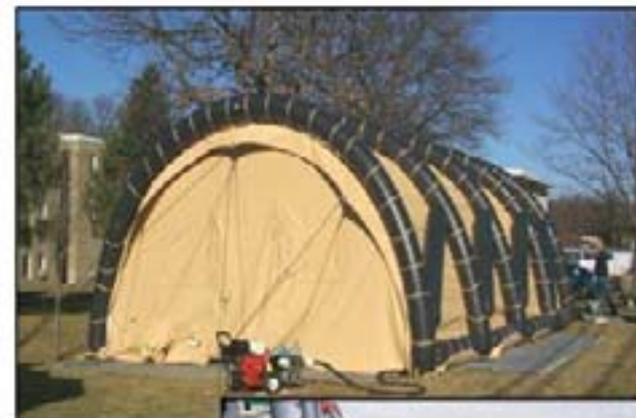
- Advertised to industry for collaborations, services and technology sharing
- Industry/Academia Workshop February 2007
- Program Announcement seeking local partners is currently open.

– Operational On-site December 2007



Center of Excellence for Inflatable Composite Structures

- Manage and guide widespread technology proliferation resulting from NSRDEC's Airbeam technology program
 - Broaden applications and obtain patents.
 - Establish and validate analytical equipment and models;
- Integrate airbeam technology into military systems – examples: Force Provider and Navy High Speed Vessel
- Internal Capabilities Offered:
 - Airbeam and airbeam system/component testing
 - Airbeam modeling and analysis tools
- **Academia/Industry Links:**
 - City College of the City University of New York (HBCU/MI), University of Maine
 - Vertigo, Federal Fabrics, Warwick Mills, Yankee Scientific
 - Technology exchange with academia /industry partners through Airbeam Summits



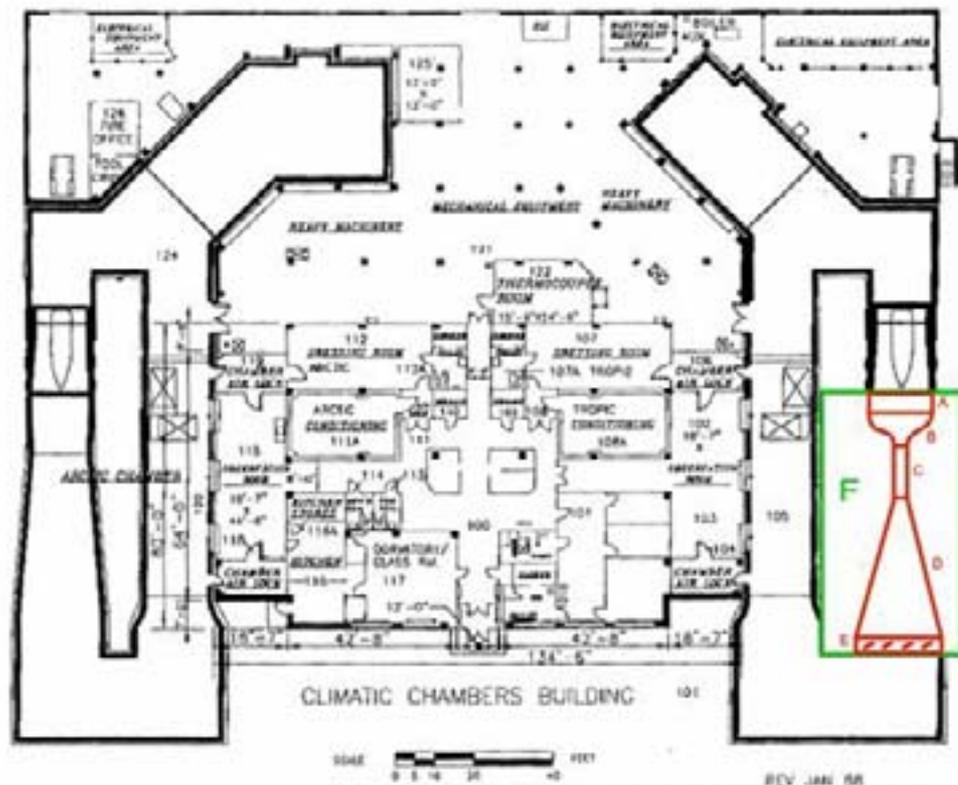
Polymer Film Center of Excellence

- R&D of new plastics and nanocomposites formulations at lab scale production level
 - Co-extrusion of multi-layer films
 - Film characterization
 - Extrusion and Compounding
- **Academia/Industry Links**
- Three Test Services Agreements in place to conduct barrier testing and to process multi-layer films
 - Collaborations with several large packaging companies, film manufacturers and material converters
- **Ribbon Cutting June 2007**
- **Workshop 29 November 2007**



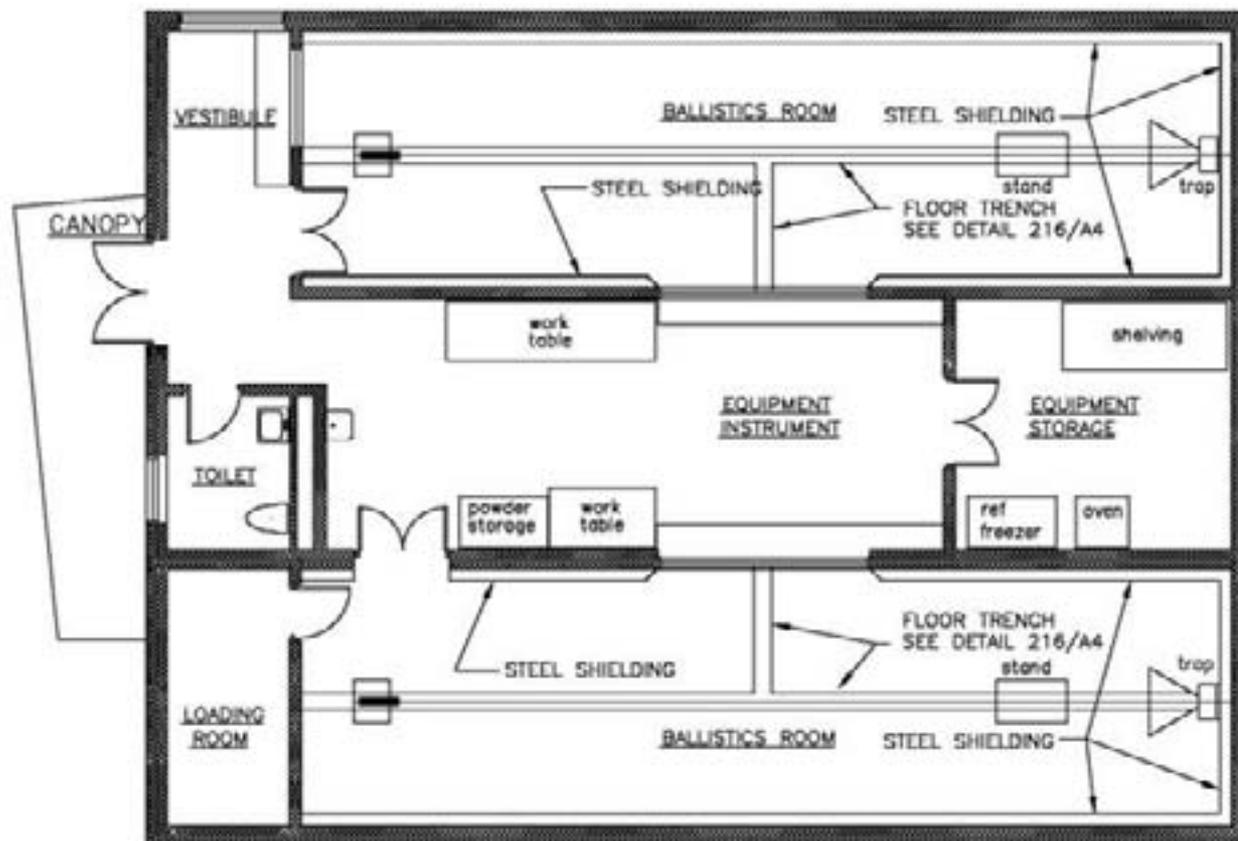
- Proposed Military Construction Project for the Doriot Climatic Chambers (\$23 M)
- Proposed Military Construction Project for a High Velocity Impact Lab for Ballistics Testing (\$2.3 M)
- Concept for Admin/Lab Space

Doriot Climatic Chambers - Upgrade and Expand Capabilities

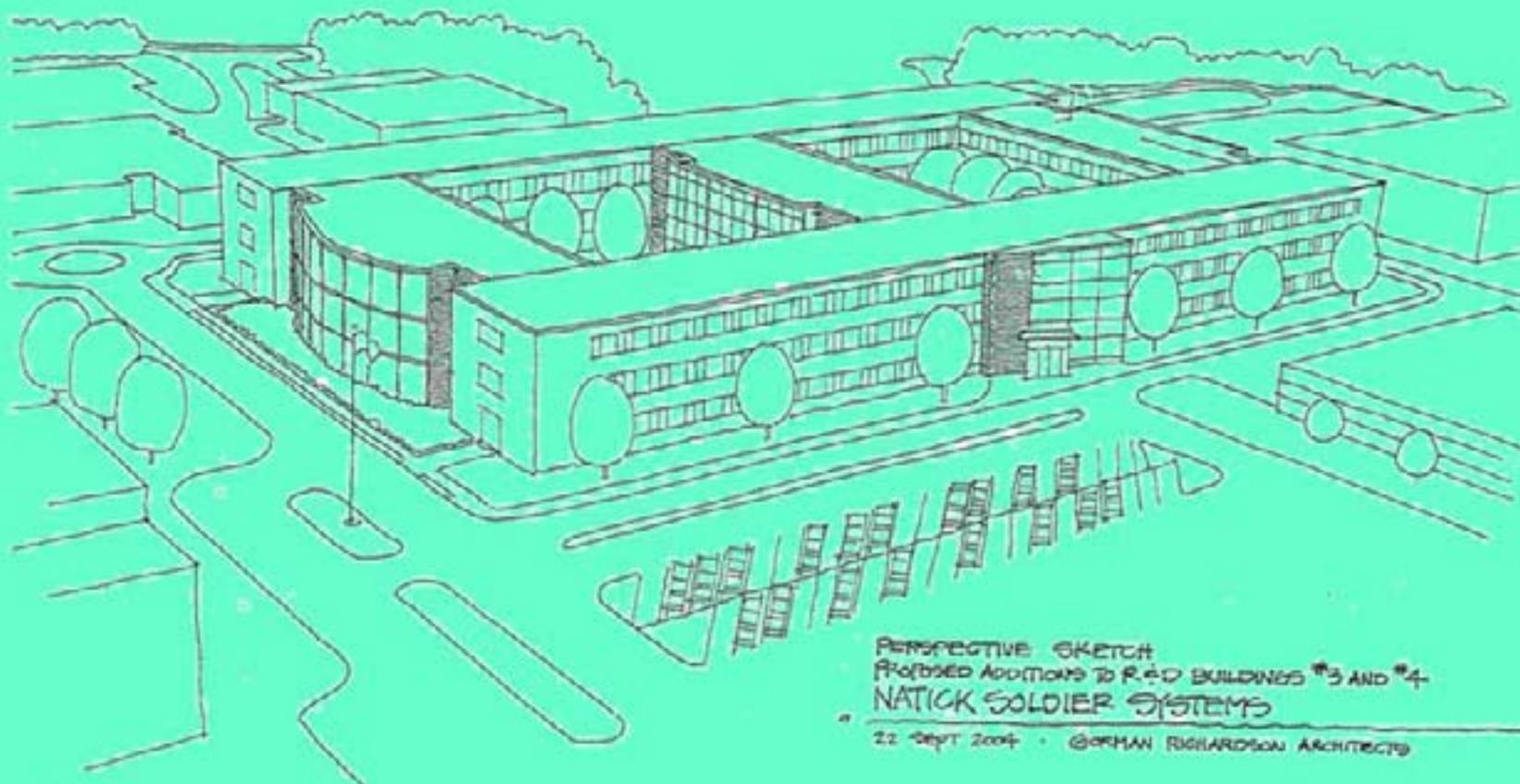


TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

High Velocity Impact Lab



Administrative, Conference and Laboratory Space





**Doing Great Things for the
Soldier Everyday
...50 Years and Counting**

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

UNCLASSIFIED