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Title:	Los Alamos Nuclear Weapons Program A Safe, Secure and Effective Deterrent Using Science and Engineering
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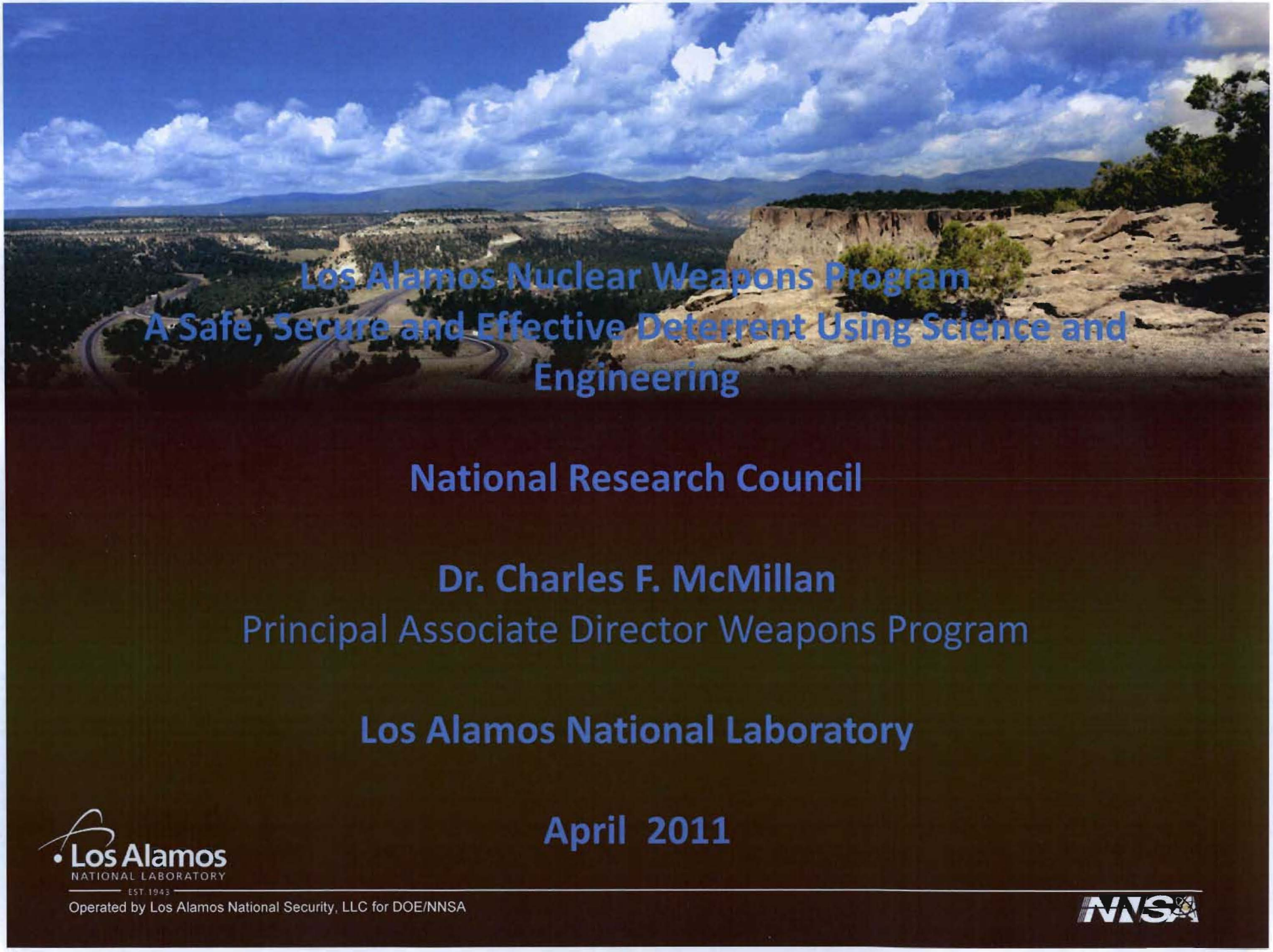


Los Alamos Nuclear Weapons Program
A Safe, Secure and Effective Deterrent Using Science and Engineering

National Research Council

Dr. Charles F. McMillan

Principal Associate Director Weapons Program

Los Alamos National Laboratory

April 2011

Los Alamos NATIONAL LABORATORY EST. 1943

Operated by Los Alamos National Security, LLC for DOE/NNSA

NNSA

Scientific integrity is essential for national security. LANL missions rely on technical excellence and the ability to challenge concepts and foster new ideas.

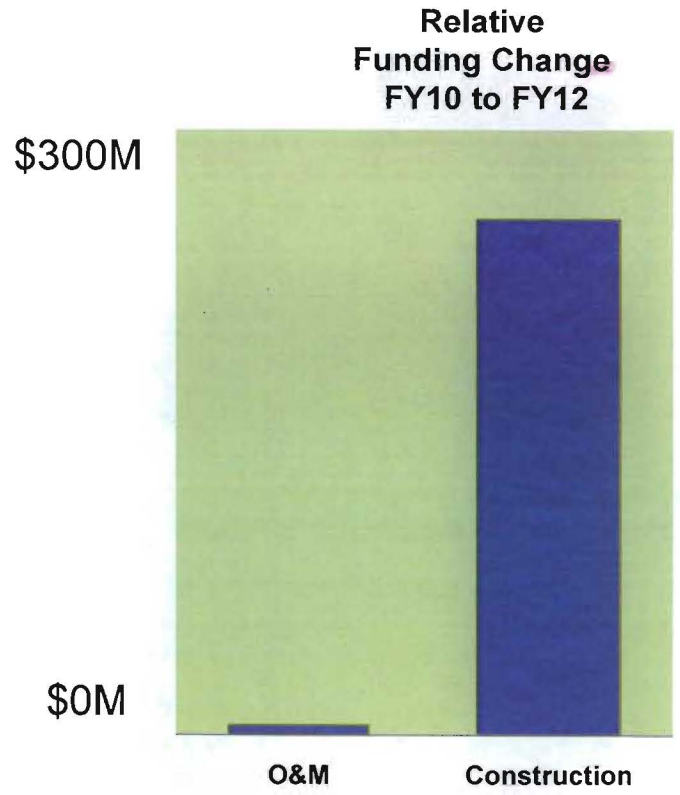
Scientific integrity is essential for national security

- **LANL missions rely on technical excellence and the ability to challenge concepts and foster new ideas**
- **Academic culture and interactions are critical for LANL's technical vitality and credibility:**
  - Peer review scientific work
  - Broad technical exchanges and scientific debate
  - Position LANL to provide technical data to inform policy formulation and decision makers
  - Faculty serve on LANL's scientific advisory boards, capability reviews, functional management reviews, and other assessments
  - Collaborative and interdisciplinary proposals, research projects, publications, and patents
  - Educational opportunities

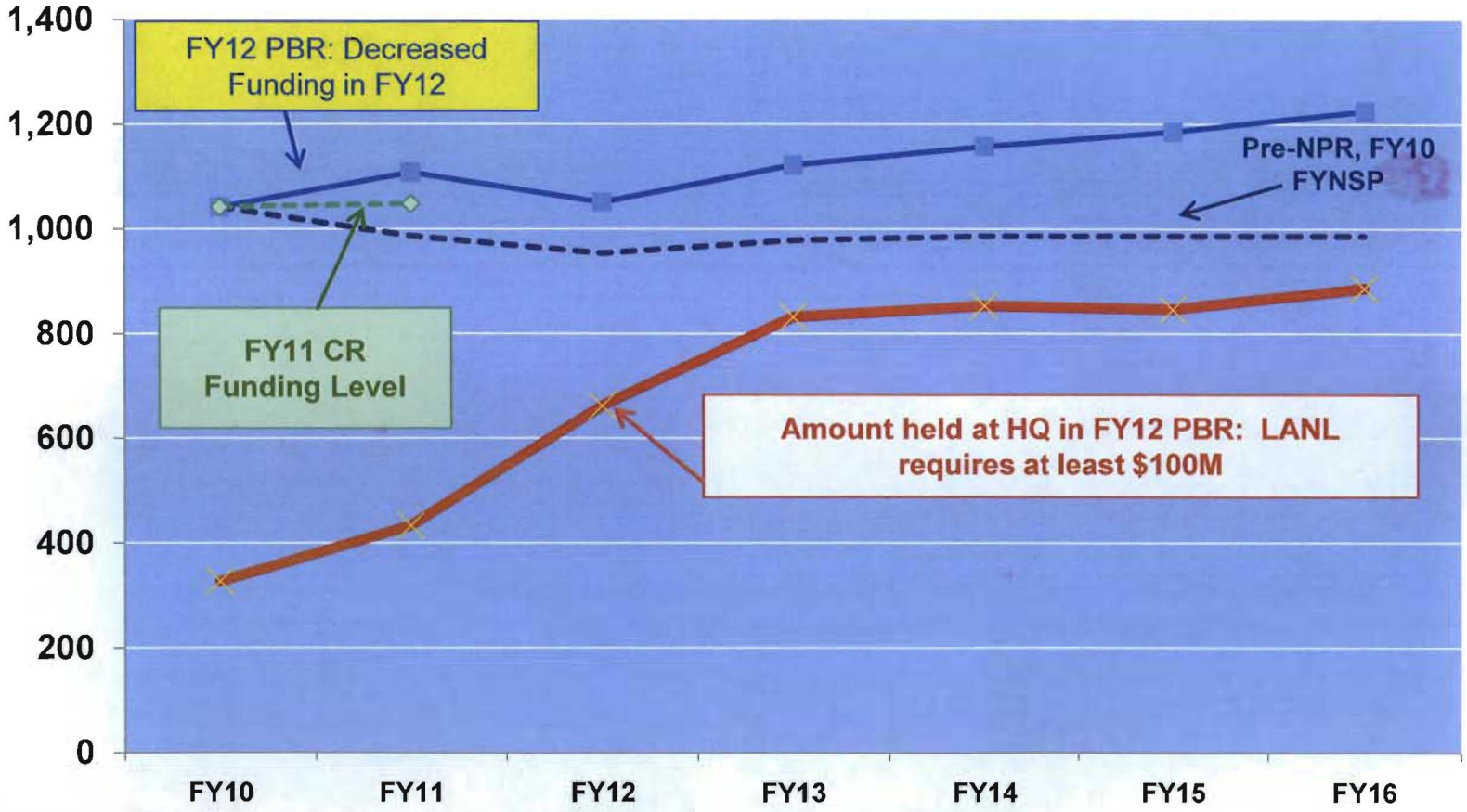
Budget uncertainties in FY 11 and prospects for FY 12 are creating management challenges and programmatic uncertainties

- FY11 funding remains uncertain until April
  - Science Campaign holdbacks
  - CR – Final budget indication of FY12,13 and beyond
- What if Congress significantly cuts to the President's FY 12 Budget Request?
  - B61 LEP, W76-1 LEP, exascale computing, scaling and surrogacy, CMRR construction…..
- $5B DoD investment paying for CMRR, UPF, LEPs, Surveillance

LANL has a large construction workload increase and corresponding budget uplift (CMRR); also have a large increase in programmatic deliverables – and NO budget increase

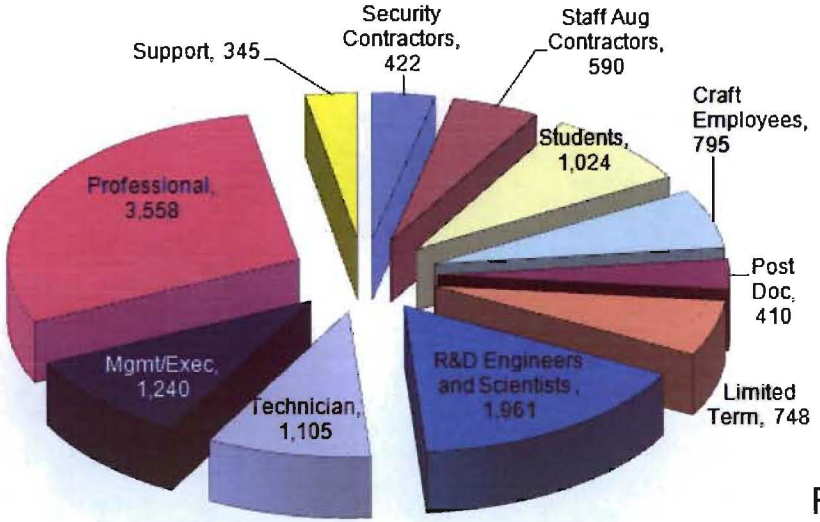


The FY12 budget DECREASES funding to LANL's base program in FY12 while scope increased

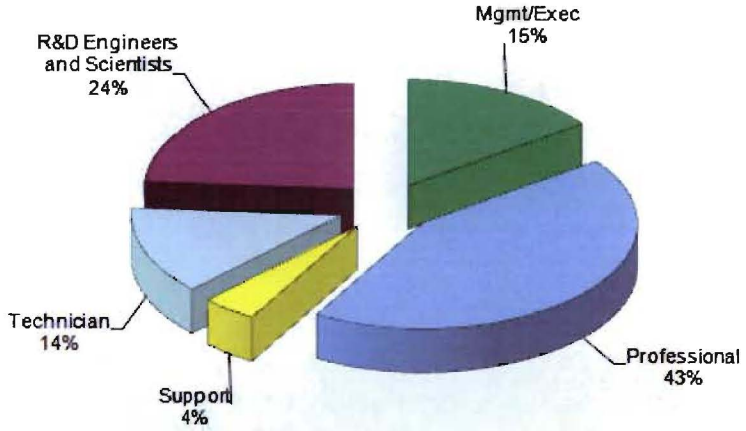


Recruiting and retaining a quality workforce critical to continued success of laboratory and stewardship

*LANL Site Staffing Levels 12,182 Employees



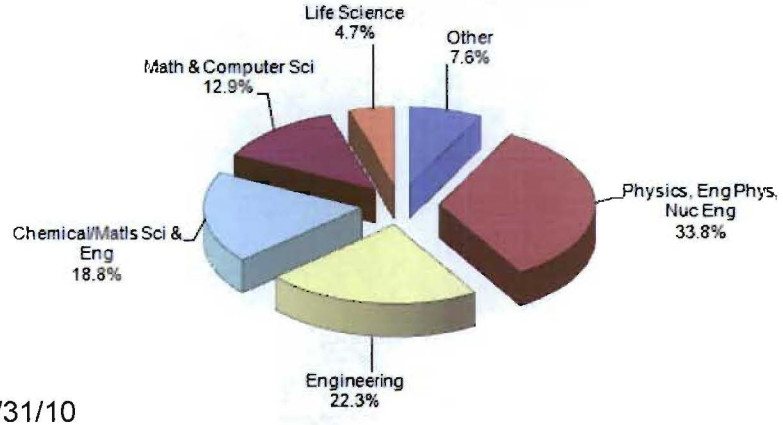
*LANL Career (Regular) Employee Distribution 8,193



Career (Regular) Employees include:

- R&D Engineers and Scientists
- Technician
- Mgmt/Exec
- Professional
- Support

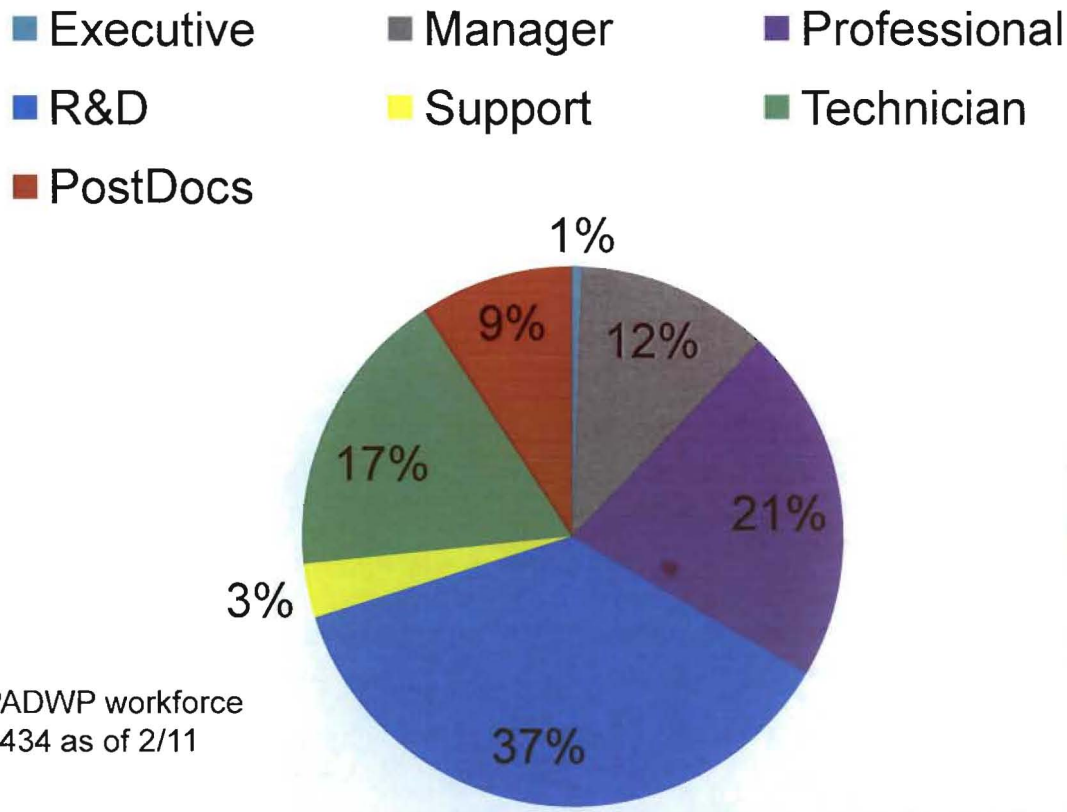
R&D Technical Staff Disciplines



*Data current as of 12/31/10

Prudent management of new hire process has allowed weapons program to add technical staff

Workforce composition



PADWP workforce
1434 as of 2/11

- Staffing increases in PADWP 1/10 to 2/11
- Professional + 25;
- R&D +27;
- Students/PostDoc +14;
- Technicians +7

86 new hires approved by DIR for weapons and plutonium directorates in 2011

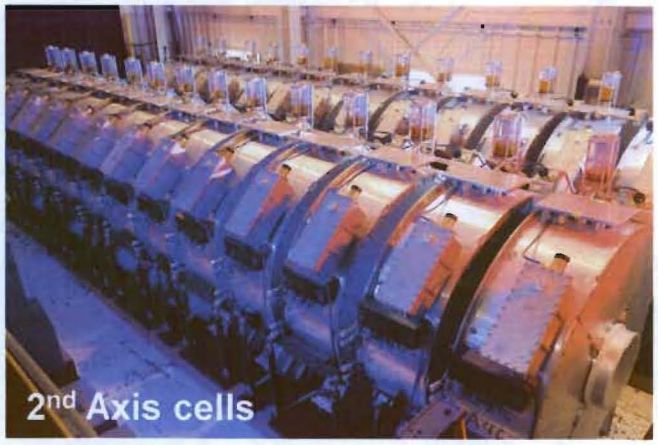
Limited, very selective hiring

LANL's three pronged weapons program strategy is sustaining the Nation's deterrent

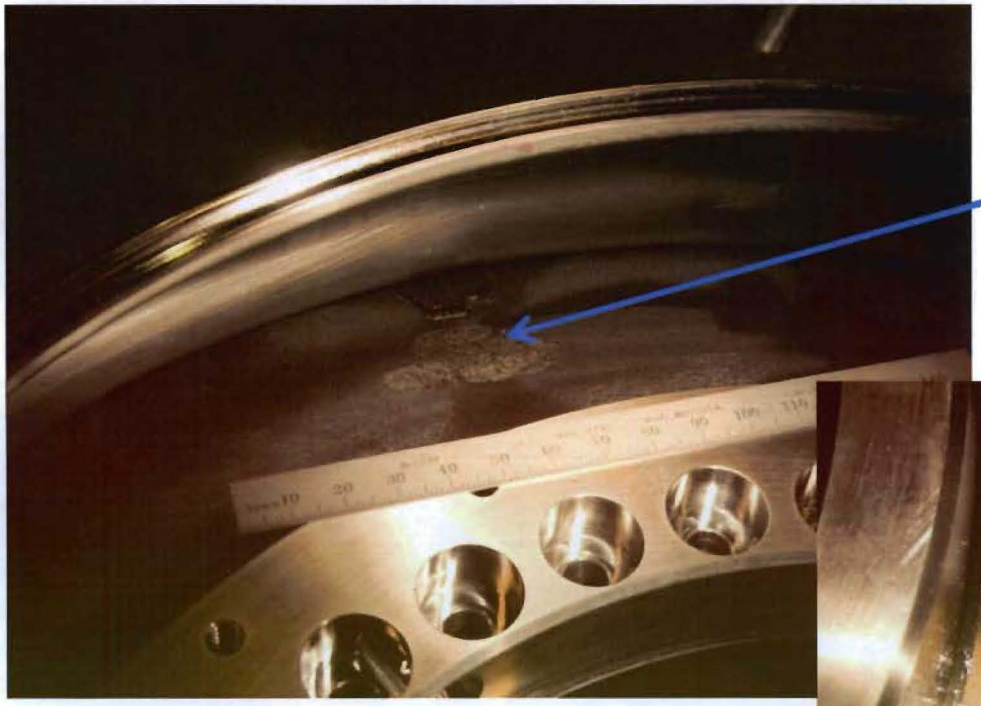
- **Stockpile management**
  - B61 Life Extension Program (LEP)
  - Support to plants on W76 LEP
  - Complete build of W88 pits begin work on W87 pits
- **Science, technology and engineering investments**
  - Use science tools to generate data to support assessment
- **Infrastructure investments**
  - Create modern, state of the art facilities to sustain laboratory capabilities
  - Hire and train next generation

DARHT is one of LANL's most important experimental tools providing critical data in support of SSP

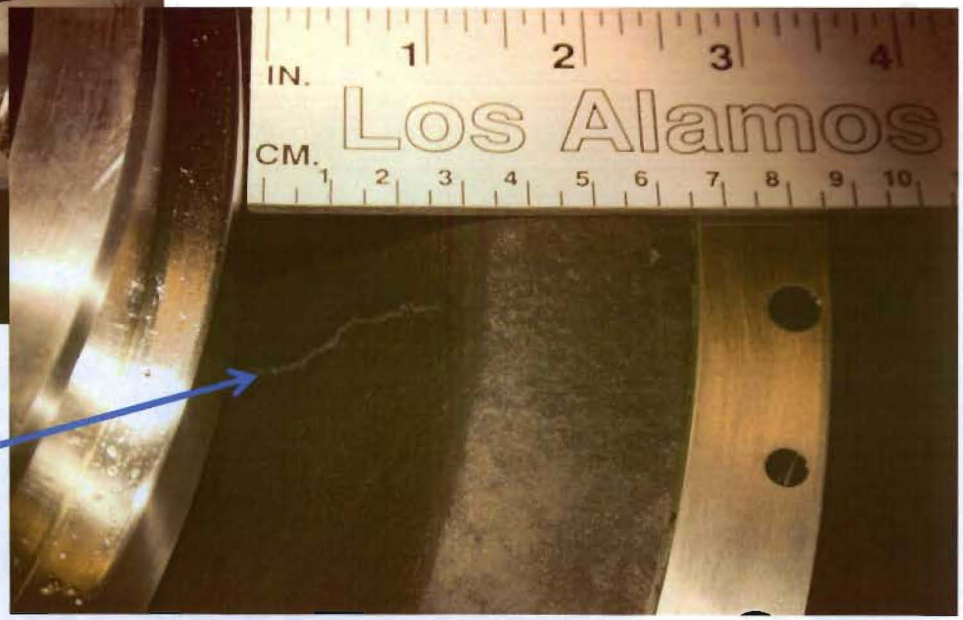
- April 14, 2008 during final stages of commissioning operation of the DARHT 2nd axis accelerator, a single cell A-64 experienced a high voltage breakdown in the oil region
- To understand the cause of the failure a complete forensic analysis of the failed cell was undertaken
- Technical experts from across the laboratory were assembled
  - Team members: DARHT 2nd Axis staff, Materials Science and Technology Group; Applied Engineering Technology Group; Chemical Diagnostics and Engineering group and P-division staff.
- Less than 24 hours after the incident the team met and quickly diagnosed the problem and implemented corrective actions in less than a week



Damage to a second axis cell during final commissioning requiring LANL scientific expertise to understand and resolve



Spallation damage to one side of the insulator caused by the Arc



Arc damage to the other side of the insulator assembly

Forensic expertise of the lab was crucial to understand the cause of additional damage observed on the dipole coil inside the cell

Top side of beam tube

Top dead-center

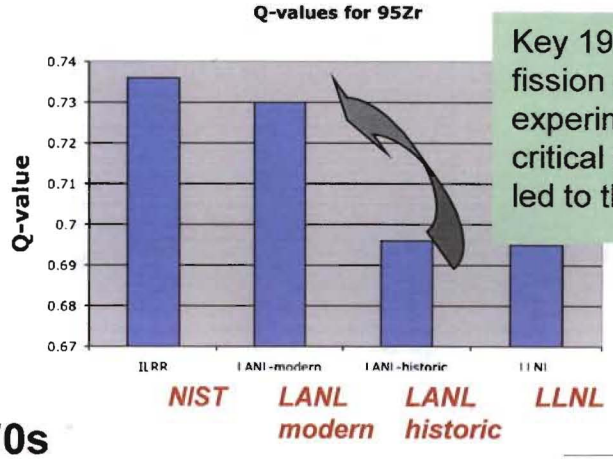
Bottom side - no damage

Damaged Kapton/Cu dipole steering coil in the cell

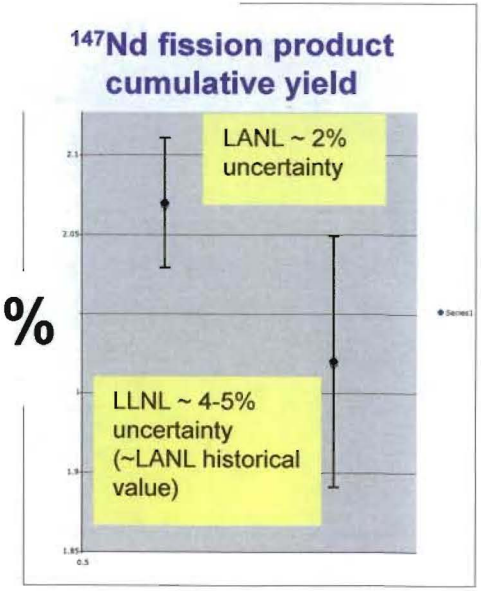
LANL/LLNL resolved inter-laboratory discrepancies on radiochemistry assessment of yields

Q-value = FP-yield(^{239}Pu fast) /(^{235}U thermal)

- Fission product yields (Q-values) differences for fast ^{239}Pu neutrons have persisted between Los Alamos and Livermore for >10 yrs
- Improved Q-values critical to accurately determine radiochemical nuclear yields – essential to reduce QMU uncertainties
- Reassessed evidence based on seminal LANL '70s *dual fission-chamber* experiments significantly improves accuracy and reduces uncertainties
- An *Expert Panel* endorsed the scientific basis used to resolve final fission product yields



Key 1970s LANL fission chamber experiments in critical assemblies led to this change

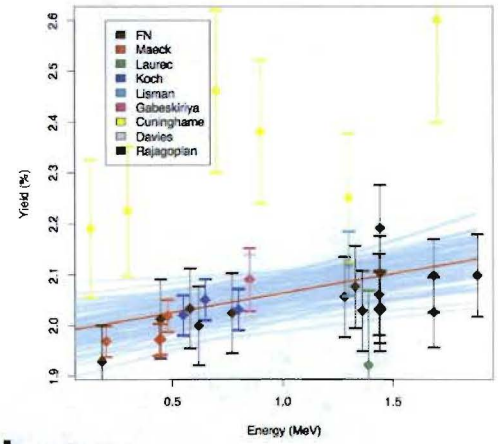


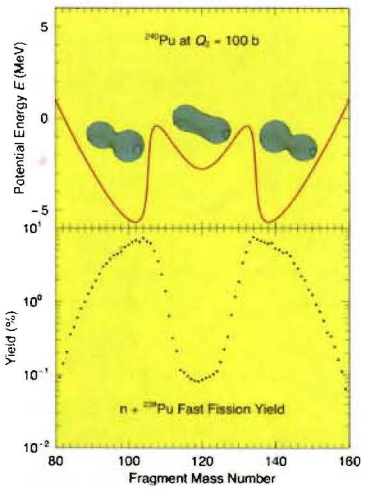
Resolution of RadChem differences will reduce UGT yield uncertainties and enable improved common baselines for all US nuclear tests

Evaluation of independently measured benchmark-quality data confirm LANL result, provide new insights into fission

- Evaluation of independently-measured benchmark fission product production data confirmed LANL experimental results
- Additional efforts provided refinement of uncertainties, and revealed previously unappreciated energy dependence of production of key fission product data
- Reinvigorated interest in improving predictive fidelity of fission theory:

^{147}Nd Fission Product Yield, showing energy dependence:





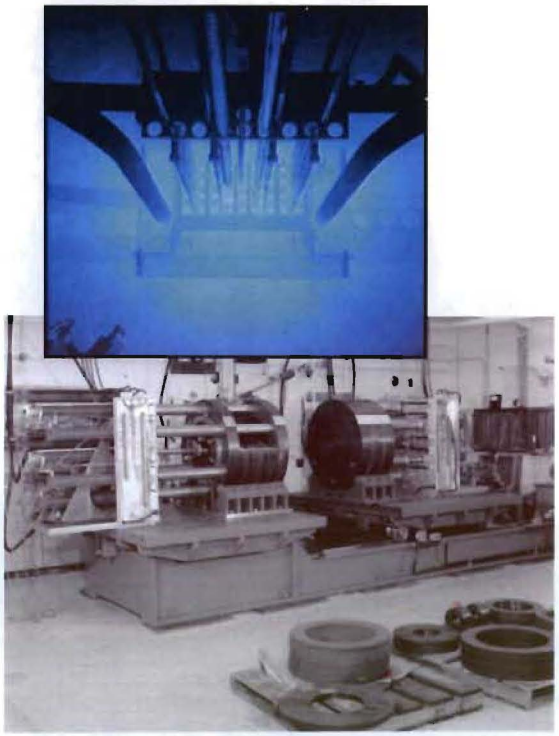


Figure 1. The Big Ten Assembly during Construction (1968).

LANL capabilities in nuclear science, radiochemistry, & nuclear theory are essential for solving such problems

Annual Assessment– A statutory requirement and the highest priority of the Lab Director

- Detailed warhead reports are prepared by lab staff
- Lab Director briefed ***in detail*** by staff
- Lab Director issues letter to Secretaries of Defense & Energy and Chair of the NWC
- Lab Director briefs the Secretary of Energy
- STRATCOM prepares separate report and briefs the Secretary of Defense
- Secretaries of Defense & Energy brief the President
- President advises Congress

Strengthen annual assessment process is crucial

Labs are applying increased rigor to Annual Assessment process

- "With increasing risks to certification I urge us to implement a more comprehensive interlaboratory peer review process as part of Annual Assessment. Only one design laboratory would have certification responsibility for each nuclear package, but all the information for each would be readily available to both design laboratories." Director M. Anastasio 4/16/08 SEWD Hearing.
- 3 weapons labs establish Independent Nuclear Weapons Assessment Process (INWAP) 2/16/10
- 1st large data transfer (W78/W87) with LLNL complete
- 2nd large data transfer (B61/B83) WITH LLNL complete
- Development of baselines and the assessments are in process--Independent codes required
- August 2011 lab directors will be briefed on 1st generation yield performance baselines

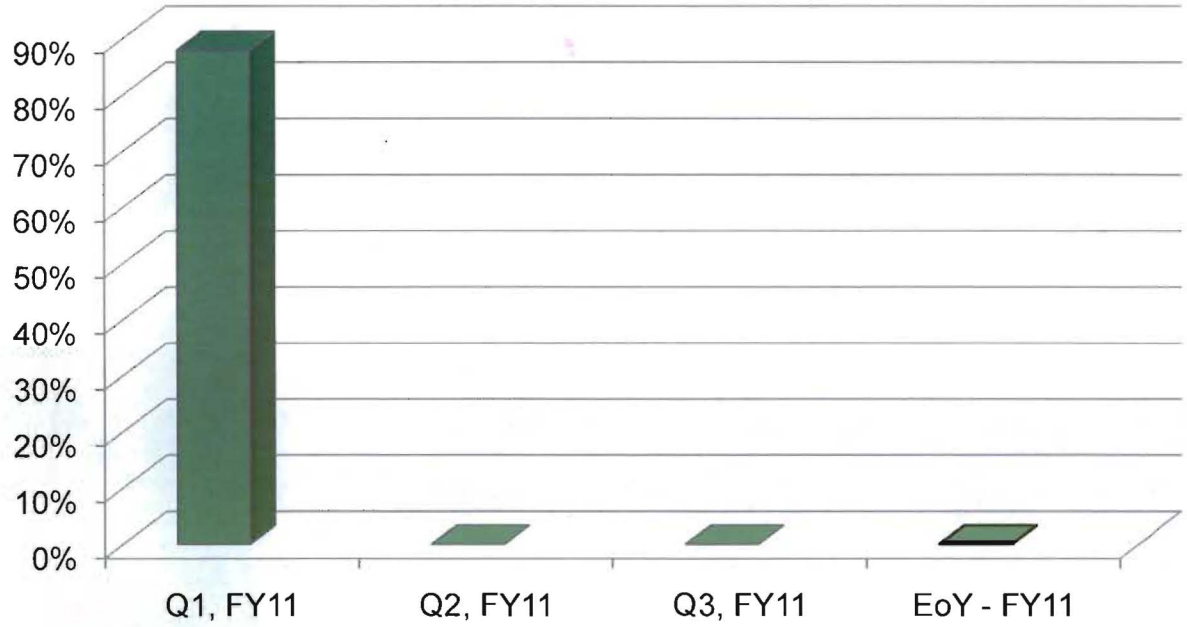
Peer review and independent assessments are critical to the annual assessment process

Active external peer review is a critical tool to help measure excellence of LANL scientific work

- **Capability Reviews 2010**
  - Chemical Sciences; Computational Physics and Applied Math; Earth and Space Sciences; Accelerators and Electrodynamics; Materials Research; Nuclear and Particle Physics; Astrophysics and Cosmology and Weapons Science
- **Capability Reviews 2011**
  - Information and Knowledge Sciences (4/13/2011); Sensors, Remote Sensing and Sensor Systems (5/2/2011); Nuclear Engineering and Technology (5/17/2011); Materials Research (5/31/2011); Biosciences (6/13/2011)
- **LANS Committees**
  - Quarterly meetings of the Mission, ST&E and Integration Committees
- **Other Reviews 2011**
  - NNSA Review Predictive Science Panel (4/12/2011)

LANL performance on ST&E level 2 milestones would indicate another successful year

Milestone Reporting Tool (MRT) Trending: Complete/On-track Milestones



G	> 90%
Y	85-90%
R	<85%

- **Red Milestones:**
- System-Perform gas analysis on WR power sources
- Re-scoping of LBPG and detailed plan to NNSA

Status & Commentary

- 140 level 2 milestones of which ~113 are ST&E related
- For Q1 status, 9 ST&E milestones were reported Yellow, and 2 Red.

2010 customer survey results indicate improvement in key metrics of program performance

- **Performance:** The new management team is viewed very positively with almost ½ of respondents "strongly approving"
- **Quality**: a significant jump in improvement with more than ½ of the respondents rating LANL as "best in class" compared to @1/3rd in 2009
- **Cost:** LANL weakest metric showed improvement. 1 respondent rated our performance as "best in class" while our margin of "good" increased to approximately 1/3rd.
- **Responsiveness:** "best in class" benchmark was applied by about 1/3rd compared to less than a ¼ in 2009
- **Reliability:** significant improvement from 2009 to 2010 with 1/3rd rating LANL performance as "best in class" compared to @ 1/8th in 2009.

Los Alamos weapons program had a great year! 2011 should be another successful year

- **Key accomplishments**
  - Conducted 4 DARHT 2-axis experiments
  - Delivered 2 key diagnostics (Gamma Reaction History, neutron imaging) to NIF
  - Conducted Bacchus, Barolo A&B, and Z pinch
  - Cielo delivering on applications from all 3 labs at 9X performance improvement
  - Achieved Roadrunner success on weapons issues
  - Completed B61LEP 90 day study
  - Initiated B61 Phase 6.2/6.2a
  - Completed 28 of 29 W88 pit builds
  - Advise & confer with plants to sustain W76-1 builds
  - Align CMRR requirements with risk, cost
  - Delivered Q1 surveillance results
  - Completed 15th annual assessment
  - Selective hiring underway

Los Alamos
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2011 is a challenging year for the program

- Build on the technical/programmatic success of the last several years
  - DARHT experiments
  - Cielo deployment
  - B61 LEP
  - RLUOB and CMRR/NF
  - Provide innovative options for stockpile sustainment
- Guide lab thru first significant management change since contract transition
- Sustain and expand Congressional support for Stockpile Stewardship program
- Manage budget challenges of FY11 and FY12
- Maintain and enhance relationships with NNSA
  - "eyes on and hands off" or "eyes on and hands on"
- Enhance relationships with DoD and military service customers
  - STRATCOM, Global Strike