

Techniques for Successful Risk Management  
Lessons Learned  
from the Spallation Neutron Source

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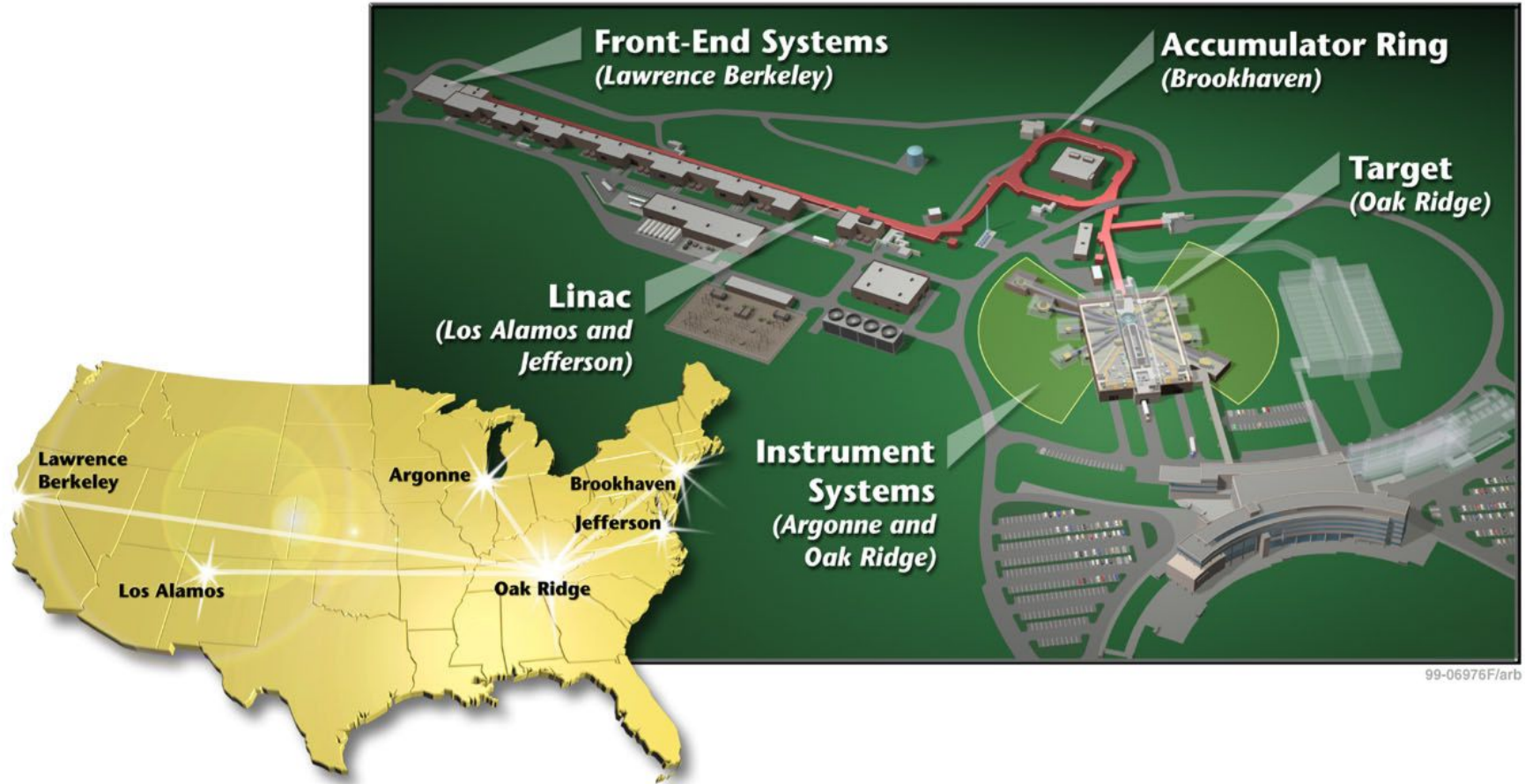
# The Spallation Neutron Source (SNS) achieved world-class objectives



- **Construction completed ahead of schedule (June 2006) and under budget (\$1.411B)**
- **World's leading facility for neutron science**
- **Room for eventual 25 instruments spanning physics, chemistry, biology, and materials science**
- **Upgradeable to higher power, second target**



# SNS was a partnership among six national labs and a major industrial partner

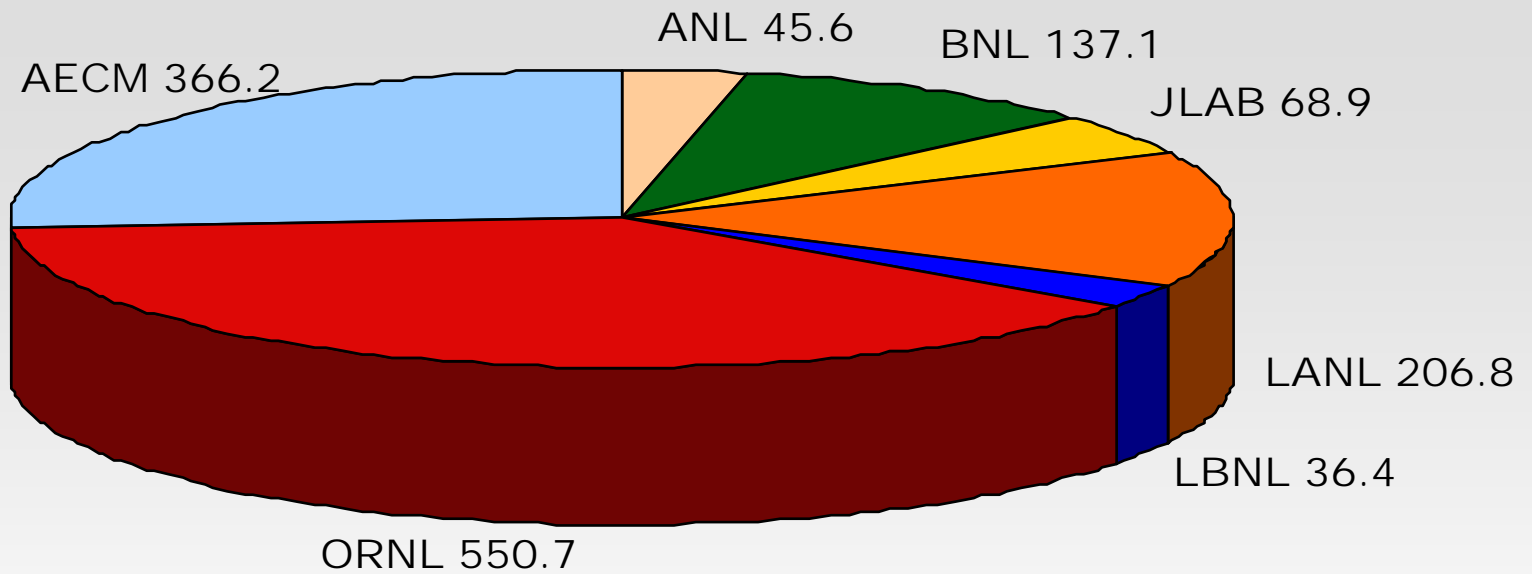


# SNS partners owned major scope, budget, and risk!



Total Project

\$1411.7M



## Legend

- |  |                                       |   |
|--|---------------------------------------|---|
| Argonne National Laboratory                      | Los Alamos National Laboratory        | Oak Ridge National Laboratory           |
| Brookhaven National Laboratory                   | Lawrence Berkeley National Laboratory | Architect Engineer/Construction Manager |
| Thomas Jefferson National Accelerator Laboratory |                                       |   |

# Risk Management is not a part-time job

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- **Risk management must be implemented early and continually applied throughout the project**
- **Can not treat it as an add-on or parallel activity – should be an integral part of the daily project discussion**

# Risk Management is a closed loop process





- **Activity manager and their teams (not admin support staff) must analyze the risks**
  - Must report risk even if believe the cost for the mitigation and residual risk can be absorbed in the existing budget (even though should strive to absorb in existing budget!)
- **Analyze for risks at least monthly**
- **Open communication to the project management team necessary**
  - Encouraged to exercise judgment in reporting so not flooded in details and lose the big picture



# Rigor must be applied for completeness

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## All project elements need to be reviewed for risks

- ES&H
  - Scope
  - Technical
  - Cost estimating
  - Schedule control
  - R&D
  - Design
  - Acquisition Management
    - Number of suppliers and capabilities
    - Materials cost
    - Exchange Rates
  - Performance
  - RAMI
  - Operations
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- **Systems should be:**
  - Useful
  - Not overly complicated
  - Designed to be effectively used by the working engineer
  
- **SNS utilized a WEB based system**
  - Allowed all participants to access and update the risk register in an easy, timely manner
  - Provided an effective way to sort for various reports (e.g., most likely risks, all schedule risks....)



**SNS**  
**Risk Management Process**

# Consequence thresholds changed as the project evolved



**Table 3. Risk likelihood categories**

| Likelihood category | Definition   |
|---------------------|--|
| Very likely         | Risk is likely to occur with a probability greater than or equal to 90%. |
| Likely              | Risk is likely to occur with a probability greater than or equal to 50%. |
| Unlikely            | There is less than 50% chance that this event will occur.                |

**Table 4. Risk consequence categories**

| Type of risk                                | Marginal  | Significant   | Critical   |
|---|---|---|--|
| <b>Cost:</b> Impact on project contingency  | <\$1M   | \$1M - \$5M   | >\$5M  |
| <b>Schedule:</b> Impact on project schedule | None  | Impacts Level 0-2 milestones defined in PEP   | Impacts early finish date                                      |
| <b>Technical:</b> Impact on performance     | Minor degradation; performance falls below upper end of goal; CD-4 can still be met | Moderate performance shortfall, but workarounds available; Performance falls below mid-range goal | CD-4 will not be met (essential performance parameter not met) |

# 3x3 matrix was sufficient for risk categorization



## Consequence

|            |             | Consequence     |                 |                 |
|------------|-------------|-----------------|-----------------|-----------------|
|            |             | Marginal        | Significant     | Critical        |
| Likelihood | Very Likely | <i>Moderate</i> | <i>High</i>     | <i>High</i>     |
|            | Likely      | <i>Low</i>      | <i>Moderate</i> | <i>High</i>     |
|            | Unlikely    | <i>Low</i>      | <i>Low</i>      | <i>Moderate</i> |

## •SNS Management team input their assessment of risk probability and consequences

- Considered overall project consequences
- Direct managers would frequently see problems before they saw solutions and without solutions the problems would appear insurmountable resulting in risks being categorized as very likely
- Management team was further removed from problem, often had experience in similar situations, and could present a more objective view





# **Thorough, credible mitigation plans must be prepared and implemented**

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- **Emphasis should be on developing/implementing viable risk-mitigation plans rather than on simply generating the risk registry**
- **Individuals responsible for performing mitigation were specified and held accountable**
- **Development of performance incentives in contracts helped achieve safety, schedule and cost objectives and reduce risks**



- **As risks turned into reality (or if >95% probability of occurring), the EAC was updated and/or the baseline schedule revised**
  - If appropriate rigor is applied, the majority of new costs in the EAC should have first appeared in the risk analysis
- **Total estimated value of residual risks (cost and schedule) plus a value for unknowns were routinely compared to the project's cost and schedule contingency to understand if adequate contingency remained**



- **Project management team would apply systematic attention each month by evaluating the risks and mitigations status**
  - Drive credible mitigation plans and ensure progress is made on resolving risk issues
  - “Higher risk” technical innovations received management attention early, but risks in low-tech areas can not be dismissed
  - Integral part of the daily project discussions and considered in decision making and setting project priorities



# **Risk reporting/tracking accomplished through a variety of meetings**

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- **Various meetings used to identify new risks and discuss/track mitigation plans on a continuing basis**
  - Weekly executive management meetings
  - Weekly videoconferences with technical managers
  - Subproject Group meetings
  - Monthly Performance Indicators Review meetings
  - Quarterly Cost/Schedule Review meetings
  - Monthly Technical Issues meetings
- **EAC/Contingency/Risk summary discussed monthly with DOE- ORO and DOE-HQ**

# **Regular, candid advice is an excellent risk management tool**

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- **SNS Project strongly supported regular, disciplined external reviews on all aspects of the project**
- **Value added**
  - “Peer pressure” strong motivator
  - Allows sharing of knowledge and expertise to identify issues and resolve problems
  - Excellent tool for understanding and managing risks
  - Benefits accrued from preparing for formal reviews



- **Quantitative approaches are valuable in risk management, however, success or failure largely depends on the organizational culture and interactions**
  - Implement early, continually applied
  - Open communications
  - Emphasis on risk mitigation
  - Integral part of daily discussions and considered in decision making