

# **Lessons from Industry-University & Industry Partnerships Industry Perspective**

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Support for Team Science***

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# ***How we work...*** ***(Business Areas & Laboratories)***

# Lockheed Martin Business Areas

NRC, Industry-University & Industry Partnerships



## Lockheed Martin Corporate Enterprise Operations



### Aeronautics

Tactical aircraft, airlift, and aeronautical research and development

### Information Systems & Global Solutions

C4I, federal services, government and commercial IT solutions

### Missiles & Fire Control

Terminal High Altitude Area Defense System, Joint Light Tactical Vehicle, PAC-3 Missiles are some of its high-profile programs

### Mission Systems & Training

Naval systems, platform integration, simulation and training and energy programs

### Space Systems

Space launch, commercial satellites, government satellites, and strategic missiles

# Lockheed Martin Laboratories

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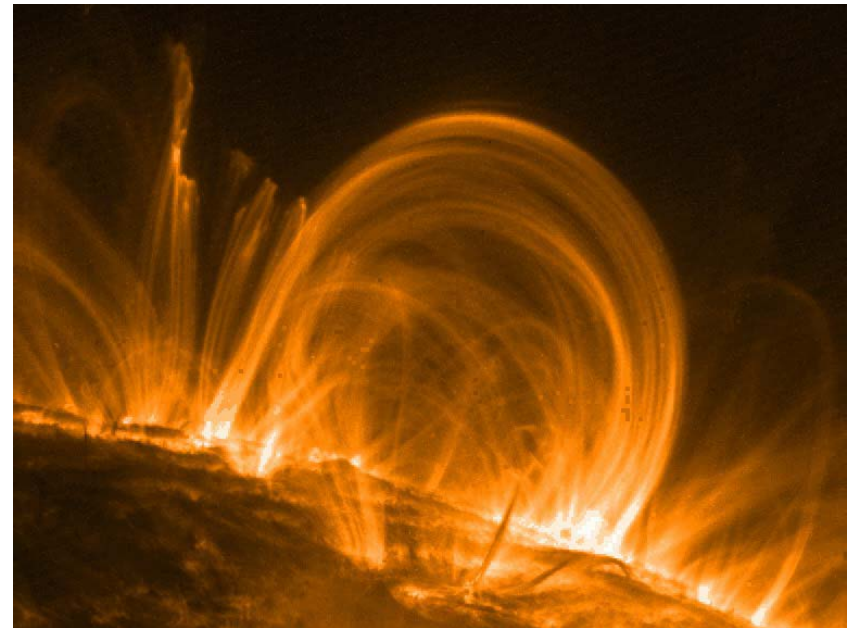
- **Aeronautics Advanced Development Programs (Skunk Works)**

- Advanced technologies for manned & unmanned systems
- “Quiet, quick, and quality”



- **Space System Company Advanced Technology Center (ATC)**

- Optics/Electro-Optics
- Phenomenology
- Precision pointing & controls
- Advanced telecommunications
- Materials & structures
- Thermal sciences
- Modeling & simulation
- Space sciences & instrumentation



# Lockheed Martin Laboratories

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- **Corp. Engr. & Technology Advanced Technology Laboratory (ATL)**

- **Informatics**

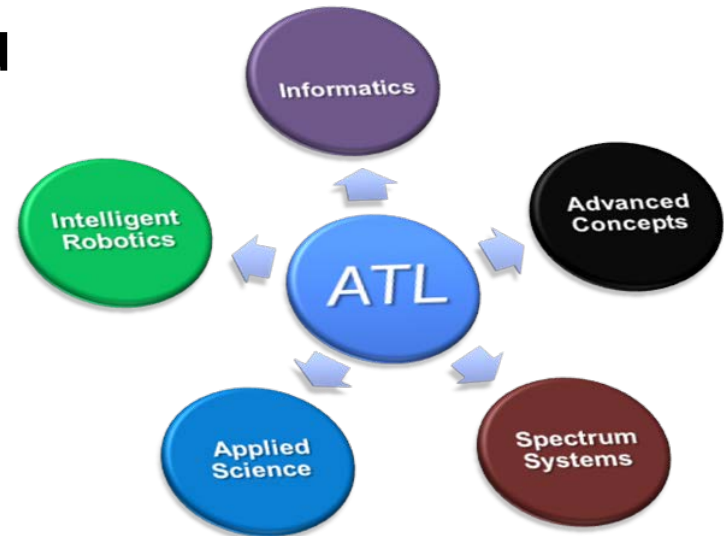
- Battlespace Awareness
- C4ISR Decision Support
- Open Source Exploration
- Socio-Cultural Analysis

- **Advanced Concepts**

- Information Operations
- Cyber Defense

- **Spectrum Systems**

- Spectrum Protection & Denial
- Spectrum Management & Exploitation
- Spectrum Awareness & Surveillance
- Advanced Processing, Photonics, & Sensors



- **Applied Science**

- Computation Physics & Nanotechnology Modeling
- Computational Manufacturing

- **Intelligent Robotics**

- Perception & Understanding
- Decisions & actions

# Center for Innovation

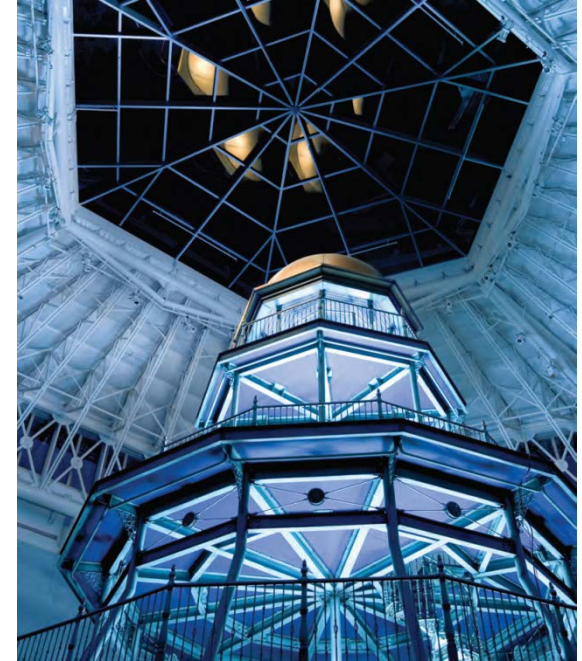
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The “Lighthouse” is a distinctive proving ground to conduct experimentation, prototyping, and assess new operational concepts/solutions for global security in a world of linked information.

It is a focal point for experimentation by experts from government, industry and academia as well as a place to accelerate the development of these systems through broad collaboration.

The Center for Innovation is located in Suffolk, VA.





# ***Approach & Philosophy***



- **Align R&D with Strategic Technical Threads**
  - Corporate Engineering and Technology leadership identifies high-level technology threads (Ex. Sensor Phenomenology)
  - Technology threads address needs across multiple corporate business interests
  - Internal and external R&D is funded to develop and mature these technologies for use in programs of record



# Technology Development Approaches

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- **Within Business Areas & Labs**
  - Internal Research & Development (IRAD)
  - Contract Research & Development (CRAD)
- **Across Business Areas & Labs**
  - Corp. Engr. & Technology Coordination & Funding
  - Transition to Technology Readiness Level 6 or higher
  - Move to Business Area Programs of Record
- **Collaboration with External Organizations**
  - Cooperative Research & Development Agreements (CRADAs)
    - Defense Intelligence Agency
    - National Laboratories (Ex. Sandia & Los Alamos)
  - University R&D and University-affiliated R&D Institutions
    - Business Area supported
    - Corp. Engr. & Technology supported



***Comments on Report  
by  
Drs. Bozeman & Boardman***

# Focus & Boundaries

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- **Multi-discipline, Multi-purpose University Research Centers (MMURCs) are attractive to industry**
  - One-stop shopping for capabilities & support
  - Multi-disciplinary problem solving is key for success!
- **Two industry concerns:**
  - Who provides the unique value we desire?
  - Who is best structured to accommodate our business model?

# Social Capital

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- “... acquaintance and the trust it engenders leads to progressively fewer and less formal structures and authorities for governing the collaboration.” (Gulati, 1995)
- **Our world of technology development rests upon building and sustaining relationships.**
  - Personal relationships first
  - Institutional relationships follow
  - Personal and organizational trust results
  - *Key challenge*: Rapid changes in personnel and their organizational responsibilities within organizations can erode trust.
- **Formal structures & processes can be costly and frustrating for researchers.**

# Motivations & Related Characteristics



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- “...larger firms participate in university research centers to build new research capacity outside core research areas...” (Santoro & Chakkrabarti, 2002)
- **Example: University of Southern California Lockheed Martin Quantum Computation Center**
  - LM has a history in high-performance computing
  - Exploring Quadratic Unconstrained Binary Optimization (QUBO) for addressing new/unsolved mission-critical problems
  - Unique industry-university collaboration

# Outputs & Impacts for “Knowledge Focused” Collaborations

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- **Agree**

- **“If the intent is to directly appropriate research, the concern of industry partners often has as much to do with cost avoidance, equipment access, or with the fit of the research to near-term needs as with the ‘best’ or ‘cutting edge’...” (Gray & Steenhuis, 2003; Tartari & Breschi, 2011; Bozeman & Wittmer, 2001)**

- **Doubt**

- **“...there is a strong tendency of industry-university collaborations, whatever the initial intent, to center on knowledge-focused output rather than product-focused output.” (Levy & colleagues, 2009)**

# Effects on Research & Research Careers



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- **Doubt**

- “...collaboration tends to deflect academic scientists from the research they would otherwise be doing and this, typically, is a substitution of more applied or development-oriented work for more basic work focused on knowledge development...”

- **Excellent Points**

- “...not everyone agrees that fundamental research is more inherently or inexorably more valuable than applied or product-oriented work...:
- The focus should be on an “optimal mix” of applied & fundamental research.
- “...collaboration often yields new ideas and approaches as both industry and academic scientists bring in fresh perspectives of persons with different backgrounds, interests, and motivations.”



# ***Recommendation for New Research***



# My Recommendation for New Research



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- 1. For industry partners interested in university-industry collaborations to develop deliverable products adhering to customer schedules (as opposed to academic schedules), what is the optimal university-affiliated organizational structure for teaming?**
- 2. Are university-industry collaborations better suited for “disruptive” technology developments than “incremental” or “evolutionary” technology developments? If so, or if not, why?**



- **Thank you for this opportunity!**

