DOE Risk Management Workshop for High-Performance Computing Centers

The Risk Management Partnership

Achieving Project Success Through Collaboration

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Topics of Discussion

- Evolving Perspectives on Risk Management
- The Unique Challenges of Complex Projects
- The Classic Risk Management Process
- Communicating Risk Data to Decision Makers
- A Proposed Risk Management Maturity Model
- Summary and Recommendations

“The only undervalued asset was risk”

- Robert Rubin, former United States Secretary of the Treasury & former Chairman of Citigroup, when asked how the current domestic financial crisis was not foreseen by more economic experts

Evolving Perspectives on Risk Management

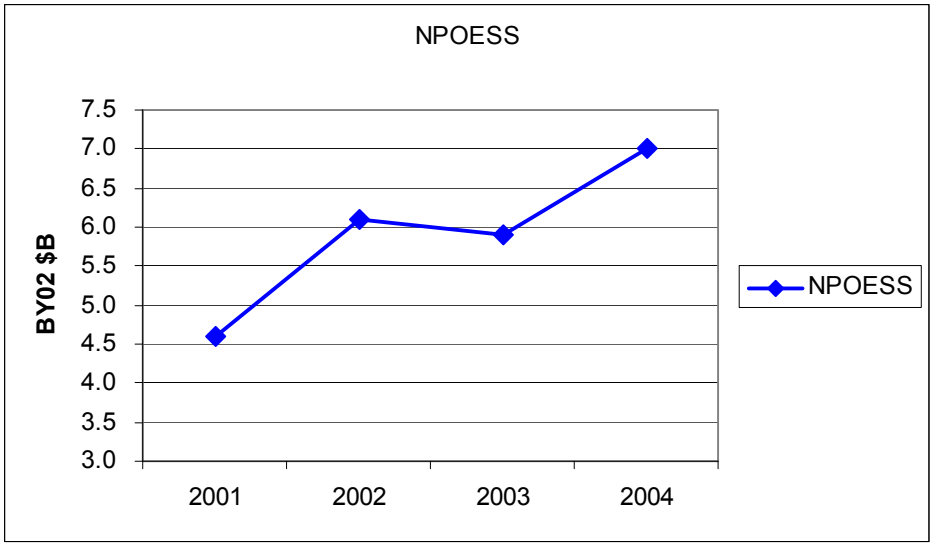
- **Historically, government agencies have largely left project risk management to the development contractors responsible for delivering system functionality**
  - Risk was viewed as stemming primarily from technical performance challenges
  - Schedule risk was “reduced” through major milestone incentivization
  - Cost risk was “transferred” to contractors through firm fixed pricing (FFP)
  - Project management expertise was not a prerequisite for leadership roles
- **Over the past decade, a new paradigm of collaborative risk management has emerged based on the well-documented failures of many large, complex projects**
  - Technical risks rarely exist in isolation from larger programmatic concerns
  - Pressure to accelerate schedules often leads to performance shortcutting
  - Highly prescriptive scopes of work for FFP contracts lead to more change orders
  - Recognition of project management as a unique functional discipline has increased
- **Today, risk management is very much a shared endeavor among project sponsors, developers, acquisition experts, and end users**

Case #1 - Military Satellite Communications (MILSATCOM)

- **Currently implementing the first enterprise-level risk management framework for a $40 billion portfolio of eight major communications satellite systems for the U.S. Air Force**
- **Cost, schedule, and technical performance challenges all at the "bleeding edge"**
- **Wideband Communications** – provide high-volume voice/data communications to users worldwide
- **Protected Communications** – provide secure global communications for high-priority military assets
- **Transformational Communications** – provide cross-linked communication among satellites
- **Consolidated Command & Control** – provide a single "central nervous system" for tracking and telemetry

National Polar-Orbiting Environmental Satellite System (NPOESS)

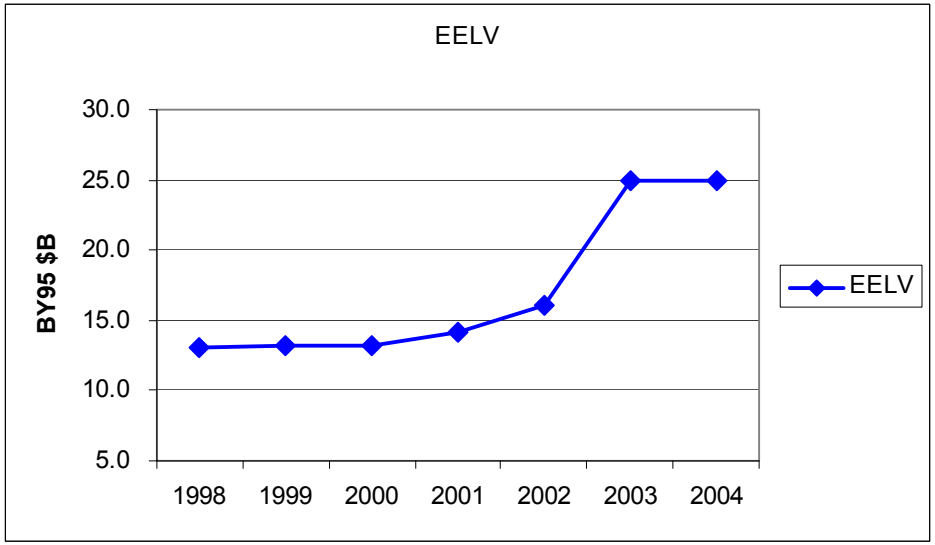
- **52% increase in total program cost estimate over 3 years**
- **Increase attributed to:**
  - Changes in development schedule
  - Increasing sensor cost
  - Funding perturbations



There has been a consistent and visible precedent for poor performance on many complex, high-technology government acquisitions

Evolved Expendable Launch Vehicle (EELV)

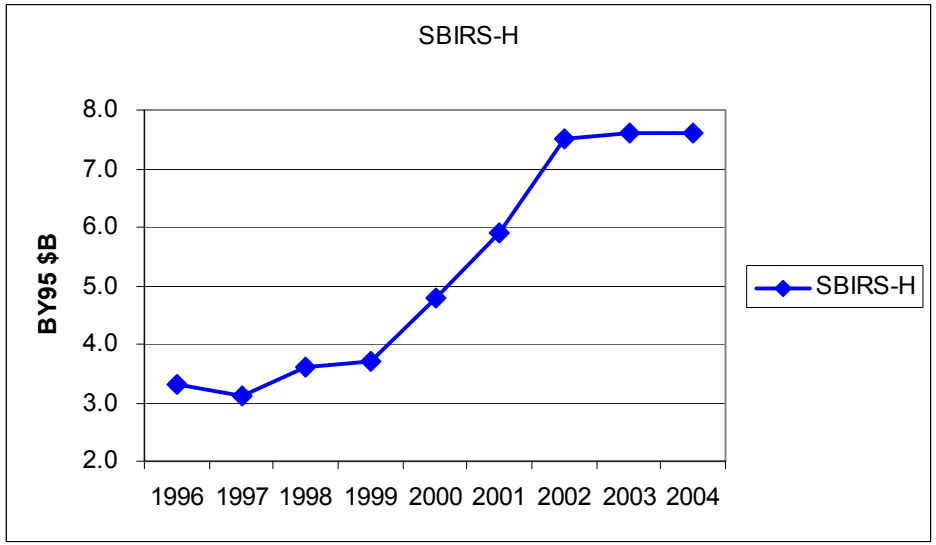
- **90% increase in total program cost estimate over 6 years**
- **Increase attributed to:**
  - Price increases
  - Schedule changes
  - Collapse of commercial markets
  - Changes in requirements (payload weight growth)
  - Necessity to continue program with two viable providers



More stringent auditing and the application of the Nunn-McCurdy provision has led to the descoping of several large DoD programs

Space Based Infrared System-High (SBIRS-H)

- **130% increase in total program cost estimate over 8 years**
- **Increase attributed to:**
  - Design deficiencies and technical problems
  - Revision of program performance responsibility strategy

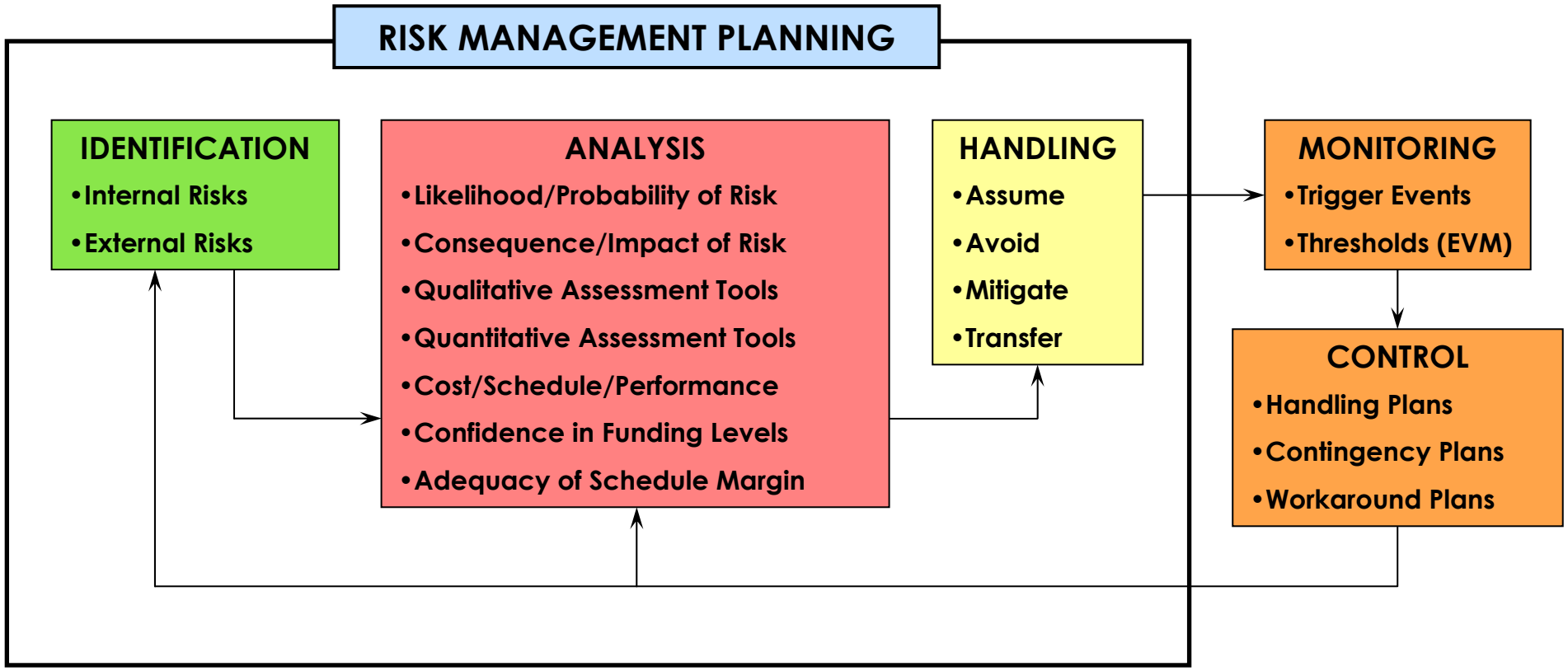


Schedule delays and cost overruns continue to be the rule rather than the exception, with performance often not improving over time

The Unique Challenges of Complex Projects

- **While many of the same difficulties faced on "traditional" projects (e.g., civil works, commercial construction) also impact complex government-owned projects, several additional challenges are usually present**
  - High visibility and intense scrutiny by government regulators and other oversight entities
  - One-of-a-kind facilities having requirements that go far beyond the current state of the art
  - Incremental, unstable, and/or disparate sources of project funding and staffing
  - Large numbers of stakeholders able to influence project design and execution methods
- **To address these challenges, government project sponsors must work collaboratively with their contractors and vendors to instill a culture of rigorous project management and proactive risk identification and handling**
- **Effective risk management requires an extremely high level of communication, which may represent a significant departure from past organizational constructs**
- ***The ultimate goal of the risk management process is to provide project leaders with the data they need to make informed decisions in an environment of high uncertainty***

The Classic Risk Management Process



Types of Uncertainty That Can Constrain Project Success

- **Decision making within the context of significant uncertainty necessarily relies on various types of "imperfect information"**
- **In risk management parlance, this imperfect information generally can be categorized into one of three types — *Knowns, Known Unknowns, and Unknown Unknowns***
- **"Knowns" are risks that can be readily anticipated by experienced project teams**
  - Seasonal hurricanes that may disrupt satellite launch schedules
  - Difficulty meeting manufacturing tolerances for plasma physics research (NCSX)
- **"Known Unknowns" are risks that may be identified in advance but with less certainty**
  - Effect of a nuclear detonation on radiation-hardened satellite electronics
  - Possible creation of micro black holes as a result of particle collisions (LHC)
- **"Unknown Unknowns" are risks that are nearly impossible to predict in advance**
  - Sustainability of life on other planets in our solar system and beyond
  - Disassembling and moving a pulsed power experimental facility to a new site (Atlas)

Not All Risks Are Created Equal

- **Different sources of risk require different identification and handling strategies**
- **"Internal" risks stem from technical or scope-related concerns**
  - Found within the project baseline plans and requirements
  - Usually under the direct control of project owners
- **"External" risks arise from programmatic or political concerns**
  - Typically not found explicitly within the project baseline
  - Often originate in organizational or contractual relationships
  - Not directly controllable but may be ***influenced*** by project owners
- **It is essential that risks from both sources be actively managed**
- **External risks often have the greatest impact on project success!**

Guidelines for Applying the Risk Management Process

- **Issues are not risks**
  - Issues are ***existing problems*** that must be actively addressed
  - Risks are ***uncertain future events*** that should be proactively handled
- **Nouns are not risks**
  - Risk implies a cause and effect relationship (If…then…resulting in…)
  - Risk identification requires a detailed description of specific conditions
- **Risks often have multiple impacts (cost, schedule, technical performance)**
- **Initiating risk handling measures is an important decision in its own right**
  - Assess the resources available to reduce risk likelihood and/or consequence
  - Perform sensitivity and cost-benefit analyses to determine return on investment
  - Seek direction and support from senior management and project sponsors

Different Organizational Levels Face Different Types of Risks

How does a risk to one project affect the delivery of other related projects?

Which stakeholder groups have the ability to influence the success of one or more projects?

How can a successful risk handling strategy for one project be leveraged by other projects?

Is the project on track to meet or exceed its baseline technical requirements?

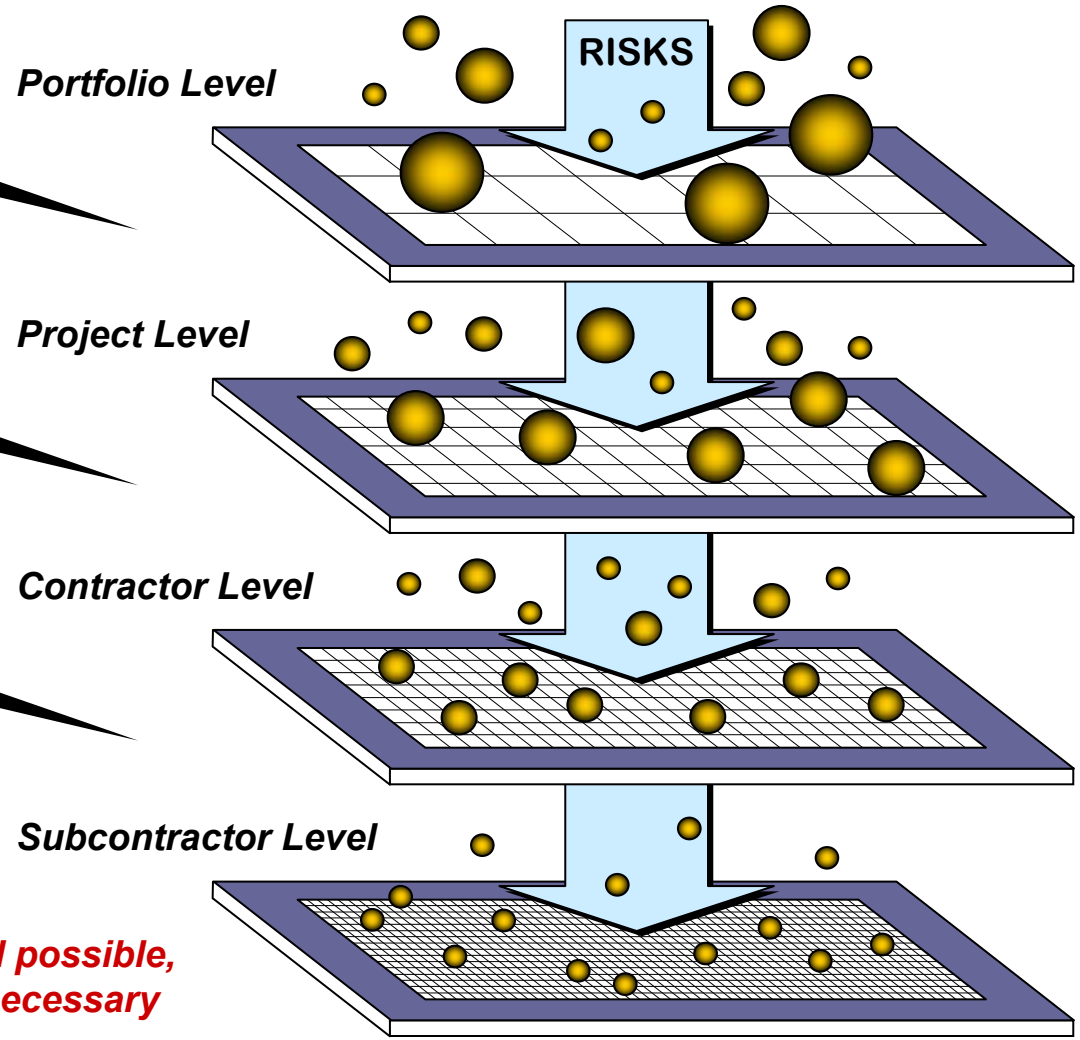
How do current risk levels impact the ability to meet critical schedule milestones?

Which design solution provides the optimal balance between capital and operating costs?

What are the technical performance risks associated with delivering a given capability?

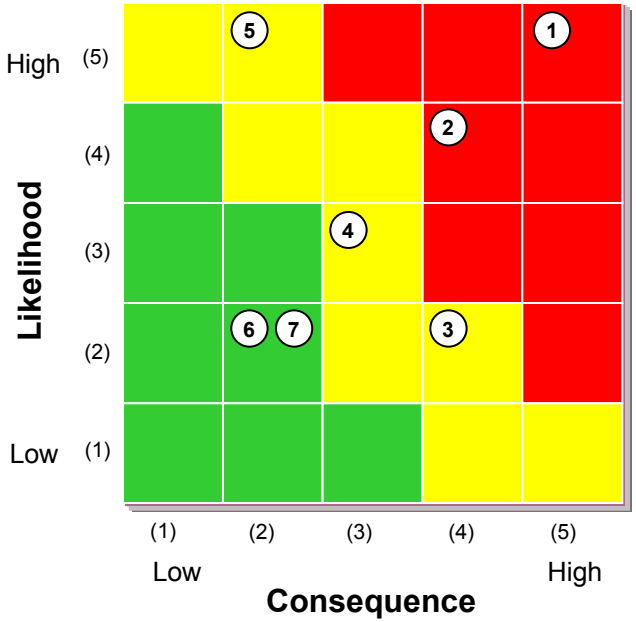
How will assembly, integration, and test schedules be impacted by a given risk?

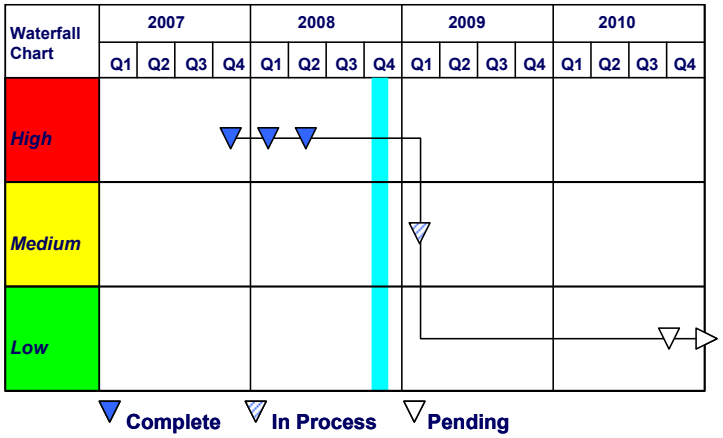
What are the cost impacts of delays in subcontracted component deliveries?

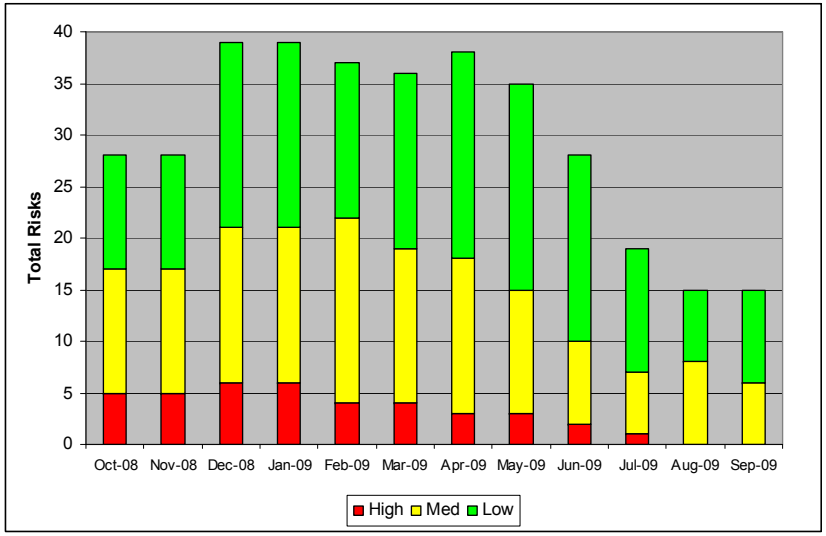


Risks should be managed at the lowest level possible, but communicated up to the highest level necessary

Communicating Risk Data to Decision Makers







Key data include the project's current risk exposure, the status of ongoing risk handling activities, and the trend of the project's risk profile over time

Case #2 - Cleanup of the DOE Nuclear Weapons Complex

- **Spent ten years supporting cleanup of various sites throughout the DOE weapons complex**
- **Cost, schedule, and technical performance challenges were also at the "bleeding edge"**
- **Human Health Risk** – ensure safety of workers and long-term health of nearby residents
- **Environmental Risk** – protect wildlife and habitat, including ground and surface water
- **Regulatory Risk** – balance cleanup levels against future land use requirements
- **Financial Risk** – expedite cleanup to reduce overhead costs and future liability
- **Political Risk** – demonstrate public stewardship of regional and national stakeholder concerns

The Rocky Flats Plant near Denver, CO (1991)

Institutional Inertia Can Be Overcome

- In the case of the Rocky Flats closure project, the new management team inherited a culture of secrecy, stovepiping, and adversarial relationships with the public
- Initial estimates for completing facility decontamination and decommissioning (D&D) and site remediation were $37 billion over 70 years
- Risk identification and analysis initially were viewed as being politically untenable and counter to the desire to demonstrate site safety and hazard mitigation
- Over time, however, a collaborative movement toward “smart” risk reduction by the DOE, its contractors, and site regulators took hold
- Ultimately, the site was converted to a National Wildlife Refuge in 14 years at a cost of $7 billion (a savings of nearly $30 billion and a schedule acceleration of 56 years)
- The successful site closure was recognized as the 2006 Project of the Year by the Project Management Institute (PMI)

A Proposed Risk Management Maturity Model

	1 – Minimal Capability	2 – Functional	3 – High Performing	4 – Best in Class
People	▸ Minimal understanding of concepts and language ▸ Minimal experience in applying basic principles and methods	▸ Dedicated resources do not exist ▸ Limited to individuals who may have had little or no formal training	▸ In-house core experts formally trained in basic skills ▸ Previous application of specific processes and tools ▸ Dedicated team resources	▸ Ongoing learning occurs through repeated application of methods ▸ Regular training conducted to enhance skills and capabilities ▸ All staff informed and capable of applying basic to advanced concepts ▸ Dedicated organizational resources
Process	▸ Formal, documented process does not exist ▸ Inconsistent application of concepts and language ▸ Formal risk decision-making body does not exist ▸ Risk reporting metrics are minimal or nonexistent	▸ Common processes defined and formally documented ▸ Process effectiveness limited to a few individuals ▸ Qualitative analysis based on a subjective rating system ▸ Established risk decision-making body/forum	▸ Formal processes integrated across multiple project areas ▸ Active allocation and management of budgets for risk management ▸ Risk metrics regularly reported ▸ Key internal stakeholders actively participate in the process	▸ Qualitative and quantitative analysis methods employed using reliable data ▸ Integrated with other organizational processes and decision-making ▸ Risk metrics widely distributed with consistent feedback for improvement ▸ Key external stakeholders actively participate in the process
Tools	▸ No structured application of tools to record/archive risk data ▸ No formal analysis performed ▸ Risk tracking and reporting tools not in use	▸ Customizable solutions tailored to each project ▸ Few repeatable technological solutions in place	▸ Integrated set of tools and methods ▸ Centralized data environment managed by dedicated team resources	▸ State-of-the-art tools and methods ▸ Distributed data environment that provides access to all project staff ▸ Standardized and automated reporting capabilities
Management	▸ Minimal management awareness ▸ No upper management involvement ▸ Reliance on existing processes in the face of potential failure ▸ Dedicated resources do not exist	▸ Process may be viewed as additional overhead with marginal benefits ▸ Upper management encourages but does not require use ▸ Application varies across projects	▸ Benefits recognized and expected ▸ Accepted as a necessary project management function ▸ Upper management requires risk tracking and reporting ▸ Focuses on mitigation effectiveness	▸ Top-down commitment by leadership ▸ Integral to informed decision-making by upper management ▸ Active use encouraged and rewarded ▸ Part of the organizational philosophy to achieving project success

Increasing maturity improves the likelihood of project success

Summary and Recommendations

- **While there are some similarities between the types of risks found on traditional projects and those faced by complex, high-technology projects in the government sector, several unique challenges exist**
  - Highly regulated project environments limit opportunities to exercise creative license
  - Technology requirements that exceed all known solutions invite significant scope risk
  - Federal budgeting cycles create the potential for overwhelming resource constraints
  - Stakeholder involvement often leads to high levels of organizational and political risk
- **The Good News**
  - Staff working in the trenches of a project often have the most “situational awareness”
  - Therefore, it must be their right and their obligation to communicate that awareness up the organizational chain (early and often!) to support the decision-making process
- **The Bad News**
  - Situational awareness is a start, but battle plans rarely survive first contact with the enemy
  - Even the best laid risk mitigation plans should be supplemented with contingencies and/or workarounds that have been pre-coordinated with upper management

“A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty”

- Sir Winston Churchill, Prime Minister of the United Kingdom during World War II

Questions

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