

*Exceptional service in the national interest*



# FFRDCs: Where are the National Laboratories? Human Dimension work at the National Laboratories

Phil C. Bennett, Manager  
Mikaela Armenta  
Cognitive Science and Systems

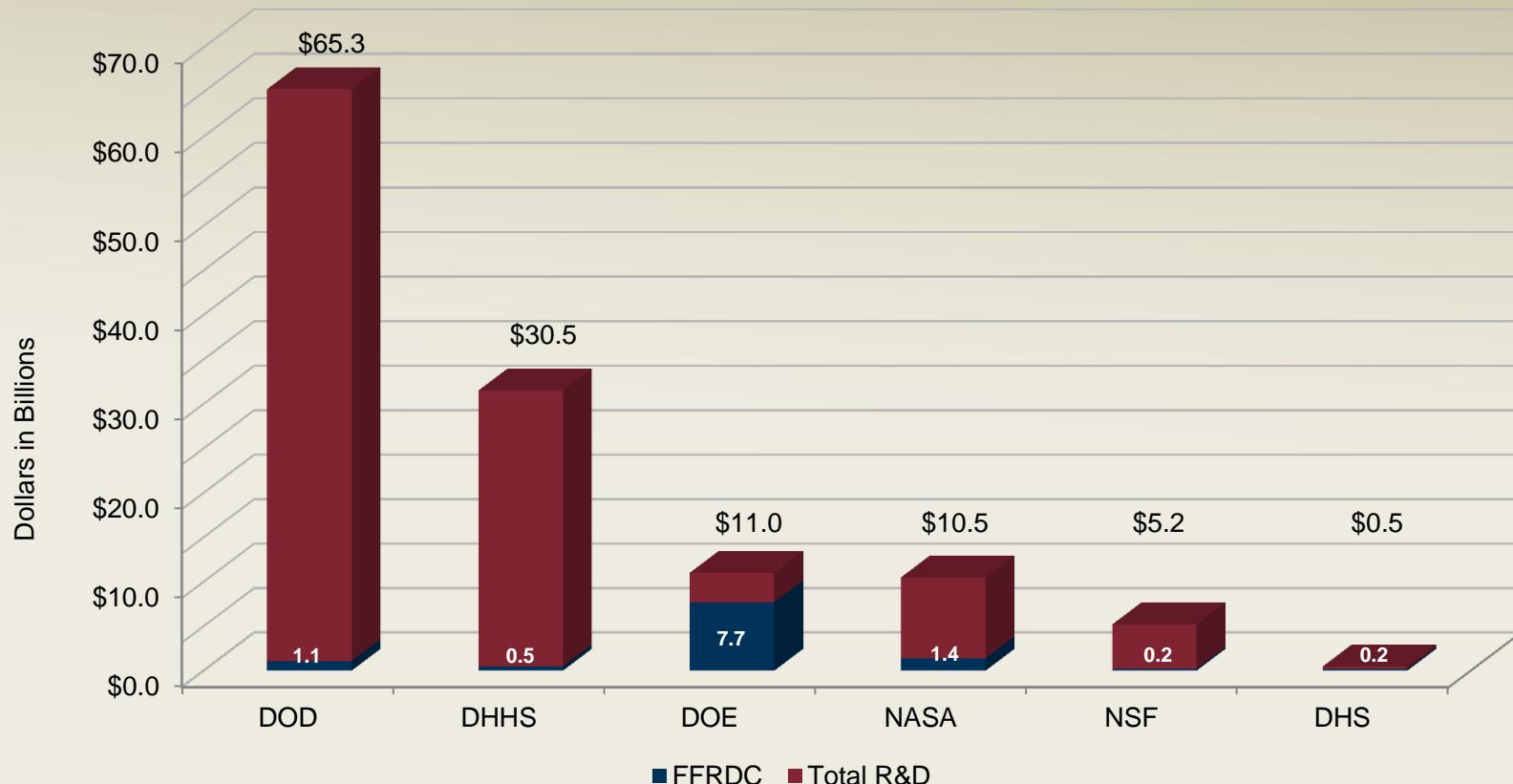


Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND NO. 2011-XXXX

## Engage the National Labs in NDIA-HSI

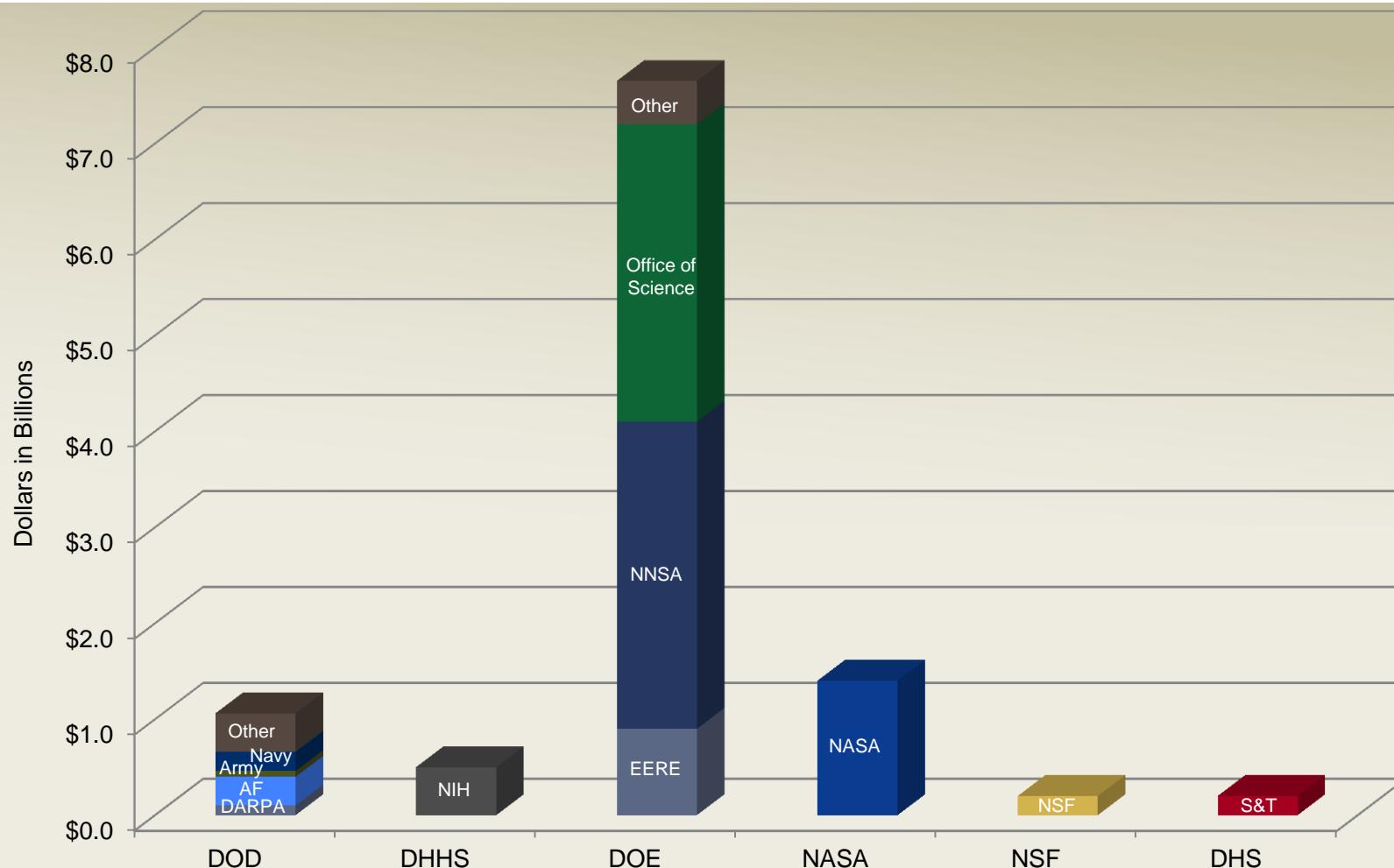
- Substantial R&D at National Laboratories
  - DOE Investments
  - Done at National Laboratories, primarily Federally-Funded Research and Development Centers (FFRDCs)
  - Significant DoD and other Agency R&D at National Laboratories
- There is HSI-Relevant work at many of these Laboratories
- Issues
  - FFRDC status?
  - Coherence – need for organization and rally point

# FY 2015 Federal Obligations for R&D with FFRDC Proportions



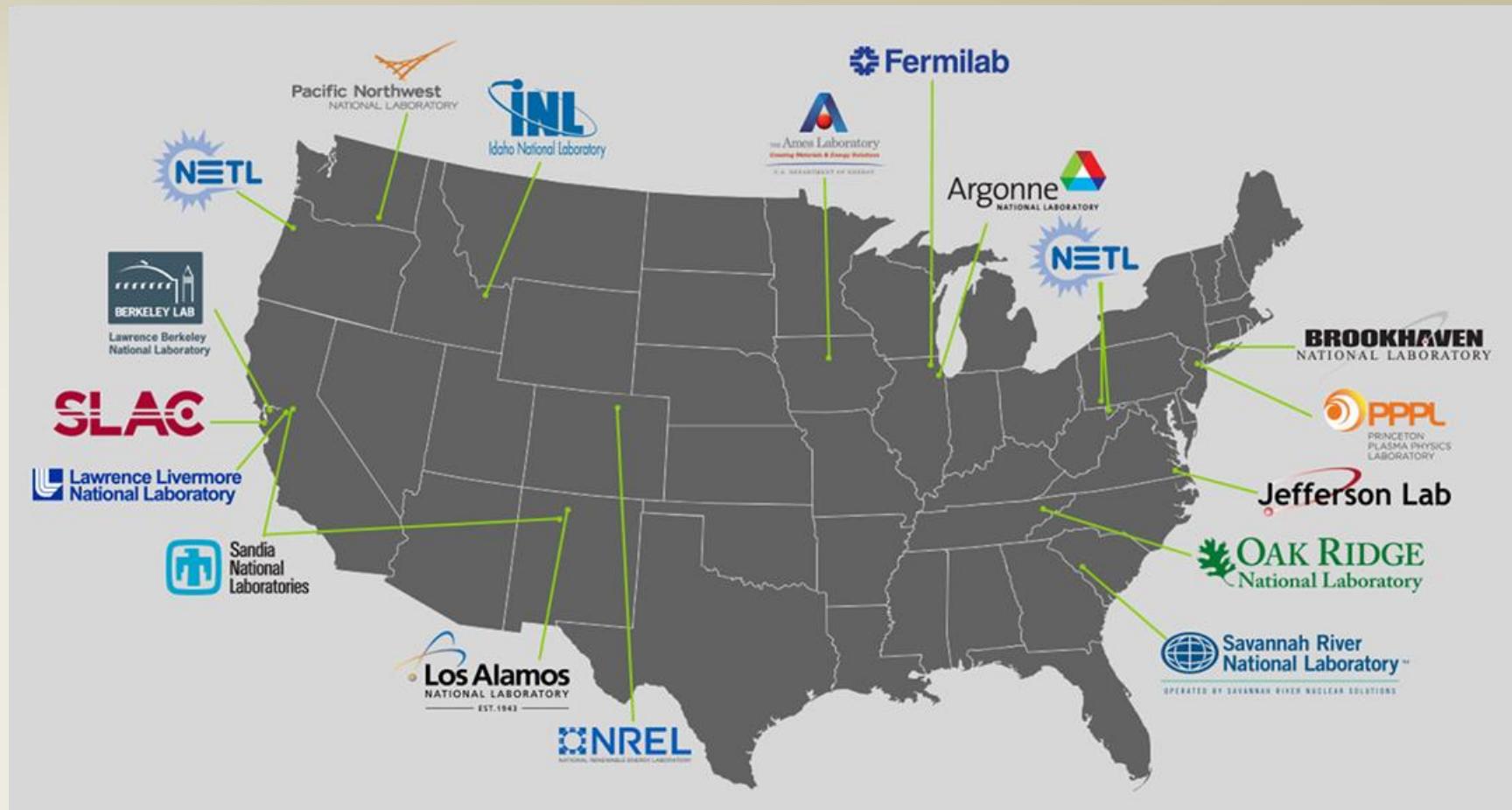
Source: National Science Foundation, Federal Funds for Research and Development,  
<http://www.nsf.gov/statistics/2015/nsf15324/#chp1&chp2>, Table 4, Table 13

# FY 2015 Federal Obligations for R&D to FFRDCs



Source: National Science Foundation, Federal Funds for Research and Development,  
<http://www.nsf.gov/statistics/2015/nsf15324/#chp1&chp2>, Table 13

# National Laboratories of the U.S. Department of Energy



Source: U.S. Department of Energy  
<http://energy.gov/maps/doe-national-laboratories>

# National Laboratories with identified active human dimension activity



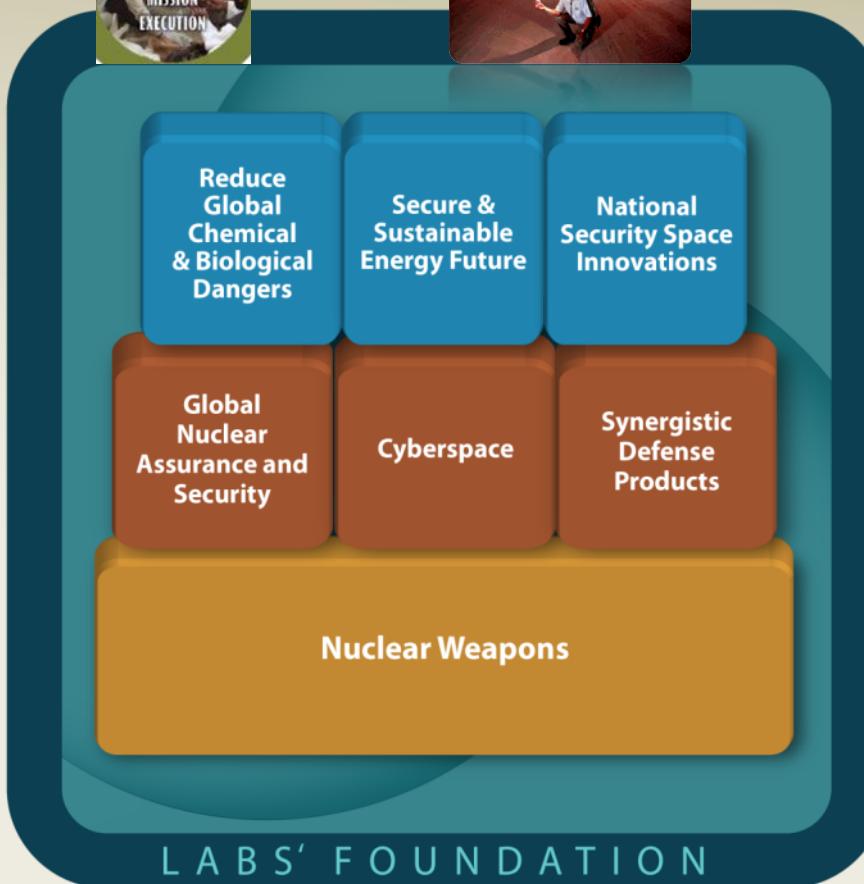
# What makes FFRDCs unique?

- A **special relationship** between the federal government and an FFRDC which is significantly different in nature than other government contractors
- Meet special **long-term research or development needs** that cannot be met as effectively by existing in-house or contractor resources
- FFRDC contractors have:
  - **Enhanced access** to privileged government **information**
  - Access to government **personnel, facilities**, and other resources
- Long-term relationships between the Government and FFRDCs ensure:
  - Familiarity with the needs of the sponsor(s)
  - Currency in field(s) of expertise
  - Objectivity and independence
  - Continuity to attract high-quality personnel
  - A quick response capability

# FFRDCs have special requirements

- All work must be within the FFRDC's purpose, mission, general scope of effort, or special competency
- An FFRDC's sponsor determines if work may be accepted from other than the sponsor and approves all work
- Must conduct its business in a manner befitting its special relationship with the Government:
  - **Operate in the public interest** with objectivity and independence
  - **Be free from organizational conflicts of interest**
  - **Cannot** use privileged information or access to **compete with the private sector**
  - **Fully disclose** its affairs to the sponsoring agency
- Intellectual Property generally remains property of the U.S. Government

# Sandia's National Security Missions



# Exploring Human Cognition



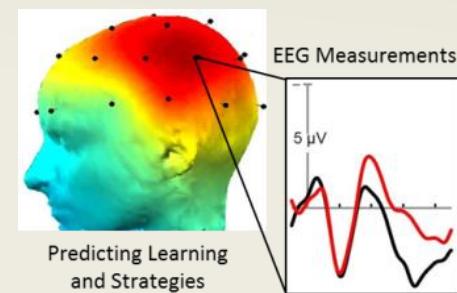
Data visualization, Pattern Analytics to Support High-Performance Exploitation and Reasoning (PANTHER)

1. Study strategies of visual information foraging in novices vs. experts
2. Develop algorithms to predict strategies
3. Informed by basic visual cognition research, enhance data visualizations (e.g. graphs), visual representation software etc.



Working Memory, Human Performance Lab (HPL)

1. Study neural signatures of memory via EEG
2. Study impacts of tDCS
3. Test memory training strategies



**POC, PANTHER:**  
Kristina Rodriguez Czuchlewski  
ISR Systems Engineering & Decision Support  
Sandia National Laboratories  
krczuch@sandia.gov

**POC, Memory:**  
Laura Matzen  
Cognitive Science & Systems  
Sandia National Laboratories  
lmatze@sandia.gov

# The Human System Simulation Laboratory (HSSL)



- Reconfigurable full-scale control room simulator facility
- Operator workstations for performance analysis.
- Technologies to measure human response:
  - audio and visual surveillance,
  - heart rate,
  - breathing
  - skin conductivity
  - eye-tracking)
- Instrumental in nuclear power plant control room modernization in the U.S



## Human System Simulation Laboratory

*A complete virtual nuclear control room*

**POC:**

**Ronald Laurids Boring**  
**Human Factors**  
**Idaho National Laboratory**  
[ronald.boring@inl.gov](mailto:ronald.boring@inl.gov)

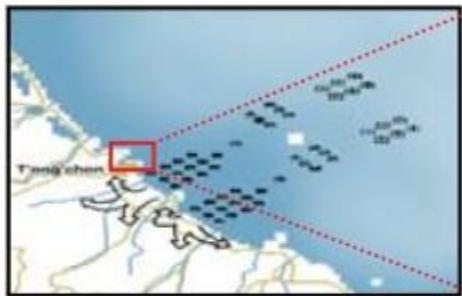


Lawrence  
Livermore  
National  
Laboratory

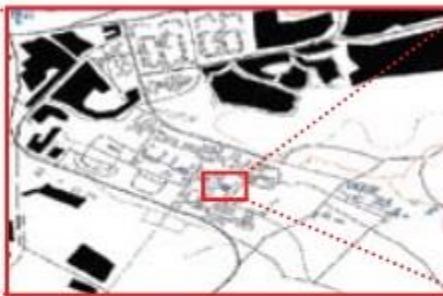
# Joint Conflict & Tactical Simulation (JCATS)



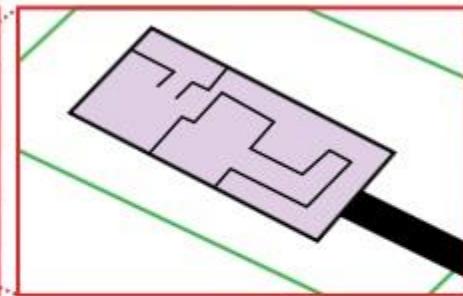
Sandia  
National  
Laboratories



Campaign view



City view



Building view



Soldier view

POC

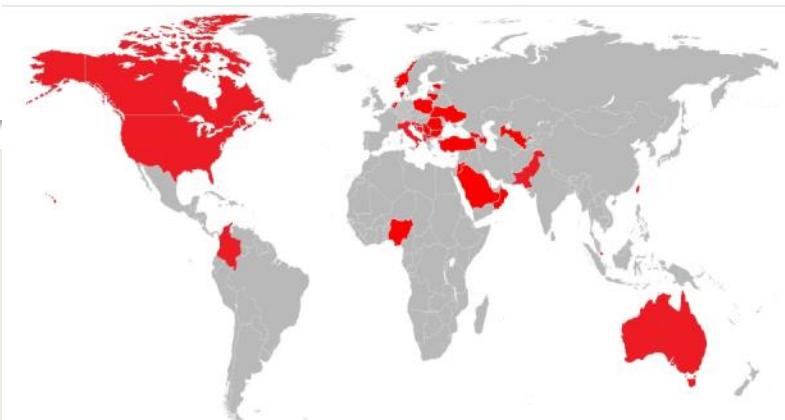
**Mark Piscotty**

**CSL Program Lead**

**Global Security  
Program**

**piscotty3@llnl.gov**

Planning and rehearsal  
capabilities that extend from  
the Joint Task Force level to  
that of individual soldier





Lawrence Berkeley National Laboratory

Energy efficiency

- Basic research on how people interact with energy technology

Ex: Gesture-sensing Thermostats

-Thermal Confidence Index (TCI)

Real-world applications:

- Application of machine-learning (e.g. TCI) to energy technologies
- Nest thermostats (smart thermostats that learn a user's habits)

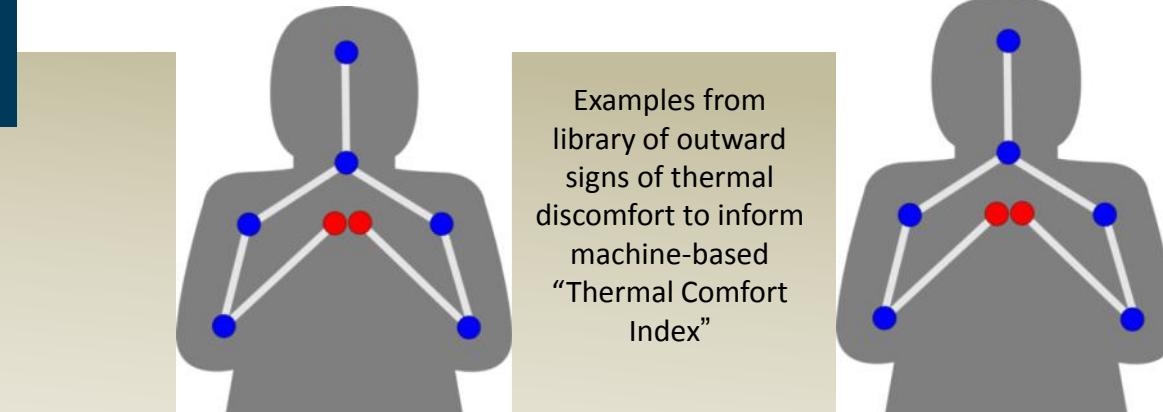
-Goal:

1. Create technologies that make energy saving user-friendly thereby...
2. Encouraging the user to save energy.

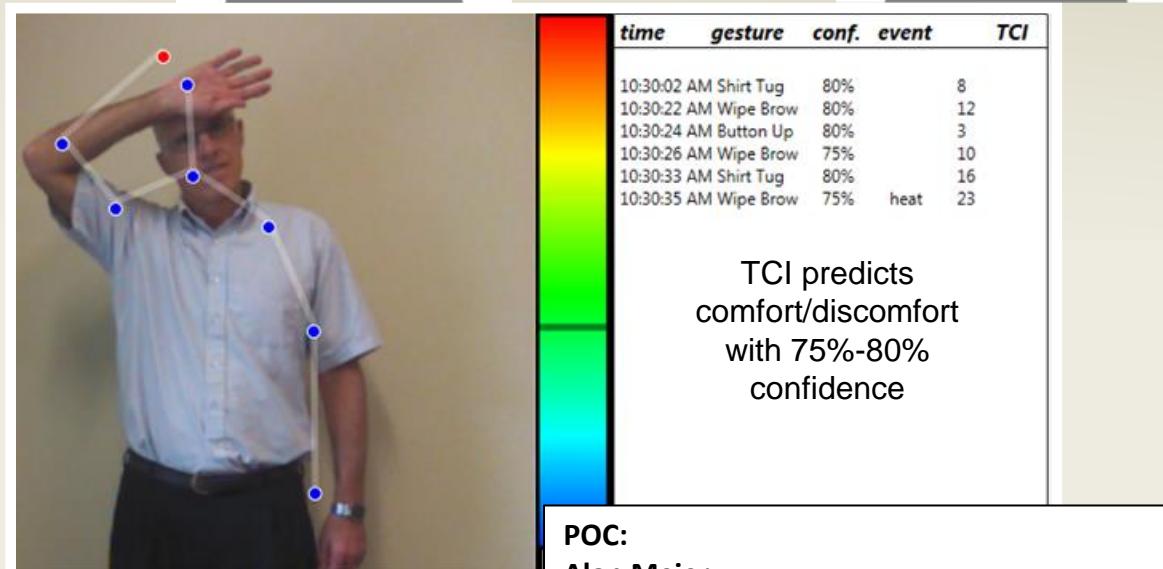
# Gesture Interpretation & Environmental Control



Sandia National Laboratories



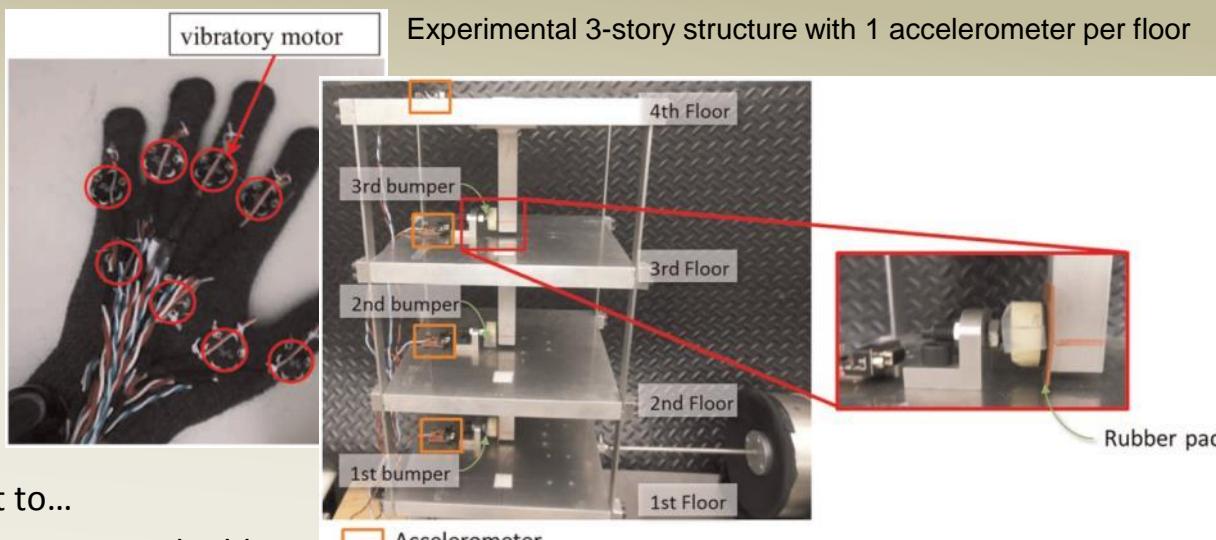
Examples from library of outward signs of thermal discomfort to inform machine-based "Thermal Comfort Index"



POC:  
Alan Meier  
Building Technology and Urban Systems  
Lawrence Berkeley National Laboratory  
akmeier@lbl.gov

# Turning Data into Sensations

Engineering Institute of the  
National Security Education Center



A proof of concept to...

1. Place accelerometers on building floors provide data on harmonic base excitation – maybe an earthquake.
2. Data is preprocessed.
3. Data is then encoded as vibro-tactile stimulus which human subjects feel through a glove.
4. Humans asked to characterize the damage to the structure.



**POC:**  
**David Mascarenas**  
**Engineering Institute of the National Security Education Center**  
**Los Alamos National Laboratory**  
[dmascarenas@lanl.gov](mailto:dmascarenas@lanl.gov)

# Implantable and Wearable Neural Interface Electronics

## Objective:

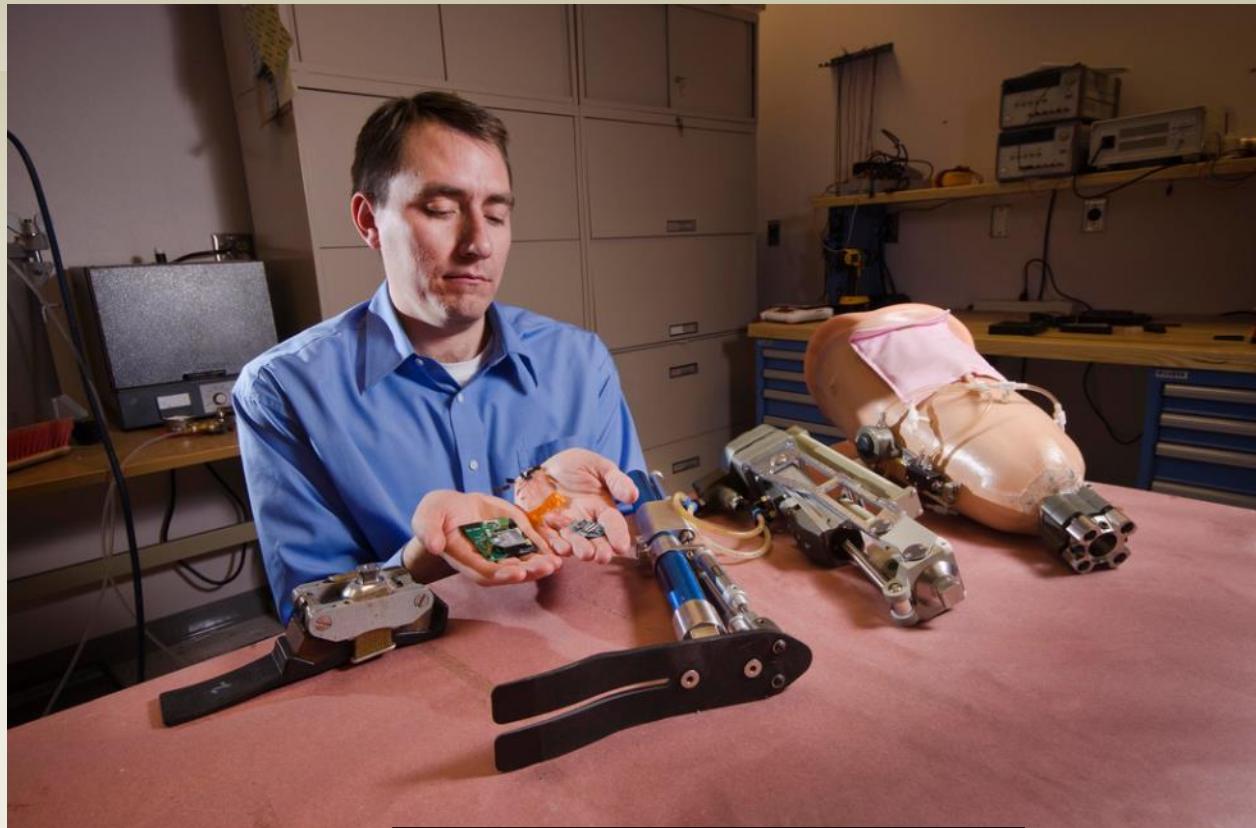
- Enhanced neural control of prosthetics for amputees

## Proof of concept designed to:

- Match flexible, biocompatible, conductive materials to nerve fibers so they can integrate with nerve bundles.

## Example:

- Thin evaporated metal or patterned multi-walled carbon nanotubes



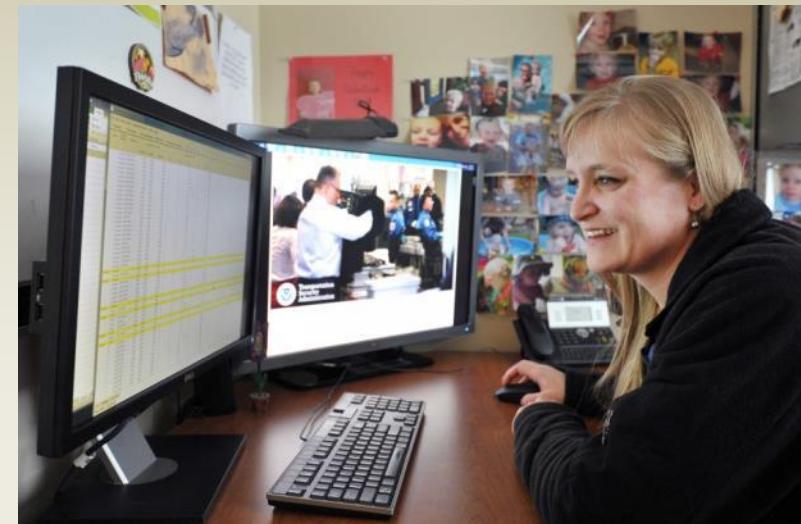
**POC:**  
**Steve Buerger**  
**Robotics R&D**  
**Intelligent Systems Controls**  
**Sandia National Laboratories**  
**[sbuerge@sandia.gov](mailto:sbuerge@sandia.gov)**

# Human Performance in Threat Detection

Transportation Security Administration (TSA),  
understanding human decision-making during  
threat detection by...

- observing officers' behaviors and accuracy
- in representative, non-laboratory samples (e.g. in actual airports, actual TSA officers)

Possible effects on behavior and accuracy:  
supervisor emphasis (accuracy or throughput),  
image resolution, officer experience/training,  
cognitive attributes ....



## Analyzing how cognitive attributes impact performance



Cognitive psychologist and TSA research team lead Ann Speed conducts research aimed at quantifying human behaviors.

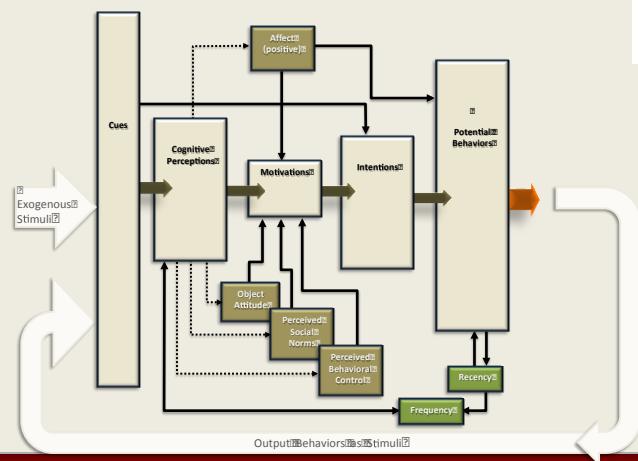
POC:  
Ann Speed  
Data-driven & Neural Computing  
Sandia National Laboratories  
[aespeed@sandia.gov](mailto:aespeed@sandia.gov)

Theory-based framework

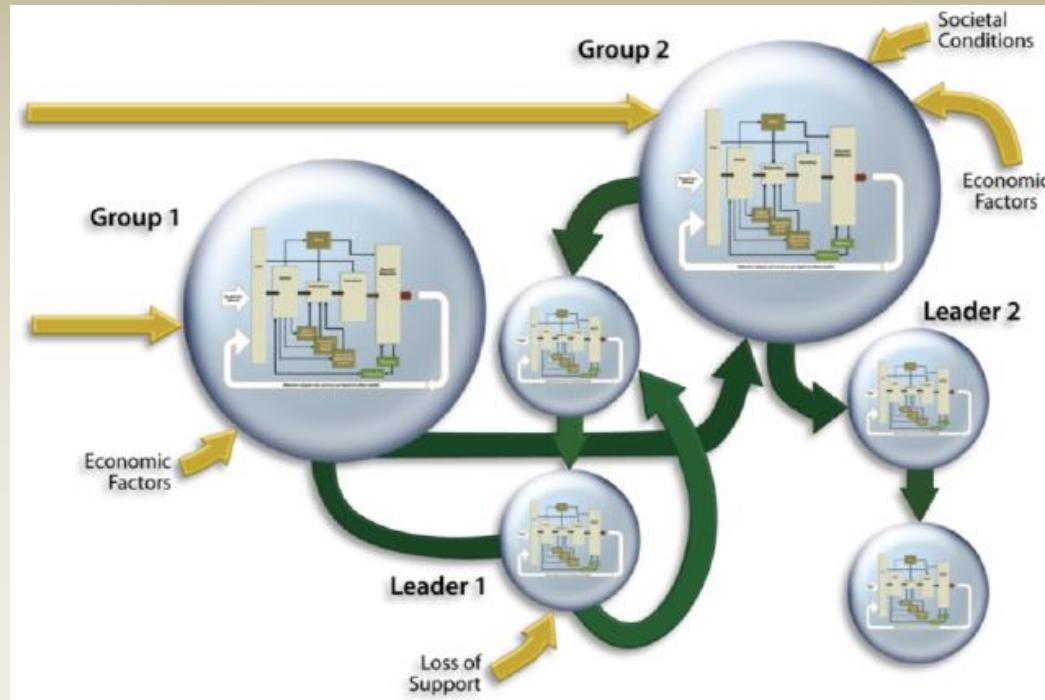
Individual and group/organizational decision-making

Informs High Consequence Decisions

- Likely range of outcomes of potential courses of actions or events
- Assess higher-order (cascading) effects
- Track confidence levels
- Transparent

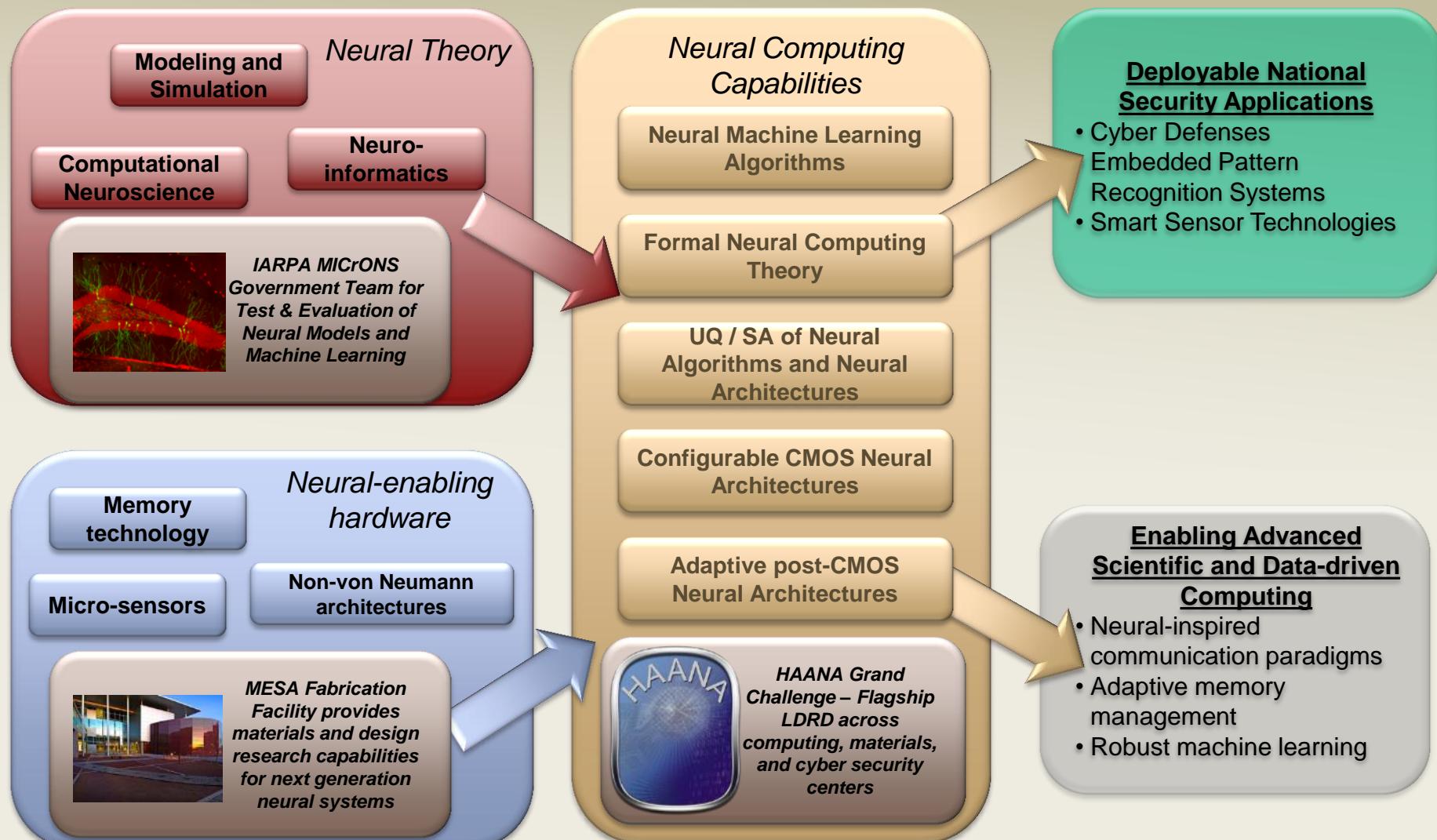


# Decision Calculus

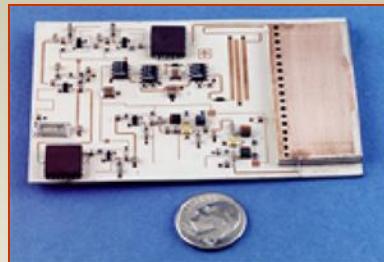


POC  
Mike Bernard  
Cognitive Science &  
Systems  
Sandia National  
Laboratories  
[mlberna@sandia.gov](mailto:mlberna@sandia.gov)

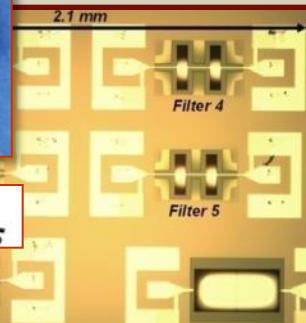
# Neuromorphic computing at SNL leverages a broad research foundation



# Industry Strategic Alliances Successes



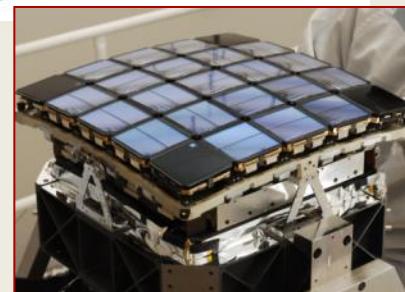
**Rockwell  
Collins**



**BOEING**



**NORTHROP GRUMMAN**



**GENERAL ATOMICS**

***Bridging lab interests and industry capabilities in service to the nation***

## Agreement Type

**CRADA** (Cooperative Research & Development Agreement): Sandia and one or more partners outside the Federal government (usually from industry, nonprofit organizations, or academia, domestic or foreign) collaborate and share the results of a jointly conducted research and development project.

## Benefits

- Leverages research efforts by Sandia and partner.
- Each party may take title to its own CRADA-generated intellectual property.
- Partner has option to obtain license to Sandia's CRADA-generated intellectual property in limited field of use on agreed-upon reasonable terms and conditions.
- Designated CRADA-generated information can be protected for up to five years.
- CRADA non-disclosure provision protects proprietary information.

## Funding

Funding to support the work Sandia performs for a CRADA may come from:

- 100% partner funds.
- 100% government program funds (from DOE/NNSA or other Federal agencies).
- Combination of funding from the partner(s) and the government.

## Requirements

- Partner "in-kind" contributions of labor and possibly property or services.
- Work must benefit a DOE/NNSA mission.
- Written statement of work.
- Related collateral documentation.
- Acceptance of legal terms and conditions.
- Substantial U.S. manufacturing requirements (or benefit to U.S.).
- Government retains non-exclusive, paid-up, royalty-free license to all CRADA-generated intellectual property for U.S. government use.
- Approval by DOE/NNSA required before Sandia can perform work.
- Final report upon completion of project.

# Industry: Interested in partnering with a laboratory?



Linda Field

[linda.field@hq.doe.gov](mailto:linda.field@hq.doe.gov)

(202) 586-3440



Sandia National Laboratories

Jason Martinez,

CRADA Agreements Specialist

[jdmarti@sandia.gov](mailto:jdmarti@sandia.gov)

(505) 284-4392

Or visit:

[www.sandia.gov/working\\_with\\_sandia/technology\\_partnerships/index](http://www.sandia.gov/working_with_sandia/technology_partnerships/index)

# Academic Partnerships



## University Partnerships / Academic Alliances

<http://nnsa.energy.gov/aboutus/ourprograms/difenseprograms/stockpilestewardship/upaa>



Sandia National Laboratories

**Yolanda Moreno**  
**University Partnerships**  
[ymoreno@sandia.gov](mailto:ymoreno@sandia.gov)  
**(505) 284-2106**

# Conclusion:

## Engage the National Labs in NDIA-HSI



- Substantial R&D at National Laboratories
- There is HSI-Relevant work at many of these Laboratories
- Issues
  - FFRDC status?
  - Coherence – need for organization and rally point
- NDIA Human Systems as that rally point?
  - Many expressed interest in the possibility.
  - Propose to spend the next year exploring how NDIA could be a unifying force among these National Lab pockets, culminating in contributions to next year's Conference.

# Questions?

Phil Bennett  
Manager, Cognitive Science and Systems Department  
Sandia National Laboratories  
[pcbenne@sandia.gov](mailto:pcbenne@sandia.gov)

# Why does the nation need FFRDCs?

- **Comprehensive knowledge of sponsors needs** – mission, culture, expertise and institutional memory regarding issues of enduring concern to the sponsor
- **Adaptability** – ability to respond to emerging needs of their sponsors and anticipate future critical issues
- **Objectivity** – ability to produce thorough, independent analyses to address complex technical and analytical problems
- **Long-term continuity** – uninterrupted, consistent support based on a continuing relationship
- **Broad access to sensitive government and commercial proprietary information** – absence of institutional interests that could lead to misuse of information or cause contractor reluctance to provide such information
- **Quick response capability** – ability to offer short-term assistance to help sponsors meet urgent and high-priority requirements

