SANDIA NATIONAL LABORATORIES

SAND2009-6127P

Excellence in Engineering: The Role of Corporate Learning and Professional Development Organization

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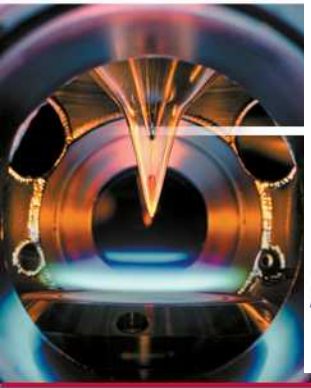
UK Visit-AVIS 5422

September 22, 2009



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

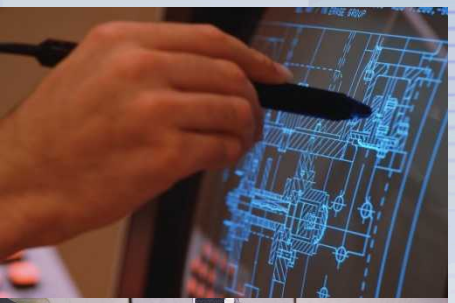
Sandia's Commitment to Education & Professional Development

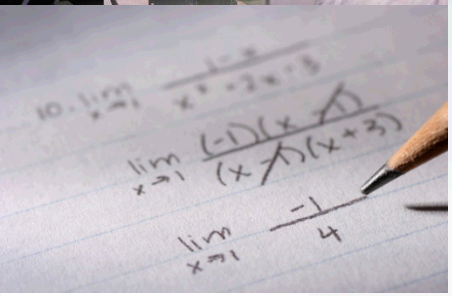
Have a continuous learning environment that enables its workforce to remain the "best of the best" in support of our national mission. Continuous education is essential to enhance employee job and mission-related knowledge and skills and contribute to employee professional growth and use of critical thinking.

Strategic Education Committee's Role

- Guides and oversees Sandia's education, professional development, and training programs.
- Assists Sandia in meeting its strategic goals for continuous improvement through education, professional development, and training.
- Partners with Corporate Learning & Professional Development (CL&PD) to ensure Sandia approaches learning from a strategic perspective.

Corporate Learning and Professional Development's Role in Educating and Developing the Workforce





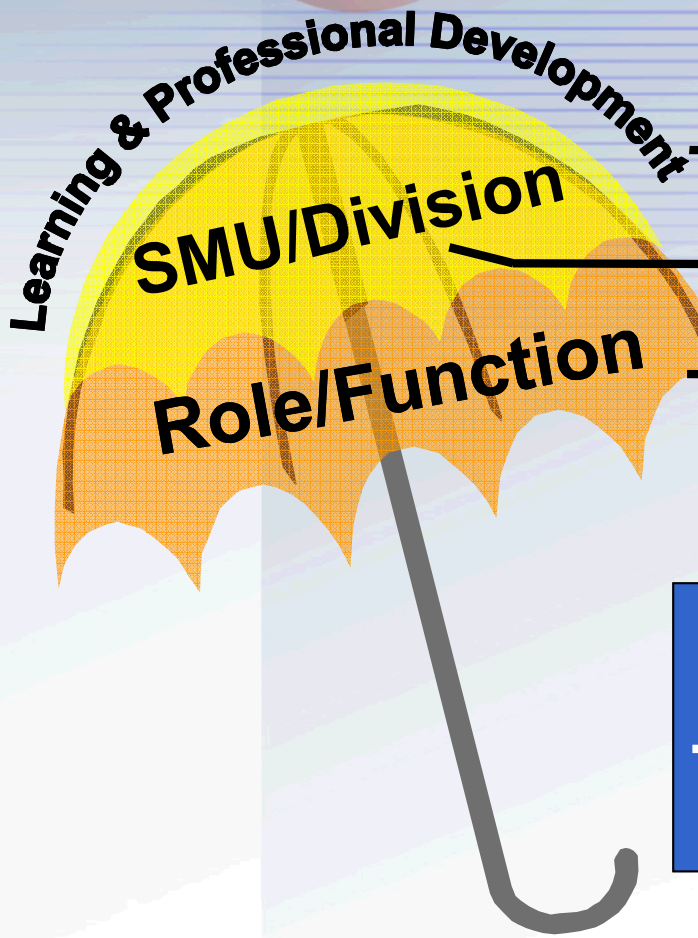
- Transformed state: Sandia has an exceptional workforce and outstanding leaders.
  - Emphasize and support *continuous* learning opportunities.
  - Enhance learning opportunities through partnerships with universities.
  - Create and sustain an environment where people do their best work.
  - *Learn* from the past and build for the future.

Corporate Learning & Professional Development (CL&PD) Goals, Objectives, and Milestones

2.0 Provide Extraordinary Talent

- **2.1** Exceptional Workforce & Outstanding Leaders
- **2.2** Emphasize/Support Continuous Learning Opportunities
  - **2.2.1** Enhanced Efficiency
  - **2.2.2** Industry Best Practices
- **2.3** Develop Partnerships w/Universities to enhance learning opportunities
- **2.4** Environment where people do best work
- **2.5** Strategic Partnerships to enhance talent

Corporate Learning and Professional Development: The Framework



Corporate Wide (CL&PD)

Division-specific

Line-specific

Like an umbrella …
They should all work together.

Communicating Education and Development Requirements and Expectations

Integrated Laboratory Management System (ILMS)

- Framework by which SNL manages all requirements and work
- Set of policies, business rules, practices, etc.
- Requirements and expectations for education and development are outlined under HR Policy
  - Corporate
  - Function/job specific/Organization Specific

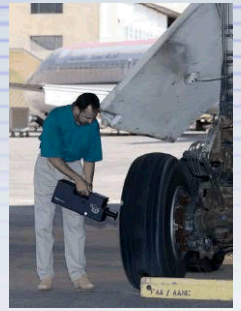
Our Core Purpose

Securing a Peaceful and Free World through Technology

Nuclear Weapons

Safe, Secure, Reliable Weapons

Defense Systems and Assessments



Detection

Remote Sensing and Verification

Integrated Military Systems

Energy, Resources, & Nonproliferation

Energy

Safety and Security

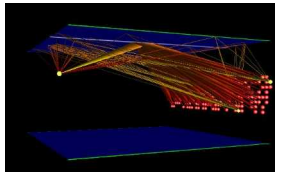
Critical Resources

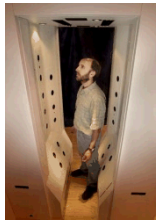
Efficiency

Homeland Security and Defense

Chem-Bio Defense

Cyber Protection





Explosives Countermeasures

Corporate Learning & Professional Development

Chart your course!

Sandia National Laboratories

Corporate Learning & Professional Development : By the Numbers

- 123k training completions in FY09
- 4.3 overall end-of-course evaluation rating (on a 5-pt Likert scale)
- Impact of Learning (One Year Later)
  - Strong to very strong indications
    - Learning transference to job
    - Knowledge enhanced
    - Customer satisfaction
    - Mgmt support of continuous learning

CL&PD Organization's Facilities and Capabilities

- 1 staff member to approximately 349 lab staff (instructional technologists, project leads, administrative support, programmers, technical staff)
- Corporate Learning Management System
- Corporate E-Learning Services to desktop
- Multiple classrooms
- Distance Learning Center
- Interactive Learning Center

STRATEGIC

Strategic Alignment

- Provide Direction and Leadership
- Strategic Education Committee
- Product Lifecycle Management

Knowledge Management

- Disseminate Historical Information, Lessons Learned & Better Practices
- Systems Engineering Case Studies
- Systems Engineering Colloquia and Technical Symposiums
- KM Capabilities

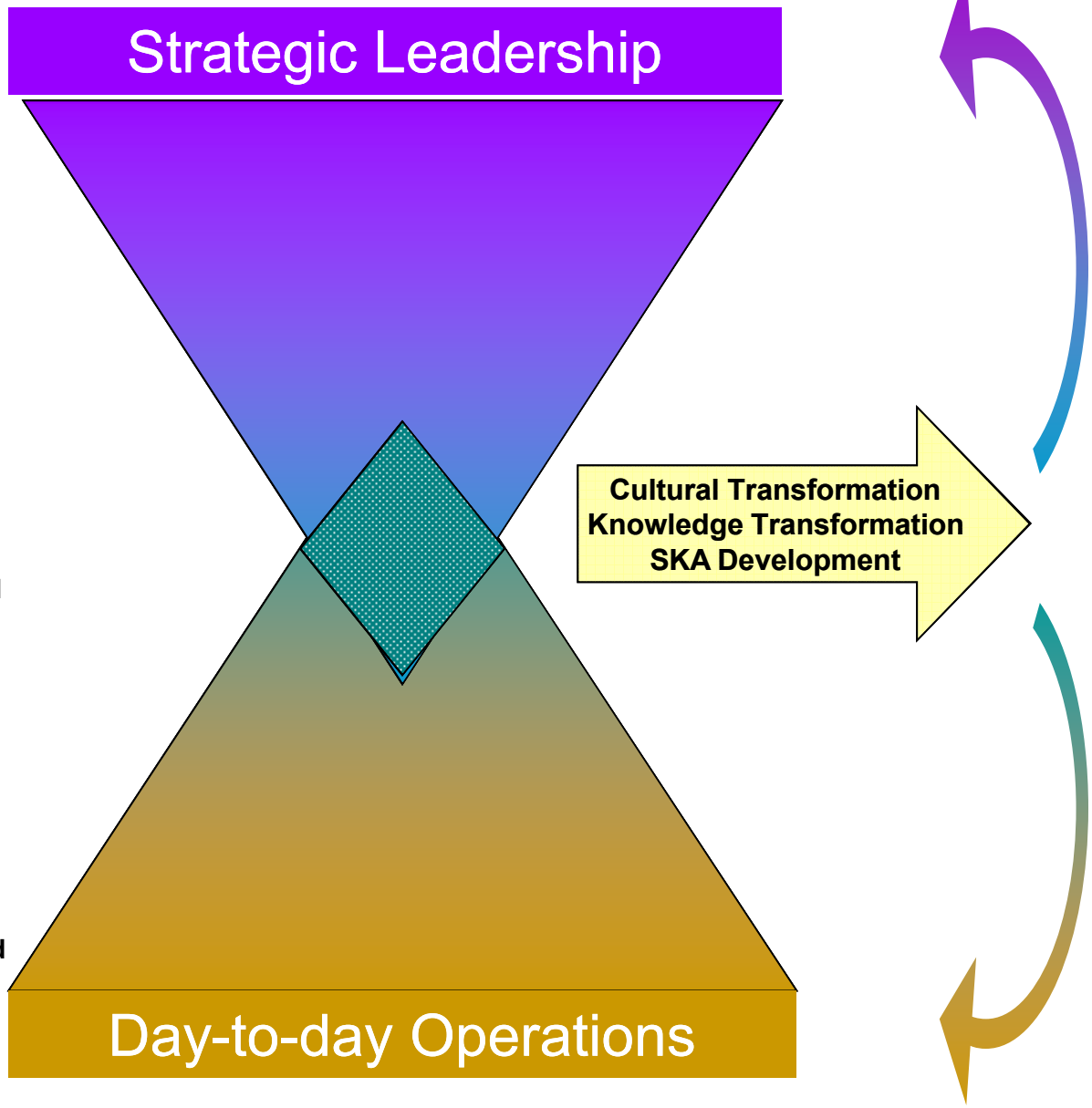
Professional Development

- Improve Technical Expertise and Build Credibility
- University Programs
- Strategic Educational Initiative
- Professional Memberships

Knowledge, Skill and Task Training

- Teach Technical Staff Members Basic Sandia Concepts, Processes & Procedures in areas of engineering and sciences
- Product Definition, Good Measurement Practices, Project Mngmt.
- Line-specific training

TACTICAL



Adapted from Source: Marsick & Watkins (1999)

In-house Continuous Learning Opportunities and Certifications

- Major focus areas:
  - Energy Surety
  - Electrical Engineering
  - Nuclear Engineering
  - Mechanical Engineering
  - Software Engineering
  - Systems Engineering
  - Engineering Sciences
  - Computer Science
  - Software Engineering
  - Bioscience
  - Material Science
  - Compliance
  - Nuclear Weapons

Engineering Training – An Example: Systems Engineering Curriculum

1. **Systems Engineering**
   a. Systems Engineering Overview
   b. Engineering Excellence
   c. Introduction to Systems Leadership
2. **Requirements**
   a. Requirements Engineering
   b. Requirements Engineering for Management
   c. Requirements Engineering Guidance Document
3. **Architecture and Design**
   a. Systems Architecture and Design
   b. Process and Procedures Guides
4. **Technical Management**
   a. Project Management
   b. Cost Financial Overview
   c. Cost Estimation
   d. Risk Management for Project Teams
   e. Cost Estimate Guide and Checklist
5. **Production, Maintenance, and Support**
   a. Sustained Production
   b. Design for Production
6. **Research/Technology Maturation and Transfer**
7. **Verification (Qualification) and Validation**
   a. Systems Integration: From Design to Proven Value

Legend
Blue = Novice/Practitioner Level
Purple = Practitioner/Expert Level
Green = Other Educational Opportunities
Gold = Other Resources

University Programs – An Example:

STEVENS Institute of Technology

Systems Engineering at Stevens Institute of Technology

SYSTEM DESIGN AND OPERATIONAL EFFECTIVENESS SDOE

Doctoral Degree (60 additional credits, after a Master's Degree)

Master's Degree (30 credits)

Core course requirements must be satisfied along the way towards a Master's Degree:

ALL students must take:
SDOE-625: Fundamentals of Systems Engineering
SDOE-650: System Architecture and Design

PLUS

PLUS, two of the following five options:
SDOE-611 Simulation and Modeling or SDOE-670 Forecasting & Demand Modeling Systems
SDOE-612 Project Management for Complex Systems
SDOE-660 Decision and Risk Analysis or SDOE 675 Dynamic Pricing Systems
SDOE-605 Systems Integration
SDOE 775: Systems Thinking or SDOE-780 Engineering of Agile Systems

At least 3 credits must be applied towards a project (SDOE-800), or 6 credits towards a thesis (SDOE-900). Multiple choices of electives exists. Selections must be approved and coordinated with the faculty advisor.

Graduate Certificate – Focus Areas (12 credits or 4 courses)

Agile Systems and Enterprises

SDOE 775: Systems Thinking

SDOE 780: Engineering of Agile Systems

SDOE 785: Architecting the Extended Enterprise

SDOE 790: Design of Agile Systems

Systems Engineering and Architecting

SDOE-625: System Operational Effectiveness & Life Cycle Analysis

SDOE-650: System Architecture and Design

SDOE-612: Project Management of Complex Systems

SDOE-605: Systems Integration

Systems and Supportability Engineering

SDOE-625: Fundamentals of Systems Engineering

SDOE-650: System Architecture and Design

SDOE-645: Design for Reliability, Maintainability, and Supportability

SDOE-640: System Supportability and Logistics

Systems Engineering Management

SDOE 612: Project Management of Complex Systems

SDOE 620: Simulation-Based Costing and Acquisition

SDOE 660: Decision and Risk Analysis

SDOE 680: Designing and Managing the Development System

Value Chain Enterprise Systems

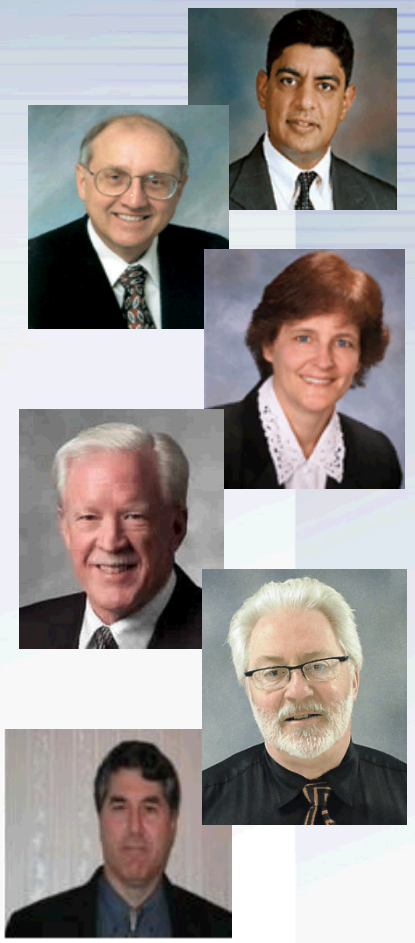
SDOE-665: Integrated Supply Chains

SDOE-670: Forecasting and Demand Modeling Systems

SDOE-675: Dynamic Pricing Systems

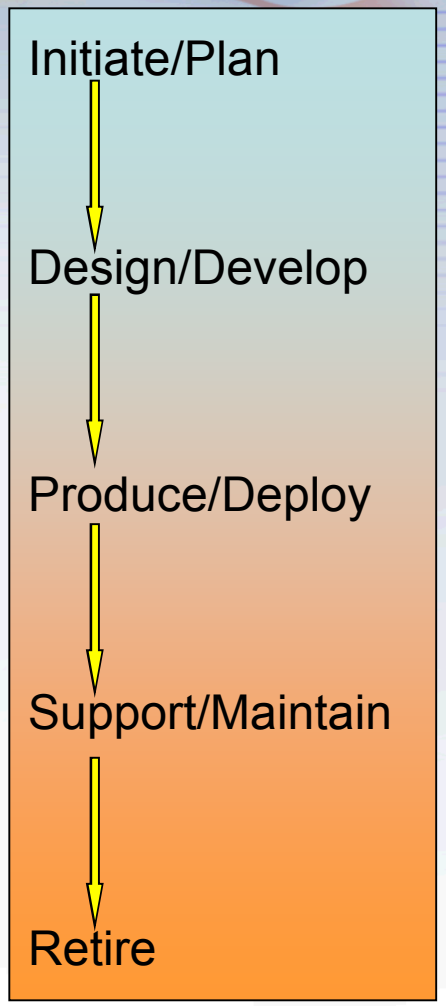
SDOE-640: System Supportability and Logistics

Excellence in Engineering: Systems Engineering Colloquia



- Provides a venue where systems engineering lessons learned and better practices can be shared.
- Gives exposure to systems engineering processes and problems.
- Facilitates discussion and reflection on experiences.
- Creates opportunities for networking and collaboration.
- Creates opportunity for individual and organizational learning and collaboration.

Product Lifecycle Management Program



- Product Lifecycle Management (PLM) is the process of managing the entire lifecycle of a product from conception, through design and manufacture, to service and disposal.
- The PLM Program Goal: To deploy scalable PLM solutions, including people, processes, and tools for all Sandia.
  - Integrate with and complement RPSS using pre-existing methodologies and successes
  - Development of processes and plans that will ensure qualification of a robust talent pool at Sandia
  - Deliver Enterprise Product Lifecycle Management System
- New Program - Long-term role yet to be defined.

Line-specific Training – An Example: Neutron Generator Professional Development

- Implemented a standard process for employee development
- Identified roles, tasks, competencies
- Deployed an electronic support tool
- Identified development opportunities
  - Non – training development opportunities
  - Internal education opportunities
  - External education opportunities
- Deployed line-specific project management training

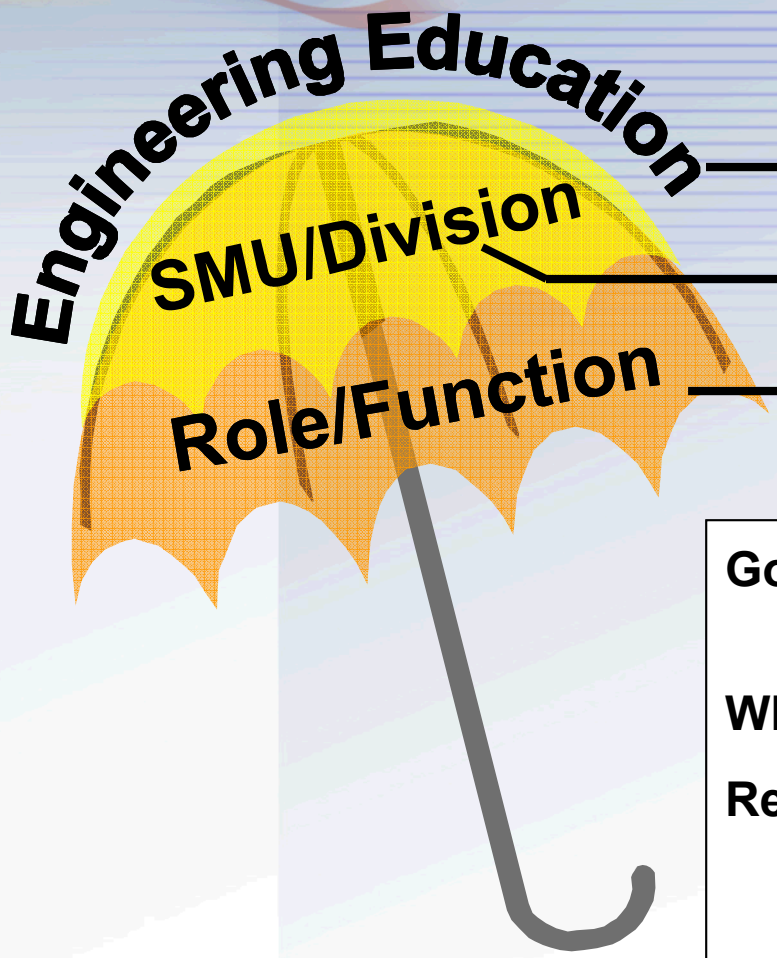
Line-specific Training – An Example: Realize Product SubSystem

- Sandia's NW product realization process to achieve Engineering Excellence.
- RPSS, a subsystem of the Nuclear Weapons Management System, includes five processes to consistently realize product.
- RPSS Awareness Training
  - Overview of PRT Responsibilities/Processes
  - Overview of Product Acceptance
  - Overview of Supplier Quality Management System
  - Overview of Engineering Authorization

Professional Development: University Programs

- Sandia provides education assistance benefits to eligible employees.
  - Tuition Assistance Program (TAP)
  - University Part-time (UPT)
  - Special Masters Program (SMP)
  - Doctoral Study Program (DSP)
- Approved courses and degree programs:
  - Business, accounting, computer science, engineering, or technology
- Programs must
  - Be accredited by nationally recognized agencies.
  - Maintain or improve an employee's job-related skills.
  - Enhance the employee's ability to perform his or her job.

2008 Engineering Education Design Review



→ **Corporate**

→ **Division-specific**

→ **Line-specific**

Goal: Develop a single, integrated curriculum for engineering professionals

Who: SMEs from eight SNL divisions

Result:

1. Gap & Overlap Analysis
2. Prioritized Educational Needs

FY10 and Beyond: Provide Learning Solutions In A Time Of Change

- Sandia policy structure transformation
  - Change from Corporate Process Requirements to Corporate Policy System
  - Introduction of additional policies and modifications
- NWSMU procedure transformation
  - Change from Technical Business Practices to Realize Product Subsystem
  - Changes to Business Management Procedures
  - Introduction of Requirements Modernization and Integration to the NWC

FY09 and Beyond
(cont)

- Provide learning solutions for gaps and indentify opportunities
  - Configuration management
  - Project management
  - Computational simulation (electrical/radiation)
  - Radiation modeling
  - Advanced programming
  - Competencies and/or qualification
- Engage Creativity, Innovation, and Problem Solving
- Explore alternative learning technologies
- Doing work faster, cheaper, and with limited resources

The challenge: Enable the Labs' mission through learning.
The opportunity: Developing new, focused partnerships across the labs.

Back Up Slides

Our Goal is "Excellence in Engineering"

Provider of innovative, science-based, systems engineering solutions to our nations most challenging national security problems.

Sandia National Laboratories should be a place:

- Considered one of the very best in the practice of engineering.
- Sought by academia to better understand new approaches to engineering.
- Sought by industry to find best practices in engineering.
- Actively involved in the national and international community in defining new approaches, standards, and best practices in systems engineering.

Embodying Excellence in Engineering

- **How Corporate Learning & Professional Development plays a role.**
  - Develop staff:
    - Orient new people to procedures
    - Assign staff to develop/exercise skills
  - Make “excellence” a fundamental, observable characteristic of Sandia and of our work.
  - Take steps to eliminate the two main causes of failure in complex tasks: Ballistic Thinking and Failure to Follow Procedures.
  - Engage the Science and Technology community.
  - Engage others in dialogue on how to achieve excellence.
  - Learn from our successes … and our failures …

Skill and Task Training: Line-specific Training

- Line-specific Training developed for and/or by specific organizations, centers, or divisions. This training may be specific to a particular Role, Job Function or Line of Business.

- Some line organizations support their own training functions, others partner with CL&PD.

Professional Development: Strategic Educational Initiative

- The Strategic Education Initiative goals:
  - Create a culture that is passionate about and supportive of continuous learning,
  - Initially increase the number of internally provided technical and leadership/management development classes or courses completed by and delivered by Sandians, and
  - In the future, increase the number of internally provided professional development courses.
  - Promote professional development by providing Sandians with corporate funding for up to 32 hours of training within a fiscal year.
- Intended to enhance or significantly expand an individual's current and new knowledge base. This knowledge must relate to or enable the mission of the Laboratories.

Professional Development: Memberships in Professional Organizations

- Sandia Corporation supports employee participation in professional association activities as a means of fulfilling its strategic endeavor to develop its workforce.
- Professional memberships and participation in outside professional organizations provide employees with opportunities in training, information exchange, and networking, while building professionalism and projecting the quality of Sandia National Laboratories' workforce.
- Sandians are members and board members at the International and Local (State) levels:
  - INCOSE – International Council on Systems Engineering (Sandia is a Corporate Member)
  - PMI – Project Management Institute
  - ASQ - American Society for Quality
  - LMC Systems Engineering Steering Council