



### Location & Facilities

USARIEM is co-located with Soldier Systems Center in Natick, Massachusetts. Located a short distance from Boston, the institute offers researchers its own unique facilities and is in close proximity to many of the finest academic and medical institutions.

### Unique Facilities

Climatic Rooms  
(-10 to 50 °C)

Immersion Lab  
(5 to 41 °C)

Hypobaric Chambers  
(9,000 m; -15 to 40 °C)

Doriot Climatic Facility  
(-57 to 74 °C)

Pikes Peak Laboratory  
(4,300 m)

Physiology / Biochemistry  
& Molecular Laboratories

Biophysical Manikins to  
test insulation and water  
permeability of Soldier  
clothing and equipment



### Current Research Questions

- Is real-time monitoring of thermal-work strain during chemical-biological missions useful?
- How thermally stressful is Ranger training?
- How long can submariners stay in a hot and humid disabled submarine?
- How long can military working dogs survive when confined in a NBC protective kennel?
- How hot are Soldiers predicted to get while wearing new NBC protective garments?
- How much cooling do helicopter crewmen need?
- How much physiological strain do Marines experience during combat patrols?
- Can weather forecasts and standard meteorological measurements substitute for more cumbersome Wet Bulb Globe Temperature Index (WBGT) currently used in DoD heat injury prevention doctrine?
- How do individual characteristics affect thermoregulation and susceptibility to environmental injury?
- Can core temperature and endurance time be predicted accurately from heart rate, skin temperature, and heat flow measured by the WPSM system?



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Dr. Reed Hoyt, Chief  
Biophysics & Biomedical Modeling Division  
[reed.hoyt@us.army.mil](mailto:reed.hoyt@us.army.mil)  
508-233-4800



United States Army Research Institute  
of Environmental Medicine



# Biophysics & Biomedical Modeling

Natick, Massachusetts



# United States Army Research Institute of Environmental Medicine

USARIEM is an internationally recognized center of excellence for Warfighter performance science and its useful applications. The institute functions as a world-class laboratory for environmental medicine, physiology, performance and nutrition research. It features integrated cellular, tissue, and human research programs.



## Biophysics & Biomedical Modeling Division

*Division Chief: Dr. Reed Hoyt*

Develop biomedical models and networked physiological sensor systems that enable Soldiers to predict and counter health threats from physical challenges, protective ensembles, non-agent chemical exposure, and extreme environments.



## BBMD Research Areas

### Biomedical Modeling and Simulation

- Use environmental, clothing, and mission data to predict water requirements and Soldier tolerance of heat, cold and high terrestrial altitudes
- Support materiel developers by performing biophysical analysis of new clothing and individual equipment (CIE)
- Develop computer displays that allow Warfighters to understand and use medical information



### Translational Field Research (Test and Evaluation)

- Gather physiological data from Warfighters performing their missions to refine and verify biomedical models, improve physiological status monitoring capabilities, and guide DoD product transitions
- Develop and validate new individual physiological sensors
- Develop and validate network-centric mission-support models and algorithms that predict physiological strain and water requirements "on the fly"
- Acquire Spartan data network technologies that enable real-time health surveillance



BBMD research was an important contribution to the award-winning "Cool the Force" program.

## Biophysics and Biomedical Modeling Division Products

Decision aids and planning tools developed by BBMD predict risk and performance decrements for Soldiers under heat or cold stress.

### The USARIEM Heat Strain Decision

**Aid (HSDA)** is an integral part of the Joint Warning and Reporting Network (JWARN) and the Joint Integrated Weather Effects Decision Aid (J-IWEDA). A version of HSDA is being developed specifically for transition to the Ranger Training Brigade.



### The Probability of Survival Decision

**Aid (PSDA)** has been transitioned to the US Coast Guard for integration into their Search and Rescue Optimal Planning System (SAROPS).



### The Warfighter Physiological Status

**Monitor (WPSM)** and the Spartan Sensor Network (SPARNET) are being developed by BBMD in collaboration with military, academic, and industry partners. Wireless squad- and personal-area networks will combine physiological sensors, predictive models, and user interfaces into applications to improve medical and situational awareness.



### Biophysical testing of clothing and

**individual equipment** supports materiel developers. USARIEM played an integral role in the development of the Joint Service Light Integrated Suit Technology (JSLIST) and the biophysics and biomedical modeling division is currently advising program managers in the development of next generation chem-bio protective ensembles for the Warfighter. USARIEM BBMD routinely evaluate insulation and moisture permeability of standard issue and prototype military and commercial gear to predict effects on performance and comfort.

