

# *Will Unrecognized Risk Kill Your Project Too?*

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- Utilize an actual DOE National Laboratory project to demonstrate the evolution of unrecognized project risk
- Use lessons learned to develop and stimulate a new thinking of the risk paradigm for projects
- Does the domain of project management lend itself to a new risk paradigm?

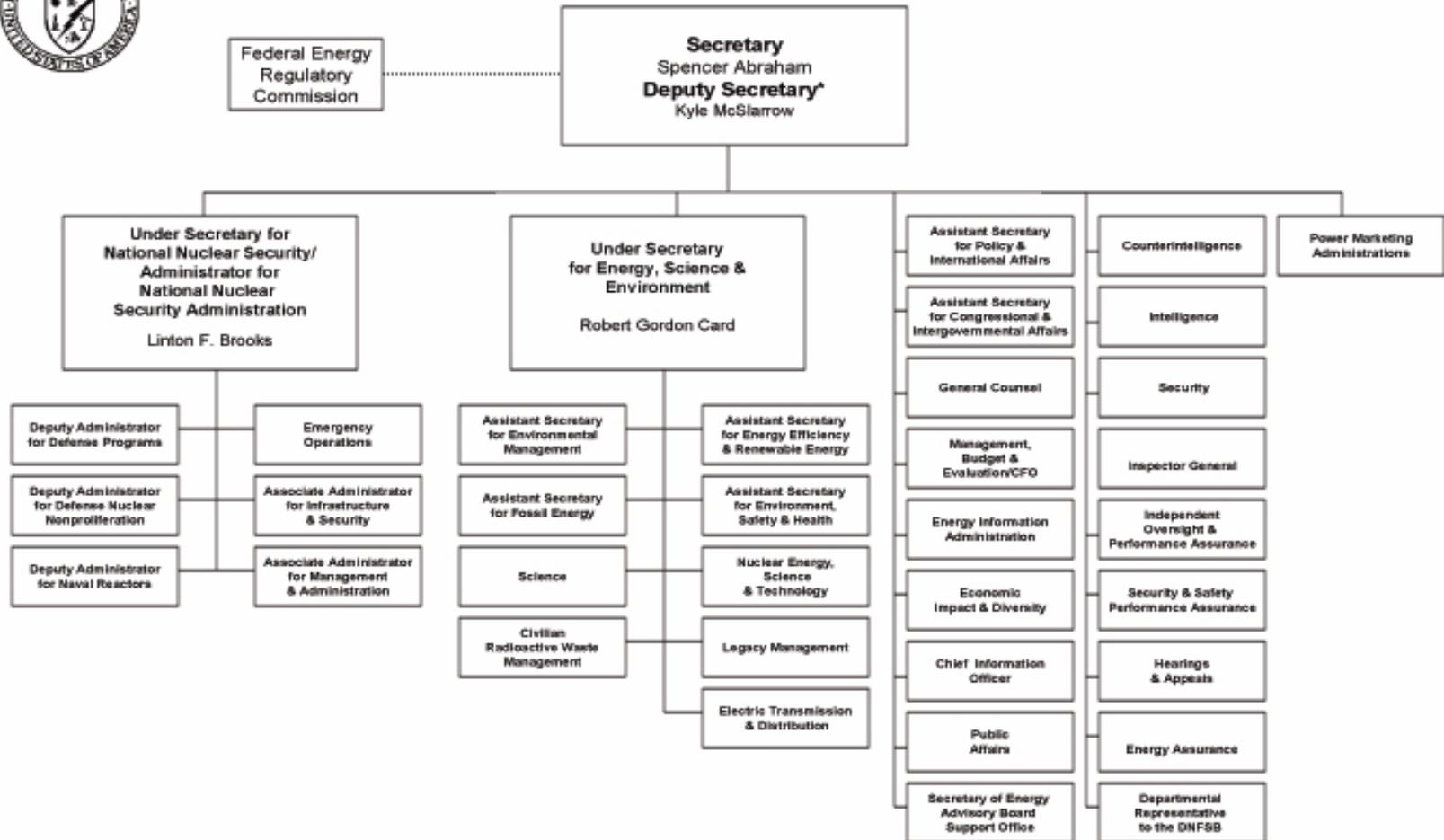
# *Department of Energy*

## Mission and Strategic Goals

- Energy
- Science
- Environment
- Defense

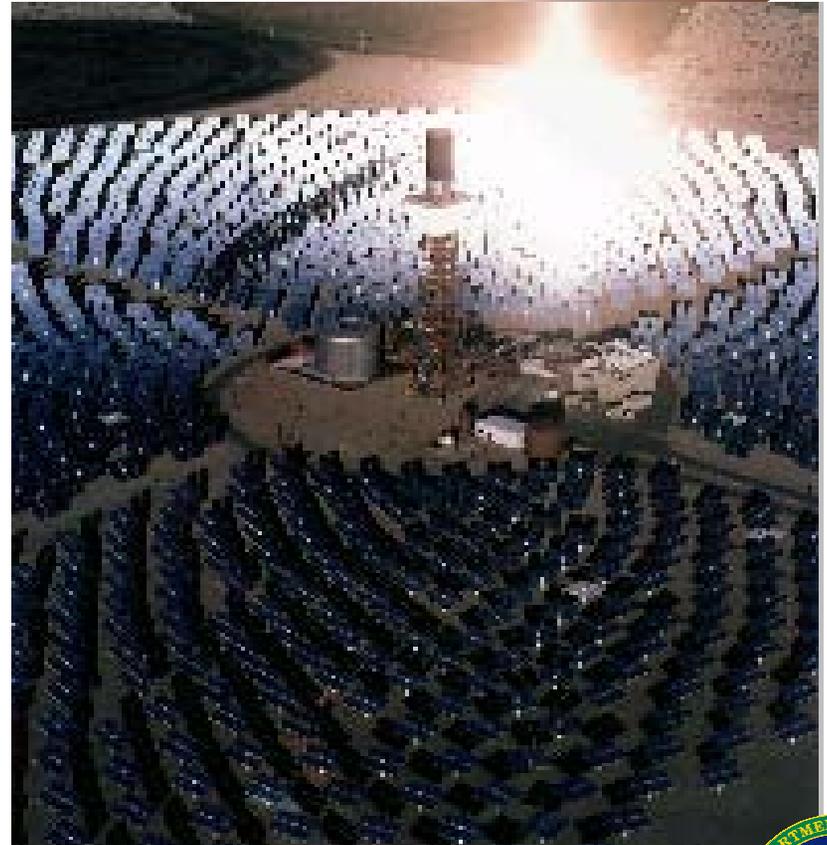


# DEPARTMENT OF ENERGY



\* The Deputy Secretary also serves as the Chief Operating Officer

# *Energy: Promoting a diverse supply and delivery of energy*



*Science: Provide scientific research capacity and advance scientific knowledge*



*Environment: Provide a responsible resolution to the environmental legacy of the Cold War; and Provide for the permanent disposal of the Nation's high level radioactive waste*



# *Defense: Enhance U.S. national security through military application of nuclear technology*





*National Nuclear Security Act  
Established NNSA*

*Maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile including the ability to design, produce, and test*



# *National Nuclear Security Administration*

- Annual Stockpile Certification
- Provide U.S. Navy with militarily effective, safe, and reliable nuclear propulsion plants
  - Schenectady Naval Reactors
  - Pittsburgh Naval Reactors
- Promote international nuclear safety
- Reduce global danger from weapons of mass destruction (and terrorism)

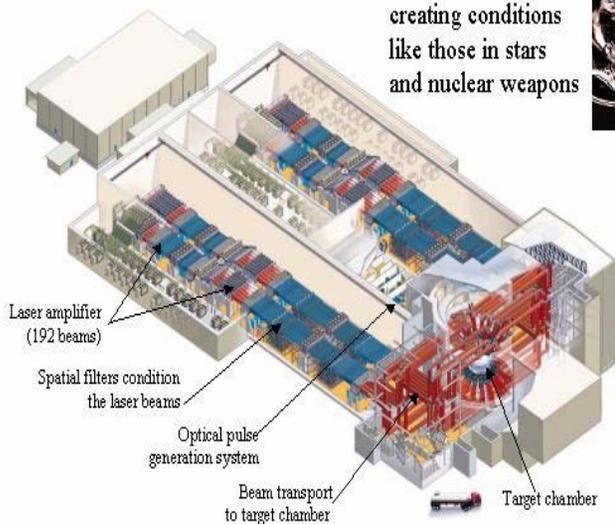
# National Security Laboratories Lawrence Livermore National Lab

## National Ignition Facility



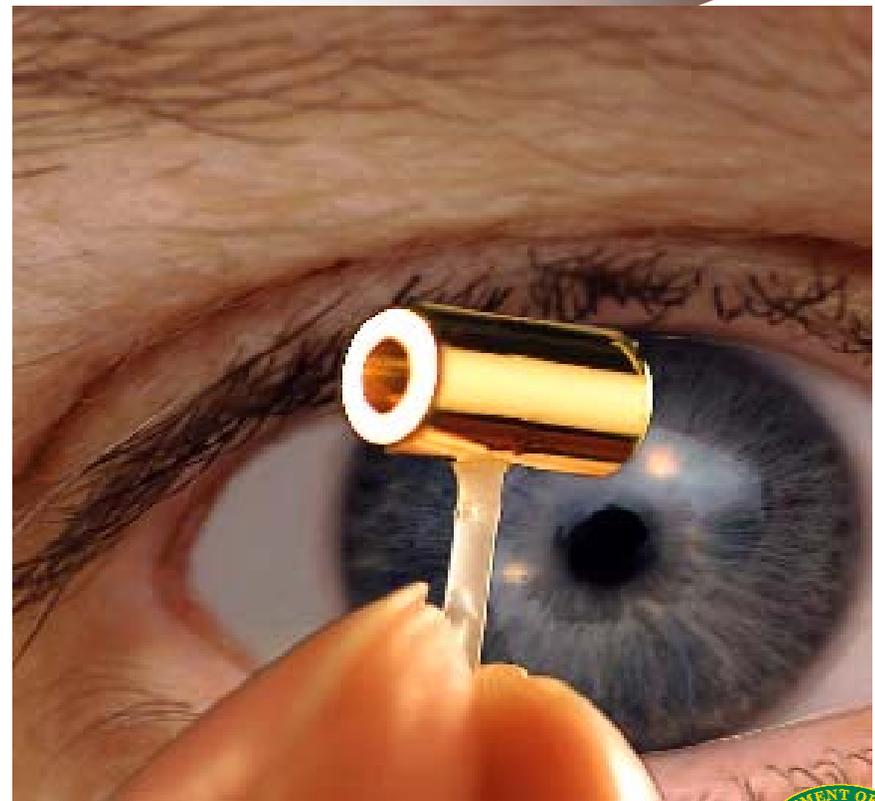
Low-hazard, radiological facility

The goal of the NIF is to ignite and burn a small fusion target creating conditions like those in stars and nuclear weapons



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# *National Security Laboratories Lawrence Livermore National Lab*



*National Security Laboratories  
Sandia National Laboratory*



# *Test Capability- Nevada Test Site*



# *Office of Project Management and Systems Support, NNSA*

## Continuous Improvement of Project Management

- Project management policies and procedures
- Conduct benchmarking
- Transfer and implement best practices and lessons learned
- Conduct independent project assessments

# *Office of Project Management and Systems Support*

- Manage the Administrator's critical decision process for approving project initiation, execution, and closeout
- Project Management Career Development Program

# *Actual Project Results Have Been at Times Disappointing....*

- Traditional risk management is identified in many Risk Maturity Models in which methodologies and practices are discussed for such areas as cost, schedule, function, and quality
  - A survey of NNSA's weak and strong project links surfaced the following:

# *NNSA Survey Results....*

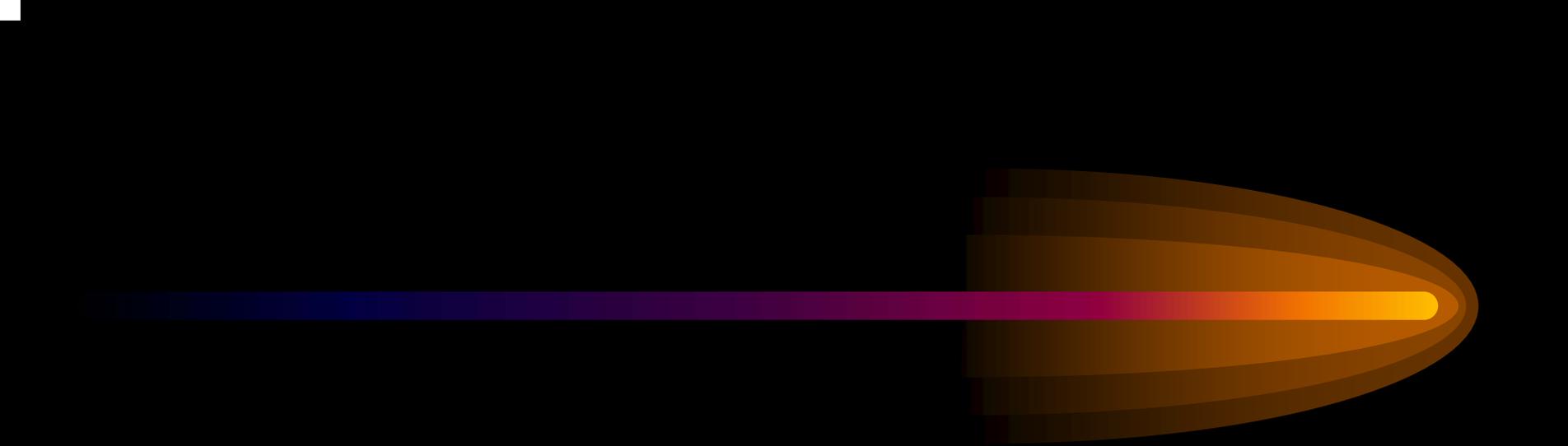
- Strongest Links
  - Federal Project Directors' knowledge of estimating, scheduling, and work breakdown tools
  - Project control techniques/procedures

# *NNSA Survey Results....*

- Weakest Links
  - Interface management
  - The human side of project management
  - The business management side of project management

# *Many of the Problems Were Traced Back to Fundamentals*

- Most individuals don't really know why projects succeed or fail
- A project's outcome is influenced by numerous linear and nonlinear variables. This makes it difficult to isolate cause and effect relationships.
- Projects are typically treated as though they are steady state operations – they aren't!



*Determining Why The CERS  
Project Failed*

# *The Initial Response*

- The cost of the project increased
- Design cost increased
- The building size increased
- There were an excessive number of design errors
- The project team had trouble working together

# *This Response Provided Little Insight*

- All of the items listed are symptoms
- We needed to understand root causes

# *Our Strategy For Finding The Real Causes*

- Both the Federal Project Director and the Operating Contractor were asked to prepare separate lessons learned reports on the project
- An independent subject matter expert would be used to prepare the Operating Contractor's report
- NNSA Headquarters would simultaneously perform a root cause analysis of why the project failed

# *NNSA Headquarters Root Cause Analysis*

- A top down/bottoms up approach was utilized to find cause and affect linkages
- The already identified list of symptoms was used as the starting point for the top down effort
- An extensive literature and experience search was initiated to identify the starting points for the bottoms up effort
- This search immediately changed our frame of reference and proved to be invaluable

# *The Search Followed A Spiral Path And Eventually Encompassed Nine Different Professional Domains*

- Project Management
- Information Technology/Computer Science
- Systems Engineering
- Business and Financial Investment
- Health and Safety
- Cognitive Psychology
- Complexity Theory
- Operations Research, Simulation, and Modeling
- Military Strategy

# *The IT and SE Professions Share The Following Tenets On Why Projects Fail*

- Incomplete, unclear, or volatile requirements
- Unrealistic expectations
- Inadequate skills & experience
- Inadequate resources
- Low technology maturity

# *Additional IT Tenets On Why Projects Fail*

- Lack of user input
- Lack of ownership
- Lack of executive support
- Lack of planning
- Too few interim milestones

# *Additional SE Tenets On Why Projects Fail*

- Organizational culture or stability
- External environment
- Commitment to best practices
- Unknowns and uncertainties
- Complexity

# *IT/SE Tenets On Failure That Were Found To Match CERS's Symptoms*

- Incomplete, unclear, or volatile requirements
- Unrealistic expectations
- Inadequate skills & experience
- Low technology maturity
- Lack of user input
- Unknowns and uncertainties
- Lack of ownership/executive support

# *IT/SE Tenets On Failure That Were Found To Only Partially Match CERS's Symptoms*

- Lack of planning
- Complexity
- Organizational culture or stability

# *Our Status After Exploring Just Two Other Professions' Tenets On Failure*

- Seven, previously unrecognized, root cause/symptom matches
- Three additional “possible” matches that were not yet fully understood

# *Knowledge Gained From The Next Group of Professions*

- A deeper understanding of one of the seven verified root cause/symptom matches
- A comprehensive understanding of the three “possible” matches
- The emergence of a totally new perspective on why projects fail and project risk management

# *Additional Understanding Gained On How Requirements Linked To Project Failure*

- Project requirements tend to be interdependent
- The interdependencies may be either positive (complementary) or negative (mutually exclusive) in nature
- Negative interdependencies must be fully understood and carefully managed

# *How This Tenet Matches CERS's Symptoms*

- The project's security, life safety, and operating requirements were negatively interdependent
- Any design solutions that fulfilled one set or requirements violated the other two
- This situation was exasperated by the late identification of the operating requirements
- Project team members doggedly defended their individual requirements rather than recognize the problem and seeking tradeoffs

# *Additional Insight Gained On How Skills & Experience Link To Project Failure*

- An individual's or an organization's ability to recognize dynamic patterns, sort out clues, and spot warning signs depends on their experience base
- An individual's or organization's ability to adjust to a changing situation depends upon their experience base.
- An individual's or organization's ability to anticipate the secondary effects of an action depends upon their experience base.

# *Additional Insight Gained On How Skills & Experience Link To Project Failure – Cont'd*

- An individual's or organization's ability to cope with complexity depends upon their experience base.
- Inexperienced individuals and organizations tend to be preoccupied with short-term goals.
- An individual's or organization's ability to anticipate obstacles depends upon their experience base.
- An individual's or organization's error rate depends upon their experience base.

# *“HEART” Date On The Linkage Between Experience And Error Rates*

## Situation

## Error Rate Multiplier

Qualified & experienced

Zero

Qualified but inexperienced

Times 3

Need to unlearn a technique  
& adopt an opposing  
philosophy

Times 6

Unfamiliar or novel

Times 7

# *How This Tenet Matches CERS*

CERS was:

- The Federal Program Manager's first "line" project
- The Federal Project Director's First "line" project
- The contractor Project Manager's first "line" project
- The first DOE project managed under our new Project Management Order
- The sites first experience with a Federally directed Integrated Project Team
- The contractor's first application of such massive physical security barriers
- The first nuclear project for many of the participants

# *Additional Insight Gained On How Complexity Links To Project Failure*

- INCOSE defines an entity as complex when it is not possible for the people working with that entity to have a clear and complete concept of it in their minds.
- Complexity, therefore, depends on:
  - The number of parts in an entity
  - Whether these parts are independent or interdependent
  - Whether the independencies are linear or nonlinear
  - The dynamics of the situation; i.e. the frequency of change
  - An individual's ability to understand a situation

# *Additional Understanding Gained On How Organizational Factors Link To CERS's Symptoms*

- NNSA is a typical of government in that:
  - It contracts rather than self performs
  - It manages these contracts thru a layered and distributed organizational structure
  - It has been described as functionally stove piped
  - Decisions are made thru a consensus progress
  - It operates under close external oversight
- NNSA's prime contractors mirror NNSA in each of these areas
- This creates a highly complex organization

# *Additional Insight Gained On How Planning Linked To CERS' Failure*

While extensive project planning documentation was developed, reviewed, and approved for CERS's; the plans did not:

- Identify or address project requirements
- Identify or address unknowns
- Assess what skill levels and capabilities the various members of the project team would require
- Consider interfaces between the project team members
- Allow for rework, schedule conflicts with other activities, or learning curves.

# *Additional Insight Gained On How Planning Linked To CERS's Failure- Cont'd*



- Most important, no one ever determined if the CERS's plan could actually be implemented given the constraints and uncertainties



*Are These Same Risk Patterns  
Causing Other Projects To Fail?*

# *Several Hundred Other Projects & Programs Were Examined*

- Our sampling drew from the NNSA, the DOE & other government agencies with projects similar to NNSA's
- Evidence of these same root cause failure patterns are found to be wide spread
- We then checked to see if our existing management control and training systems provided a defense against these failure patterns. The answer triggered immediate action

# Resulting Actions

- Two new risk management training courses have been developed and incorporated into our Project Management Career Development Program
- We are beginning to expand our management controls to cover these risks
- We are stressing the importance of:
  - Understanding a project's risks and challenges before committing to that project
  - Ensuring that our project teams are capable of meeting those challenges

# *The Prognostication*

- We are making progress, but....
  - People resist changing their frames of reference
  - Large organizations seldom change directions quickly

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*The seeds of problems are laid down early.  
The review of most failed projects...  
indicate that disasters were well planned to  
happen from the start.*

*The 100 Project Management Rules  
Learned from NASA -*

# *The Bottom Line-*

**Change involves both  
opportunity and risks. The  
final outcome is never  
certain**