



NNSA

Directed Research and Development (DRD) Programs

***-Innovation for Our Nation –
Strengthening America's Infrastructure Security***

NNSA LDRD Symposium

August 19, 2009

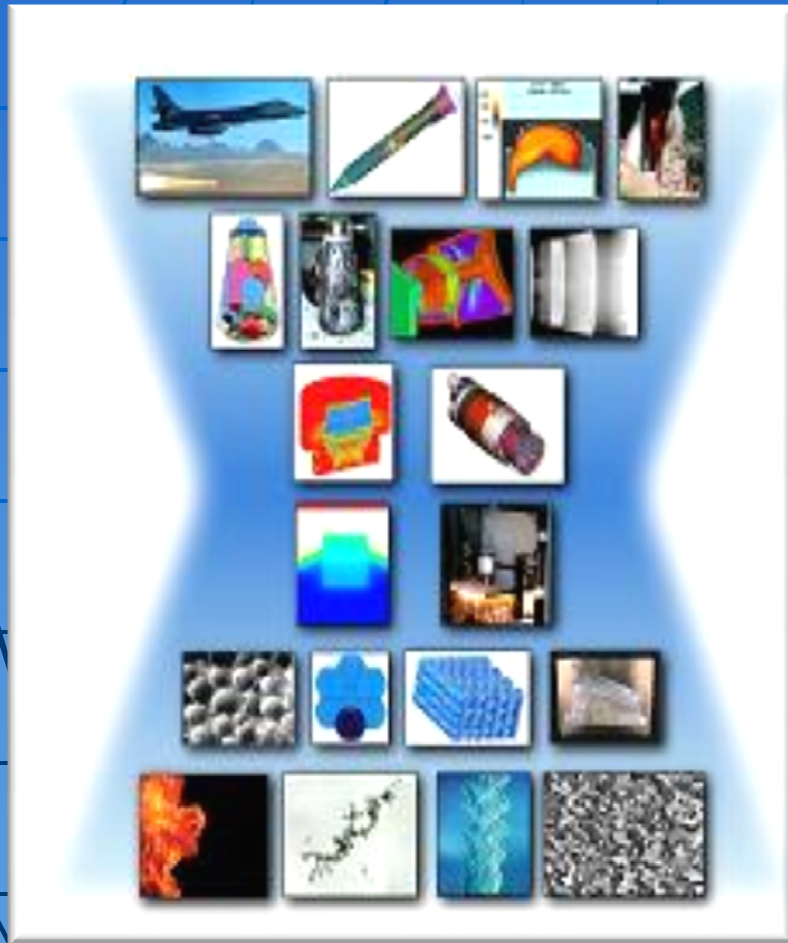
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Cutting-Edge S&T is Always a Vital Part of our National Security Enterprise

Science-Base Stockpile Stewardship



In the Forefront of the Modern S&T Revolutions



Nuclear Revolution:

- *Deterrence*
- *Energy*



Information Revolution:

- *Supercomputers*
- *Sophisticated M&S tools*



Biomedical Revolution:

- *Human Genome*
- *Bio Defense*



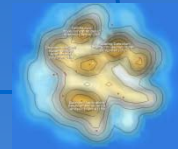
Unique Research and Development Programs at NNSA Complex

- **Directed Research Development Programs consist of:**
 - *Laboratory* Directed Research Development (LDRD) Program at DOE/NNSA national laboratories
 - *Plant* Directed Research Development (PDRD) Program at NNSA plants
 - *Site* Directed Research and Development (SDRD) Program at the Nevada Test Site.
- **Authorized by Congress to maintain the labs' vitality in advanced science and technology**
 - The Defense Authorization Act of 1991
 - 2002 Dept of Homeland Security Act (P.L. 107-296, Section 309, 6 USC 189(6)f)
 - The FY2002 Energy and Water Development Appropriations Act (Conference Report 107-258)



Unique Research and Development Programs at NNSA Complex *cont.*

- Highly competitive peer-review process (10:1) to pursue high-risk, high-value R&D
- LDRD strategic framework (April 2008) provides cohesion among the NNSA labs through:
 - Long-term, national security S&T leadership
 - Programmatic relevance, quality and performance
- Provides benefits to multiple programs/mission areas
- LDRD is critical to the pipeline of scientific and technical talent at the NNSA laboratories
 - 53% of all postdocs at the NNSA labs work on LDRD projects
 - 71% of postdocs who join the labs' full-time technical staff were supported by LDRD



*Solutions to future mission needs
High performance computer
models evolve war-fighter
technologies*



Alignment with OMB and OSTP Directions

- Applying S&T strategies to drive economic recovery, job creation, and economic growth
- Promoting innovative energy technologies to reduce dependence on energy imports and mitigate the impact of climate-change while creating green jobs and new business
- Applying biomedical science and information technology to help American live longer, healthier lives while reducing health care costs; and
- Assuring we have the technologies needed to protect our troops, citizens, and national interests, including those needed to verify arms control and nonproliferation agreements essential to our security.

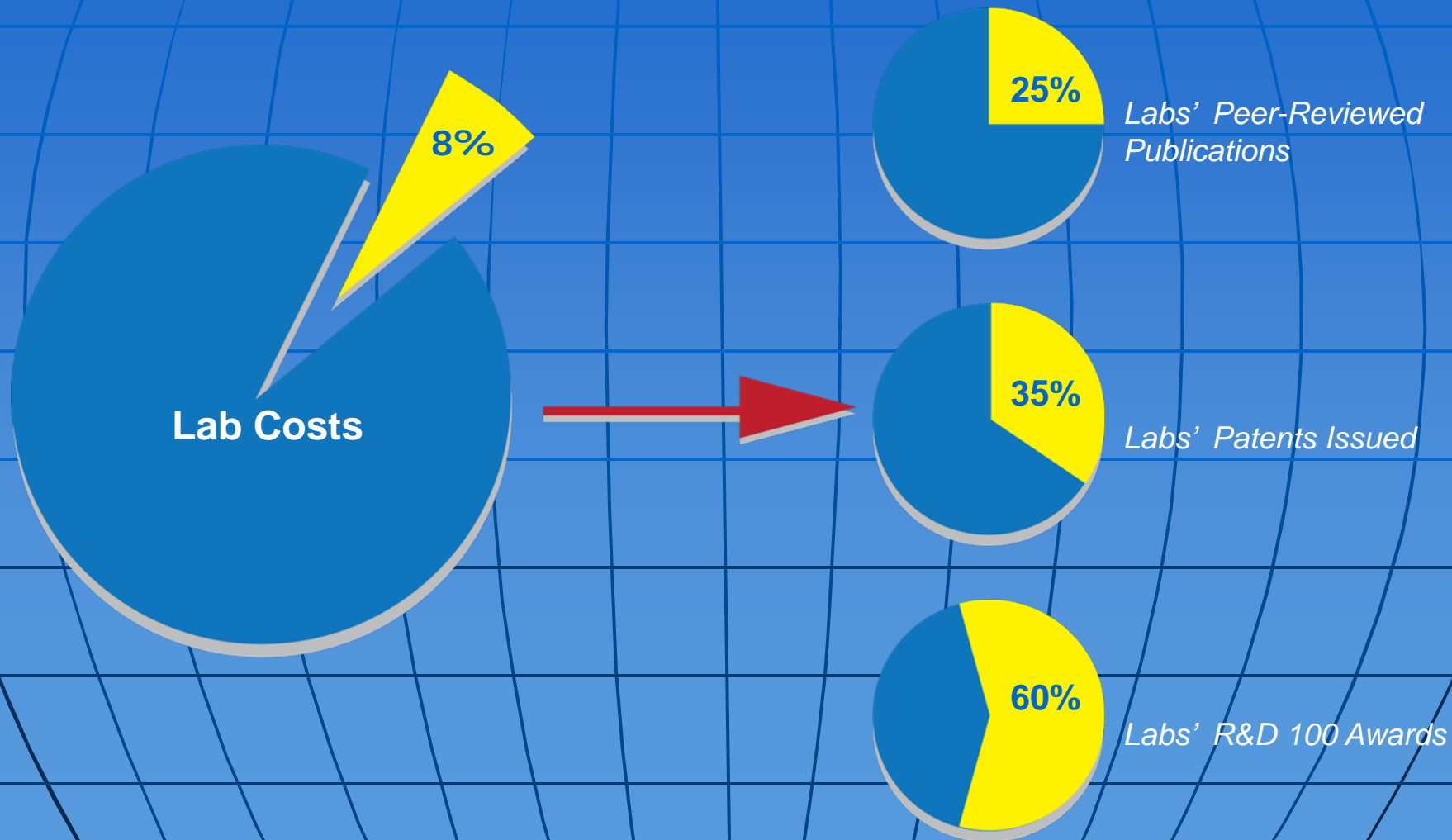


LDRD is Similar to Other Independent and Corporate R&D Programs

	Labs' LDRD	DOD IR&D	Corporate DR&D
Funding	8% assessment on direct programs	6% indirect expense on government contracts	~10% of sales profit for high-technology firms
Goals and Outcomes	<ul style="list-style-type: none">• Develop innovative technical solutions for <u>national security missions</u>• Maintain S&T capabilities and develop workforce• Avoid tech surprises• S&T <u>benefits to multiple programs</u>	<ul style="list-style-type: none">• Explore/develop new technologies for DOD & OFA <u>program goals</u>• Strengthen industrial base and economy• Support tech transfer• Technologies to <u>benefit single program</u>	<ul style="list-style-type: none">• Discover breakthrough technologies leading to <u>new products</u>• Create competitive advantage• Generate profit• Results handed-off for <u>refinement and sales</u>



LDRD Impact Far Exceeds Its Cost





Infrastructure Security is a Critical Issue Facing Our Nation

- U.S. border security continues to be a challenge for monitoring people and materials
 - Land entry – broad areas
 - Seaports – large volumes of cargo
 - Airports – monitoring people and materials
- The increasing complexity of outer space infrastructure raises security challenges for both economic and defense concerns
- Rapid response to emerging bio-threats remains a key concern



SecureBox Monitors Cargo Containers Against Unauthorized Entry During Transit

- SecureBox is a smart intrusion sensor system (LLNL LDRD enabled)
 - Monitors all 6 walls
 - Integrated communication equipment reports irregularities during transit
- Work performed in collaboration with SecureBox Corp and the National Infrastructure Institute Center for Infrastructure Expertise

2009 FLC Award
for Excellence in Technology
Transfer

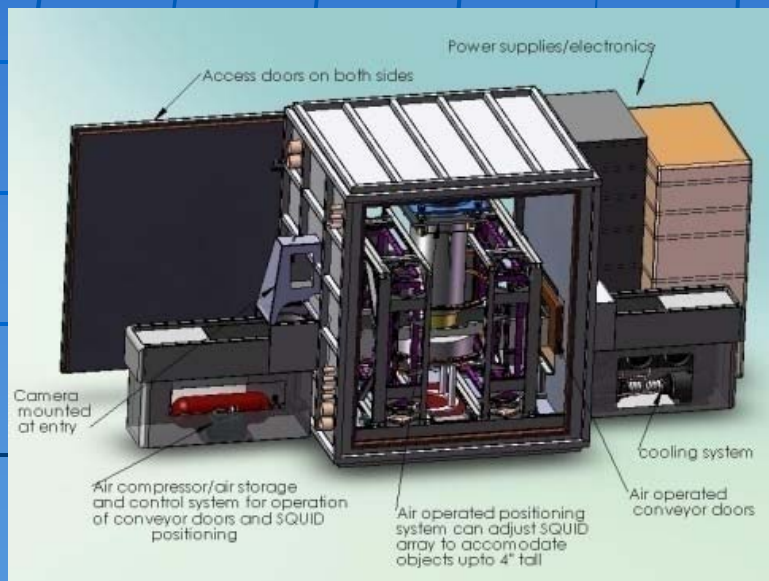


2008 R&D 100 Award

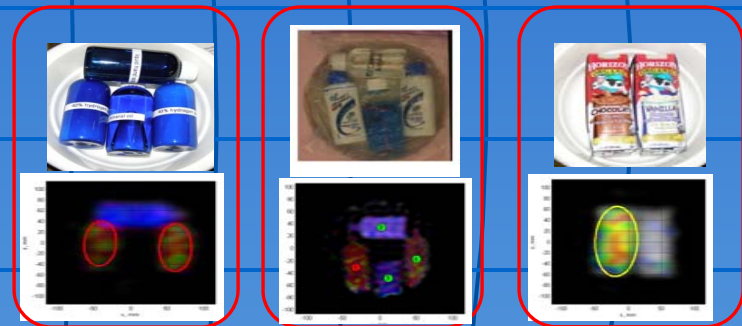


Magnetic Resonance Imaging to Protect Our Borders

MagViz: Airport screening of threats—applies ultra-low-field MRI to remotely characterize liquids and determine threats



Techniques can determine chemical composition in multiple unopened bottles, through opaque and foil containers.



System produces a 3D scan of the containers. Therefore, it can identify threats that are masked by other bottles or even hidden inside other bottles.

R&D 100 Award

The Land Mine Locator



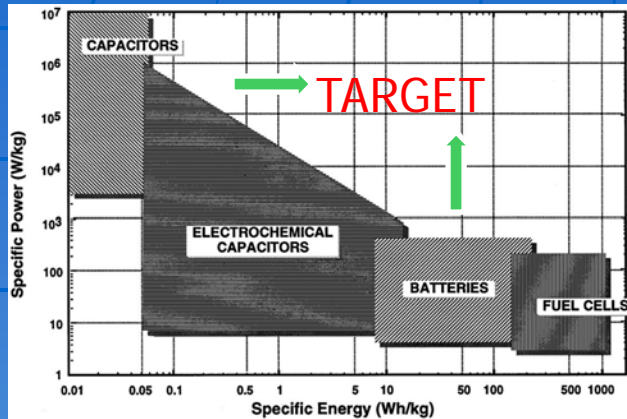
- The Land Mike Locator is being commercialized by First Alliance Technologies, LLC
 - Ultra-wide band radar sensor array (LLNL LDRD enabled)
 - Advanced tomography algorithms (LLNL LDRD enabled)
 - Hystar Aerospace Corporation's aerial platform carries the array and maneuvers over minefield
 - **Reduces the cost of finding and clearing land mines by 50% and will save lives**



2009 R&D 100 Award

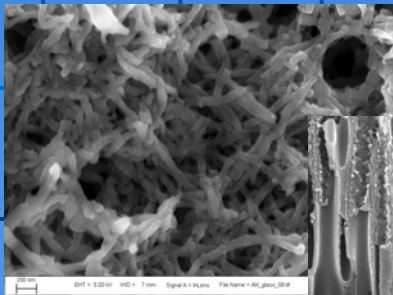
Synthesis of Nanomaterials for Ultracapacitors

(energy-storage devices that are hybrids between batteries and capacitors)

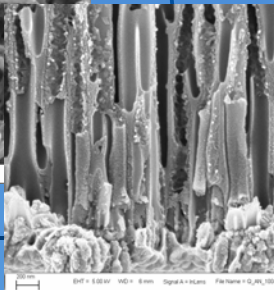


Batteries: High energy density, low power density
Capacitors: Low energy density, High power density
Ultracapacitors: High power and energy densities

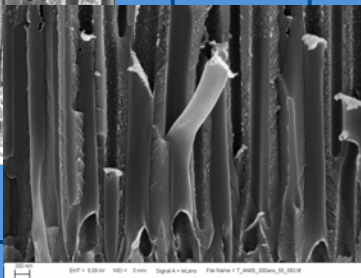
- Nano-architectures are being researched to:
 - Maximize electrode:electrolyte contact
 - Utilize all active material
 - Mix inorganic and organic components
- Electrical characteristics strongly depend on the nanostructure of the conducting polymer



Nanorods



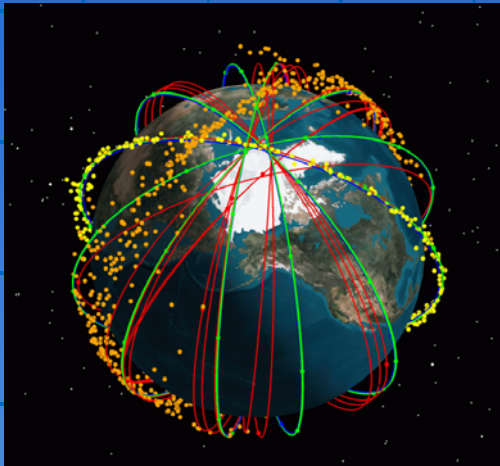
Nanotubes



Nanofibers



Protecting Our Nation's Space Enterprise



Our space infrastructure is at risk to natural and man-made phenomena, such as the debris clouds from the 2009 Iridium/Cosmos satellite collision.

Research components to address these concerns include:

- **Dynamic Radiation Environment Models**—to enable better understanding and prediction of space weather, and differentiate natural phenomenon from hostile events
- **Characterization of Large Interstellar Dust**—to enable better system protection from impacts and better understanding of communication “clutter”
- **Thinking Telescopes**—to enable autonomous “real-time” detection of key events



LDRD Symposium is an Opportunity to...

- Share information about national science and technology needs for infrastructure security
- Communicate LDRD capabilities and successes in infrastructure security research
- Identify more-effective or new collaborations

LDRD offers great opportunities for significant impacts to national security and infrastructure challenges



Questions?