

# Case Study: Sandia National Laboratories

**Kathleen McCaughey**

**Director, Emeritus**

**Sandia National Laboratories**



National Nuclear Security Administration



**Sandia  
National  
Laboratories**



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.



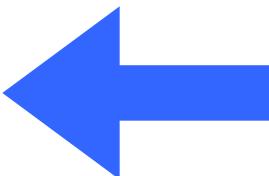
# Agenda

- Who we are
- What we do
- Burning Platform
- The conversion
- Results
- Sustainment



# Agenda

- Who we are
- What we do
- Burning Platform
- The conversion
- Results
- Sustainment



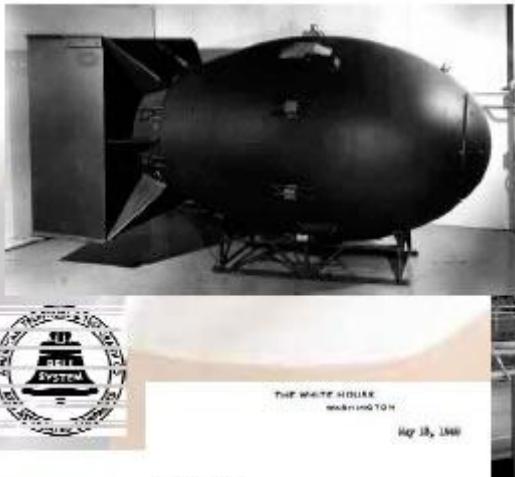
# Sandia National Laboratories

## Our Business: National Security



- **Core Purpose:** To help our nation secure a peaceful and free world through technology.
- **Highest Goal:** To become the laboratory that the United States turns to first for technology solutions to the most challenging problems that threaten peace and freedom for our nation and the globe.

# Sandia's Heritage From Day 1: “Exceptional Service in the National Interest”



Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to see that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This organization, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

I hope that after you have made over to Director of the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have been an opportunity to render an exceptional service to the national interest.

I am writing a similar note later to Dr. G. E. Mullings.

Very sincerely yours,

*Harry Truman*

Mr. Lester A. Wilson  
President,  
American Telephone and Telegraph Company,  
150 Broadway,  
New York, N. Y.



# Sandia is Responsible for the Design of Non Nuclear Components and Subsystems for Nuclear Weapons

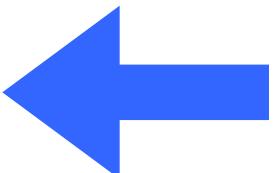
We are the Systems Integrator responsible for:

- Design of >95% of U.S. nuclear weapons components
- Production on-site of Neutron Generators, Microsystems, and batteries and procurement of technically complex, high reliability and low volume products for the nuclear weapons stockpile
- Maintaining weapons in the stockpile



# Agenda

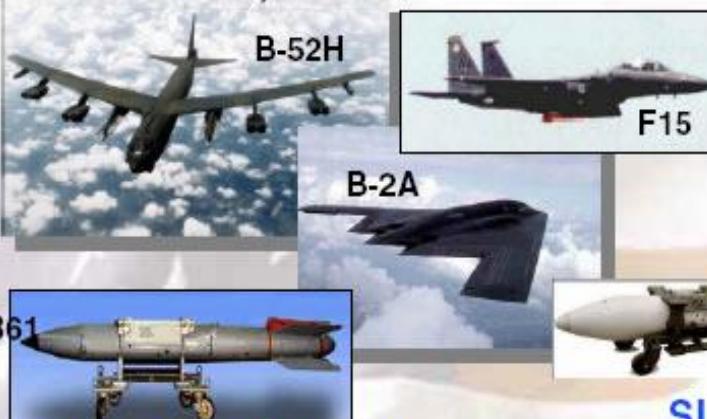
- Who we are
- What we do
- Burning Platform
- The conversion
- Results
- Sustainment



# Neutron Generators are a Critical Component in the Products for Our Ultimate Consumer DoD

## Gravity Bombs

(F15, F16, & Tornado Aircraft and B52 & B2 Aircraft)



## Cruise Missile Warheads

(ALCM, ACM, & TLAM/N)



ALCM, W80-1

## ICBM Warheads

(Peacekeeper & Minuteman III Missiles)



W62/W78/W87

## SLBM Warheads

(C4 & D5 Missiles)



C4/D5 SLBM

Trident Submarine

# Responsive Neutron Generator Product Deployment Center

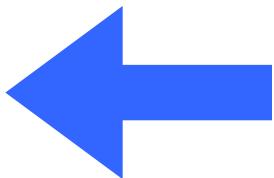
## Mission:

Responsive to deterrence needs, through science-enabled product realization and stewardship of non-nuclear products of today and tomorrow



# Agenda

- Who we are
- What we do
- Burning Platform
- The conversion
- Results
- Sustainment



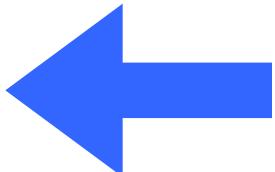
# Burning Platform, Year 2000

- Failure to meet required starts and inventory plan
- Poor production rates
  - *Low yields*
  - *High WIP*
  - *Long span times*
- Increasing production demands
- Continued to be plagued with technical issues
- Going through major redesign on neutron generator
- First ship to be 8/02
- Moving neutron generator production to new building
- Budget would not allow required ramp up in personnel



# Agenda

- Who we are
- What we do
- Burning Platform
- The conversion
- Results
- Sustainment



# The Conversion

- Focus on People
- Strategy Alignment
- Tools, Systems, and Principle Based Systems
- Leadership
- Benchmarks
- Organizational Flow



# Focus on People

- Having the right people
  - *Change the people, or change the people*
- Building a Human Resource System
  - *Focus on people development and recognition*
- Knowing the organization's culture, focus on filling the gaps
- Building mutual trust and respect into the organization's culture
- Building understanding and readiness for change
  - *In order to succeed, people at all levels must buy into the organization's goals and the journey toward achieving them.*



# Principle Based Human Resources System

## Principles which drive our system:

- Our people own their work.
- We seek perfection.
- We respect our employees as individuals and leverage their diversity of strengths.
- We develop excellence in people.
- We align meaningful to our strategic objectives.
- We reward and recognize our employees.

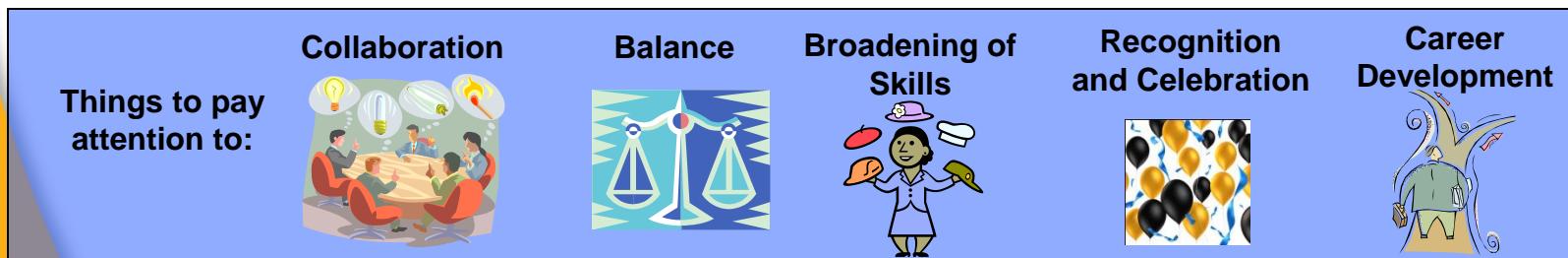
Overarching principle: Provide excellence in the work we do for the service of the nation.



**Core Principle: We have the right people, with the right skills, in the right jobs, doing the right things.**



# Organization's Culture



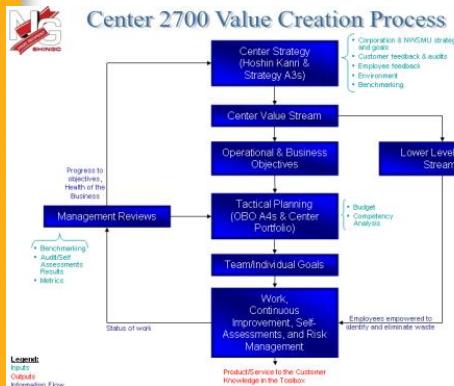
**The more fully an organization knows itself, the greater its potential for positive change and increased effectiveness.**

# Strategy Alignment

- Define what's important - what's your true north? - what's your plan to get there
- A means to concisely communicate to employees your true north
  - *One-pager allows it to be posted throughout your organization to always keep it visible*
  - *Create alignment with each employee's work scope and the organizational direction - take the time to explain, and dialogue for understanding*
- Sets empowerment boundaries
  - *Provide scope for work activities and continuous improvement*
- Drive your organization's culture to be more disciplined
- Defines a means to measure and know when you have achieved your Strategic Objectives
  - *Defining measures is challenging, but start with something and then continually improve*



# Value that Flows: “Principle Based Lean Systems” Better Align, Prioritize, and Focus Work To Achieve True North

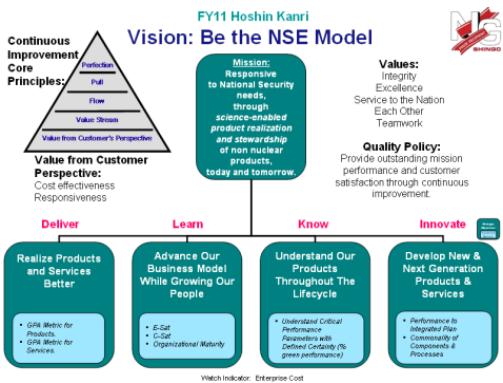


The Value Creation Process is the highest level of **Plan-Do-Check-Act** cycle in the Center.

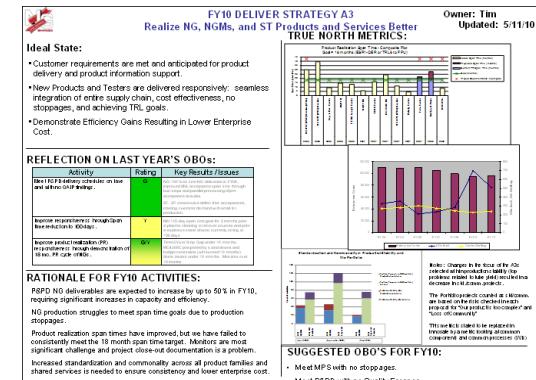
**Results**

Proposal ID	Title	Cost	Schedule	Performance
OBO: Enhance the Center business model and drive continuous improvement as the inherent way we do work in order to enable a sustainable enterprise.				
661-11 A	02701 - Front Door & Special Projects	Yellow	Green	Green
587-11 A	Equipment Life Cycle Management System	Yellow	Yellow	Yellow
141-11 A	Quality Management System (QMS)	Yellow	Green	Green
797-11 A	Division Support & Maint of Center Capabilities	Green	Yellow	Yellow
419-11 A	Financial and Budget Services	Yellow	Green	Green
354-11 B	Continuous Improvement	Green	Green	Green
530-11 B	2737 Center Data Apps, Cyber & HW Shared Services	Green	Green	Green
148-11 C	Enabling Services - Shared Resource	Green	Green	Green

The Portfolio Management System **prioritizes and aligns** all value added work activities in the Center to Strategic Objectives. It provides a visual status on cost, schedule, and performance. Each work activity has a unique project and task number that allows for clear accounting.



One Page Policy Deployment includes Center Vision, Mission, Strategic Objectives, True North Metrics, and Watch Indicators to **align, focus, and measure** work in the Center.



Strategy Deployment A3s provide a roadmap to achieve and **track progress** towards completion of Strategic Objectives.



**FY11 OBOs**

**Deliver**

- ✓ Increase Production Stability to improve responsiveness, achieve 100% schedule performance, and increase capacity to enable new product integration. (Alan/Kate/Lorraine)

**Know**

- ✓ Identify & close knowledge gaps to reduce enterprise cost & known risks. (Mike)
- ✓ Improve our technical basis of fielded products to support stockpile decisions. (Muhammad)

**Innovate**

- ✓ Develop manufacturable designs that ensure production integration to meet customer requirements. (Melecia)
- ✓ Transform existing product and create new options to enable a sustainable enterprise. (Neil)

**Learn**

- ✓ Define HR System priorities and implement activities to proactively meet the upcoming "environmental" challenges. (Jorge)
- ✓ Enhance the Center business model and drive continuous improvement as the inherent way we do work in order to enable a sustainable enterprise. (Don)

Annual Operational and Business Objectives **define empowerment boundaries** for Center employees to submit work proposals.

# Tools, Systems, and Principle Based Systems

- Start with tools, build systems, create your own Principle Based Systems
- Continuous improvement must permeate all areas of the business
  - *CI is evolutionary, not revolutionary*
- Build change agents, full time Black Belts to help lead the conversion
- Value of discipline: Plan – Do – Check – Act
  - *Standard work versus abnormal work*
- CI Action plans focused in improving processes
  - *Neither event- nor platform-driven but an integral part of the management system*
  - *Gives you something to rally behind*

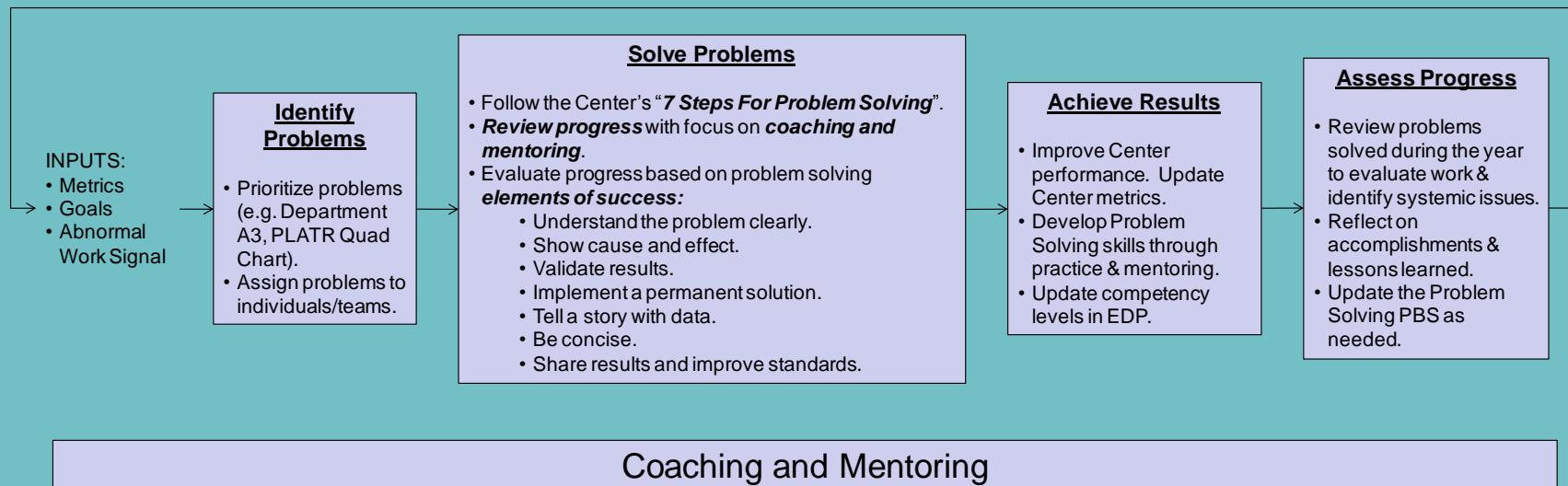


# Problem Solving PBS, an example

## PRINCIPLES

- Problems are a gap from a standard or a lack of a standard.
- Work has to flow and abnormal conditions must be recognized.
- Problems must be prioritized with respect to metric goals and resources.
- We need to enable people development and build a problem solving culture.
- Problems will be solved once and for all because of rigorous root cause, peer review, validation, and integrity.

## SYSTEM

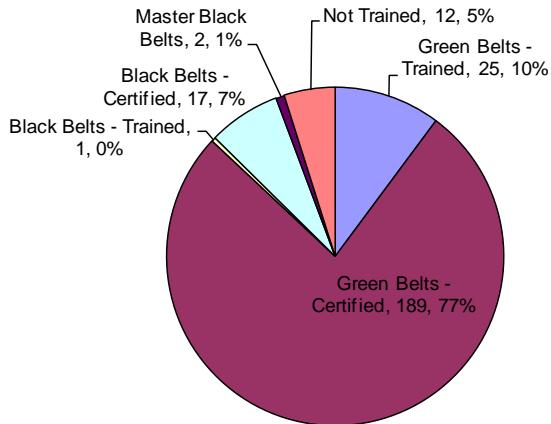


## TOOLS

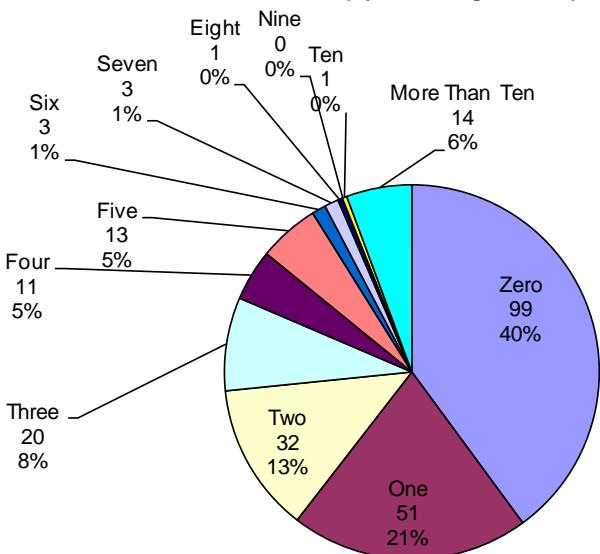
7 QC Tools (cause & effect diagram, control charts, histograms, pareto charts, scatter diagrams, run charts, check sheets), 5 Why's, Apollo RCA, Kepner Tregoe (Decision Analysis, Problem Solving), Kaizen, Design Of Experiments, Issue Trees, Affinity Diagrams, Probability Tree Diagrams, etc...

# Creating a Culture Of Continuous Improvement

Center 2700 Lean Six Sigma Training & Certification Metric  
(Sandia Employees)

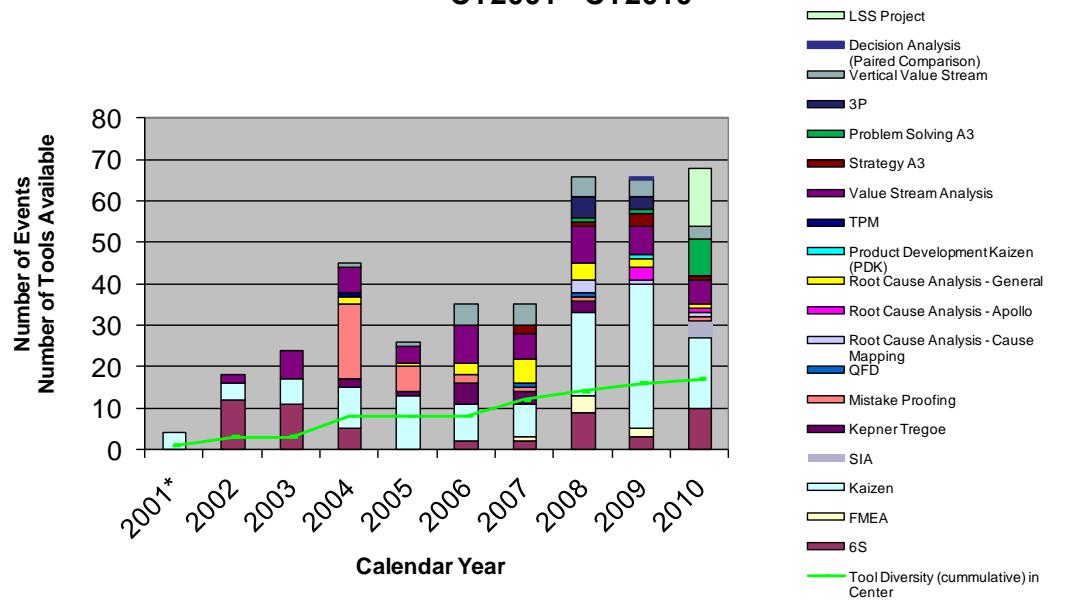


LSS Activity Participation for Regular Employees  
(Updated August 2010)



**Goal = 100% GB Trained & Certified**  
Currently 95% GB Trained & 85% GB certified

Center 2700 LSS Activities and Tool Diversity  
CY2001 - CY2010



**Goal = 100% participation in at least 1 event per year**

# Leadership

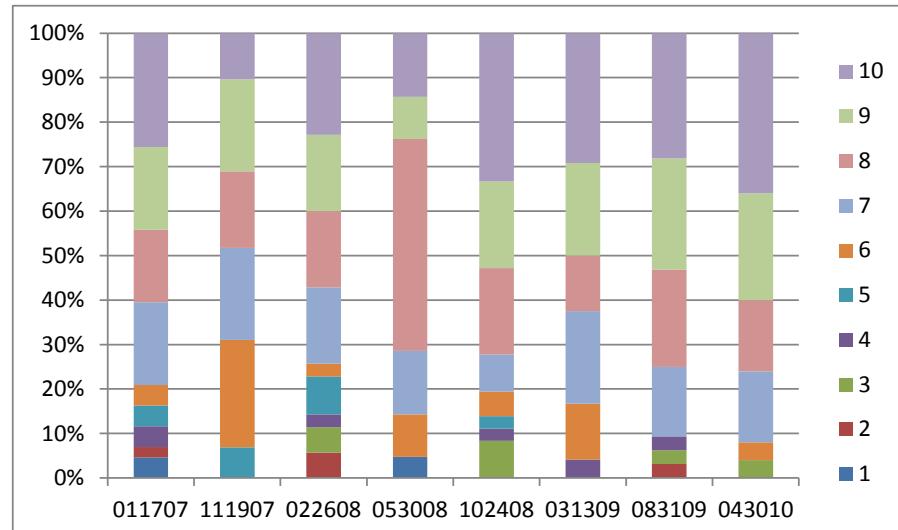
- Developing the right leaders, with the right skills, in the right jobs, doing the right things.
  - *Continuously developing future leaders through succession planning*
  - *Utilize some type of competency model to identify and analyze managers' strengths and weaknesses, and to develop leadership skills*
  - *Flexible leadership team that can work throughout the organization*
  - *Engaged in enterprise thinking and assuring appropriate alignment*
- View leadership as a sustainable system in and of itself
- Establish and then lead by principles in order to achieve a common vision and common behaviors
- Lead the annual *Hoshin Kanri*, codify strategic goals for the Center, as well as seeking the means by which to fulfill those goals, to create alignment
- Top down commitment to embrace learning and change



# Consistently and Constantly Communicate the Strategy

- Measure alignment and get feedback
  - Feedback from FY11 HK

- *In the 37 years working since graduating college, I have never been prouder of working in an enterprise than I am in the current NGs.*
- *No kidding, today's roll out was not only very informative and well presented it should have been inspirational and motivational to everyone who paid attention!*
- *I have great appreciation for the time that I have been in the Center and can see the effort to continuously improve. This goes to say with everything! I am excited to be a part of the FY11 proposal call/preparation and I think the changes are really going to improve the process.*

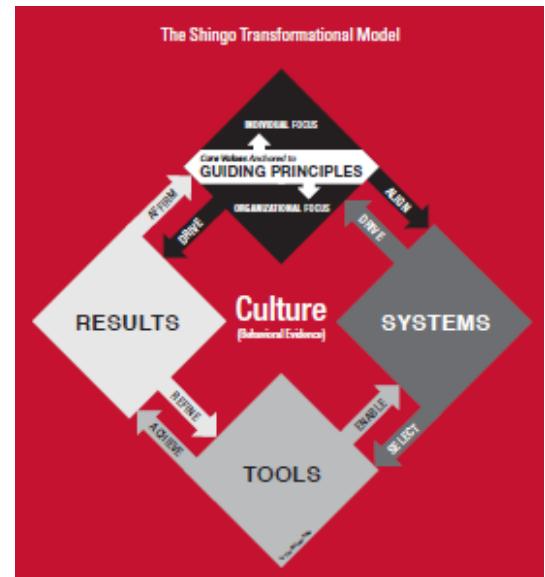


ESat question: "I clearly see the connection between my work and the Center's strategies, goals, and direction."

Rating scale: 1 - no alignment; 10 - maximum alignment

# Benchmarks

- Use a maturity model to measure progress
- Make an *intentional effort* to benchmark and to bring in new ideas
- Be open to critical self-examination – a willingness to submit the organization to external assessment
  - *Recognizing and acting upon weaknesses in the organization can be just as useful as building on its strengths*
  - *Helps clarify your own thoughts in order to be able to explain to a third party*
  - *Helps you question why you're doing what you're doing – reflection*
- Not all assessments bring about an organizational action plan – need to be associated with ongoing improvement plans

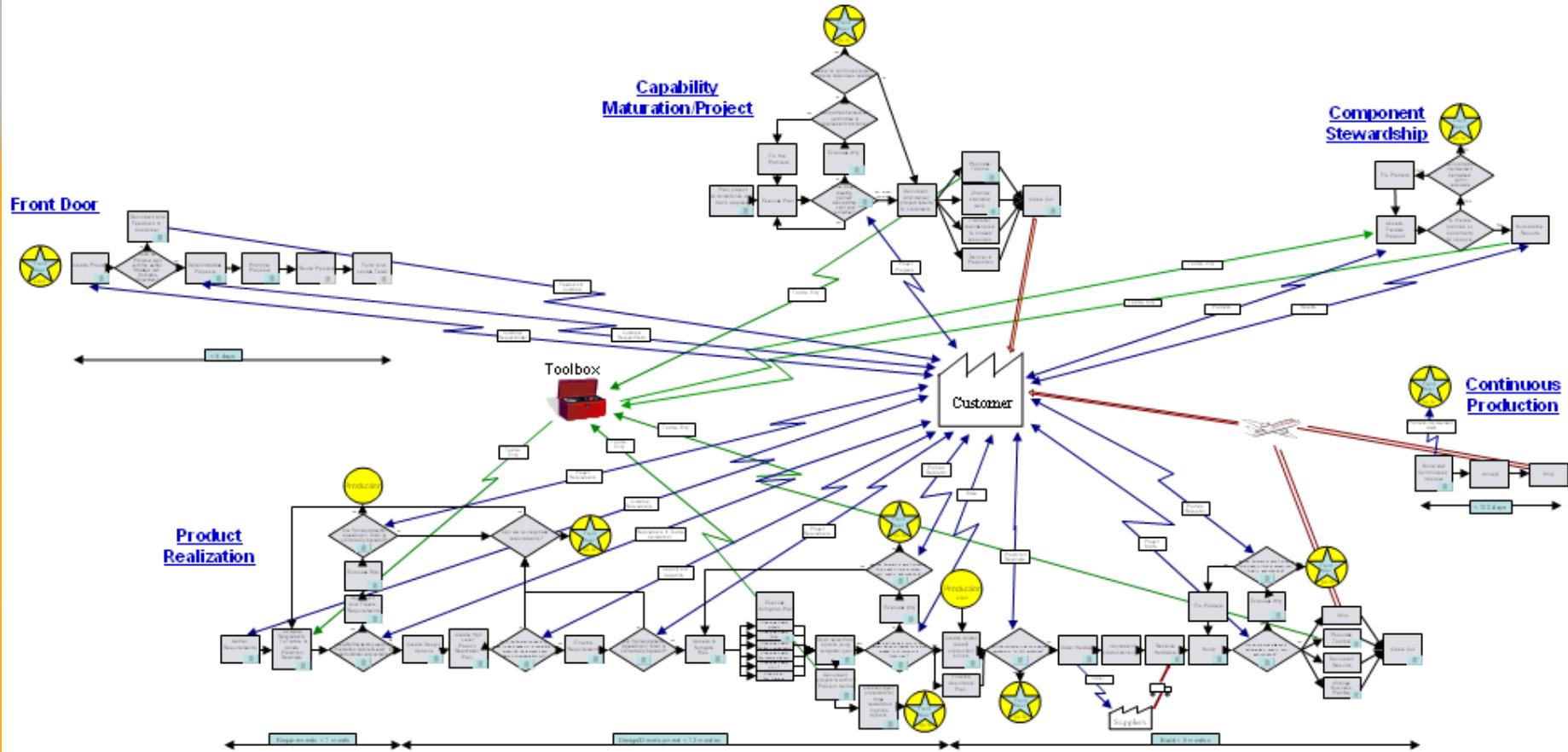


# Organizational Flow - Aligning structure to the work

- Form follows function
- To achieve flow:
  - *Focus on the product*
  - *Remove interfaces*
- Focus on the work, value as defined from the customer perspective



# Center Value Stream Map



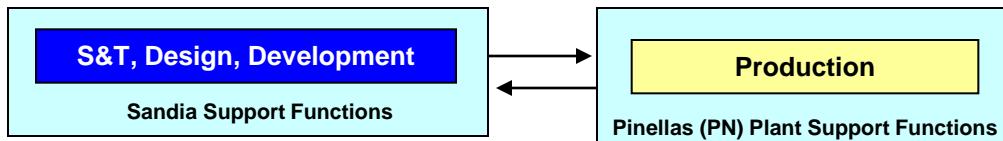
# Transforming the NG Enterprise

## Lab Recognition:

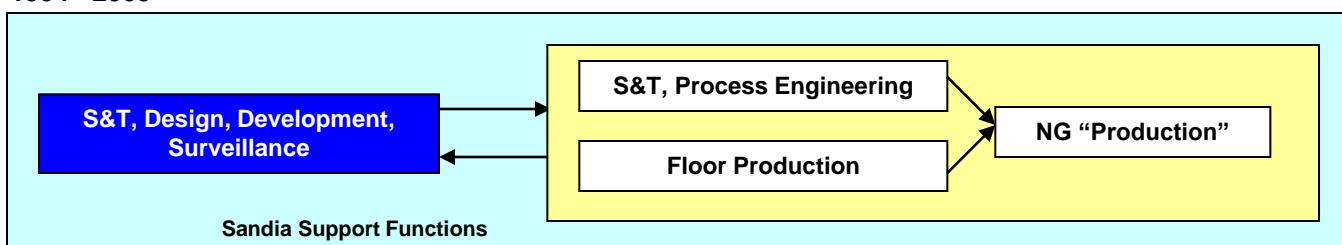
NG Enterprise is at the “forefront of operational excellence,” Tom Hunter, Lab Director (retired)

“NG embodies the vision of the NWSMU … everyone needs this level of integration . . . ,” Paul Hommert, current Lab Director

1955 - 1993



1994 - 2005



## Model Characteristics:

- Collocation of DA and PA to improve manufacturability of products and risk reduction
- Maximum use of existing capabilities within Lab
- Emphasis on new designs, less parts, common processes
- Emphasis on meeting cost and schedule
- Major effort on implementing Lean/Six Sigma Continuous Improvement
- Movement of development work off production floor
- Application of S&T to more quickly address production issues

## Model Characteristics:

- Product issues passed to Design to solve
- Emphasis on schedule, cost secondary

2005 – Present & Future

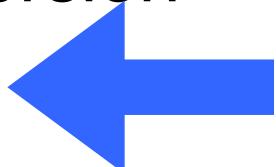


## Model Characteristics:

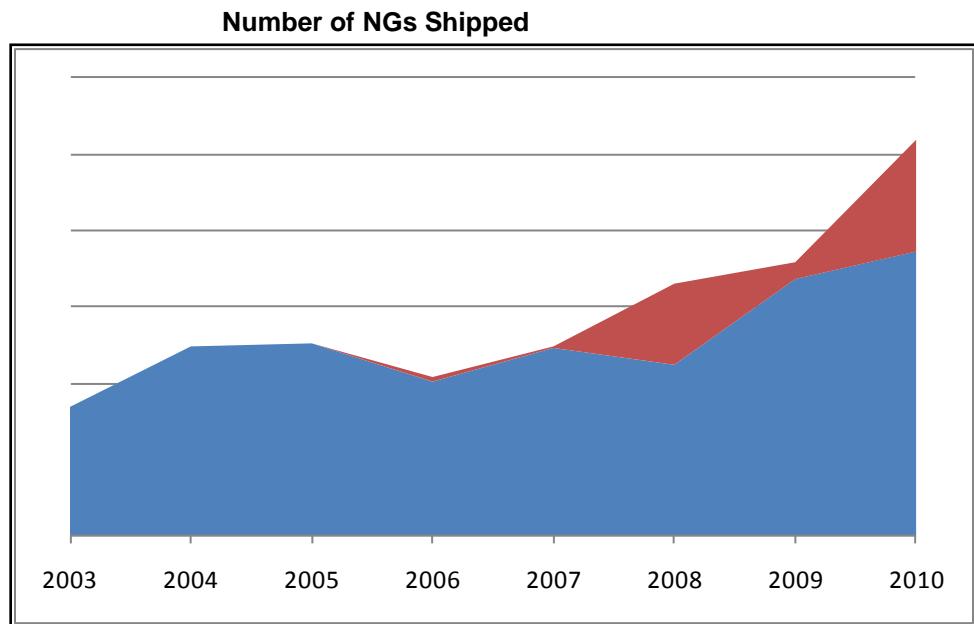
- Integrated Design & Production within Sandia
- Focus on Responsiveness
- Separation of Capability Maturation & Product Realization
- Science-enabled product realization
- Focused QMU activities to increase NG knowledge
- New Product Assurance Model

# Agenda

- Who we are
- What we do
- Burning Platform
- The conversion
- Results
- Sustainment

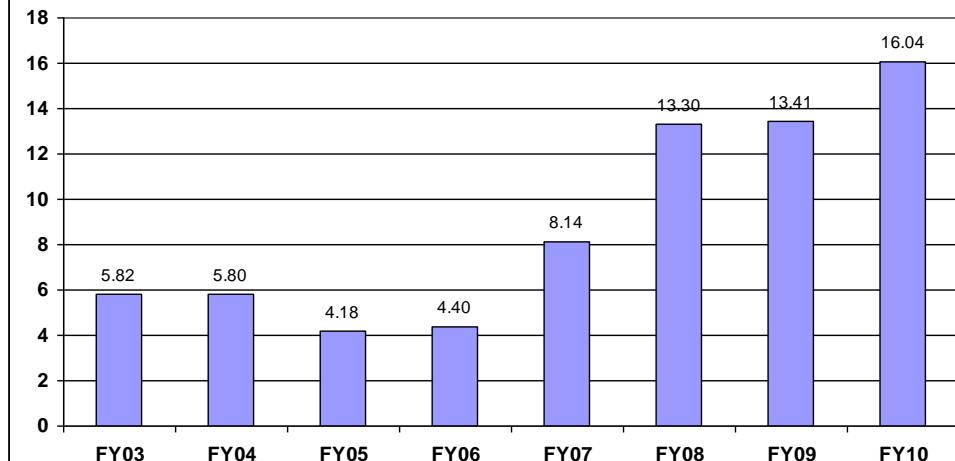


# Increased Number of Shipments Without Adding People

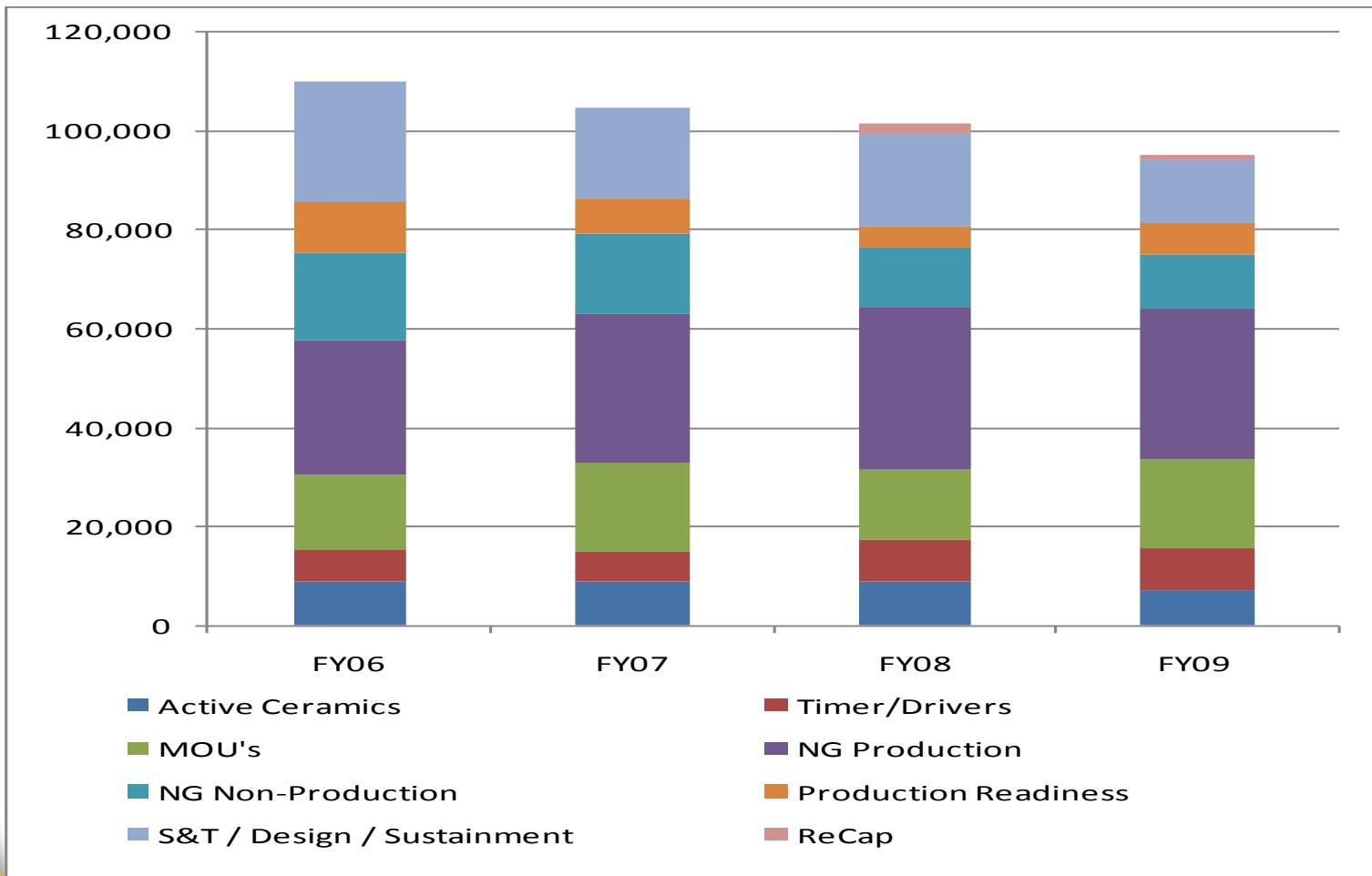


*Tripled number of shipments and increased productivity by 175% in 7 years*

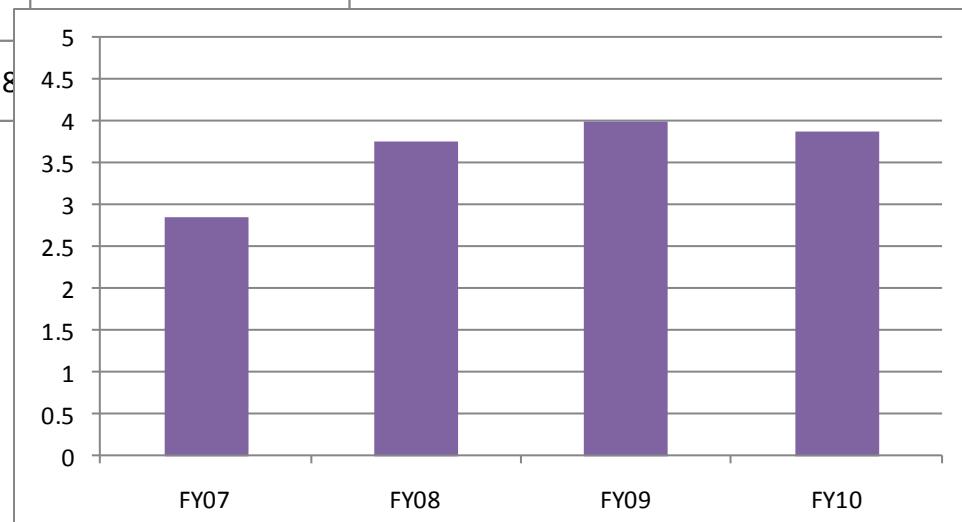
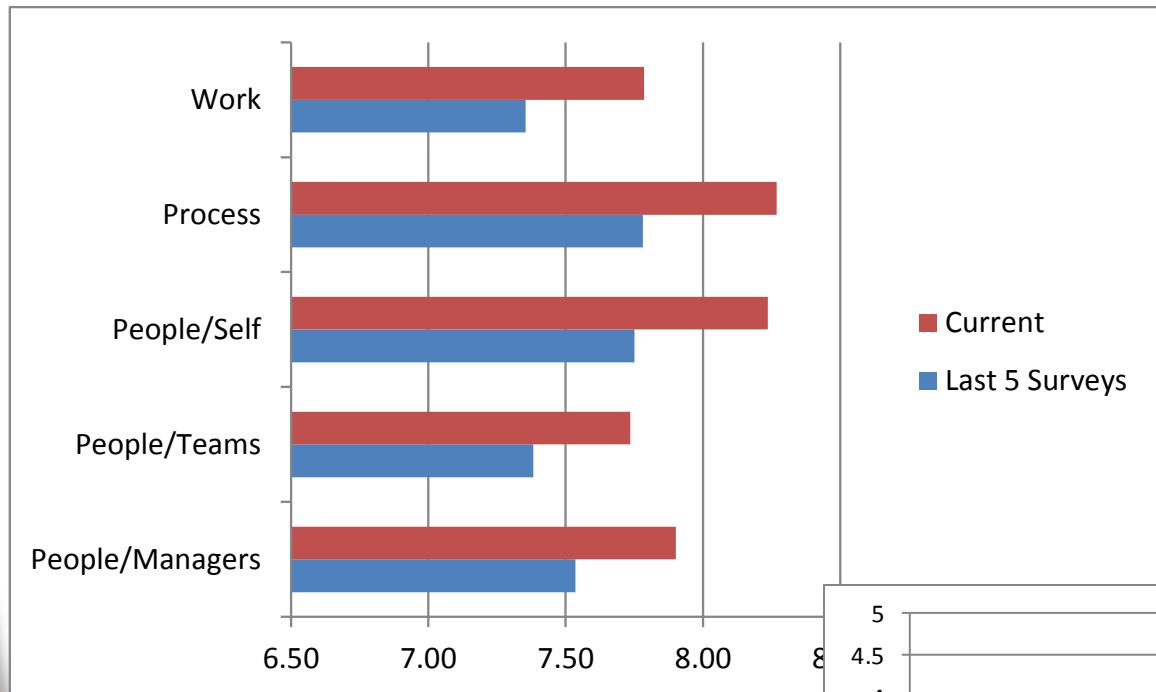
Productivity  
Number of NGs (New) Built per Operator



# Overall: Reduced Enterprise Cost by 13.5% over 4 Years

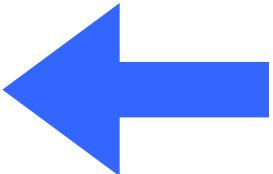


# Employee & Customer Satisfaction Surveys



# Agenda

- Who we are
- What we do
- Burning Platform
- The conversion
- Results
- Sustainment



# Sustainment - CI

Key set of success factors that are critical to the sustainment of a culture of continuous improvement:

- Provide an inspiring vision and a focused plan to get there
- Define the core principles that will drive all
- Create management systems (at all levels) aligned with core principles and the enterprise culture
- Drive discipline in continuous improvement (always follow the Plan-Do-Check-Act cycle)
- Require leaders to set the example

Define key set of metrics to measure progress against

- *To drive the right behavior*
- *Measure at all levels throughout the organization – relevancy and alignment to true north*



# Sustainment – Leadership

- Drive the strategic alignment, ongoing measurement, and continuous improvement
- Learn by doing, be visibly and constantly engaged
- Clearly communicate expected lean behaviors and actions, such as the removal of waste from all activities
- Be role models
  - *If you expect all employees to be Green Belt certified, you must be GB certified*
- Identify and make available change agents for leadership and the sustainment of the lean effort
  - *These leaders must be respected within the organization*
  - *Work to build critical mass*



# Sustainment – Leadership

- Drive a learning organization
  - *Take advantage of benchmarking opportunities*
  - *Reflect on your actions, accomplishments, and problems, and learn from them*
  - *Measure yourself against standards, and learn continually from others*
- Provide an environment conducive for change
  - *Connect with others who also want to create change*
    - *Work together, start where you have built trust or have common goals, and share knowledge*
  - *Think globally, and integrate across potential stovepipes*
  - *Try to exert influence beyond your control*



# Sustainment – Tools, Systems, Principle Based Systems

- Continue to learn and disseminate new tools, creating new systems, and principle based systems – aligned with core principles
- Apply the right tools to the process
- New and improved ideas should be institutionalized via systems, or standard work, or procedures, to create and sustain change



# Sustainment - People

- Focus on the people in the organization
- Create a strong and consistent culture across the enterprise, and work with it
- People should be comfortable with change but intolerant of wasteful activities
- Focus on getting the right people – people who are self-motivated, critical thinkers, and want to work on continual improvement because it is the right thing to do
  - Act on the responses obtained from the ESat surveys and communicate those actions to employees

**There is a strong correlation between continual improvement, sustainment and employee satisfaction.**



- Thanks for Listening!

