New Agenda and Opportunities at Los Alamos

Alan J. Hurd

February 17, 2021

NMTech Research Expo

Los Alamos
NATIONAL LABORATORY

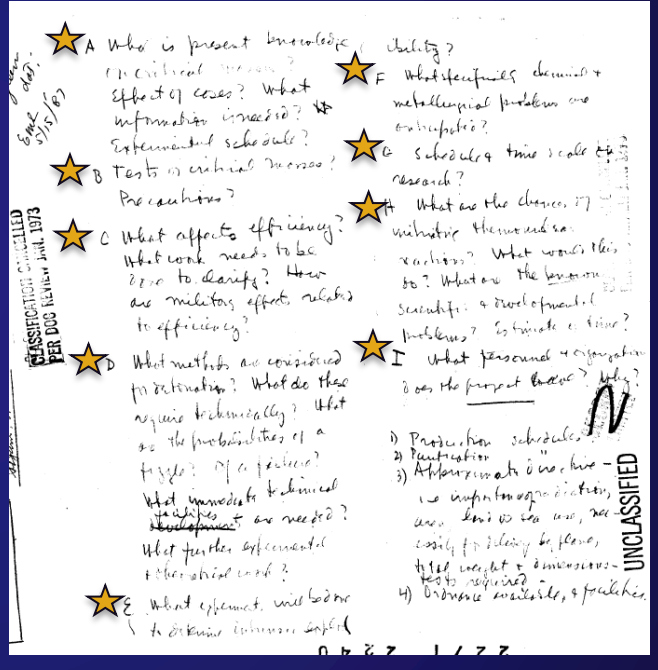
Scope and Purpose

- The excitement of national security science
- Enhancing academic collaborations & institutional relationships

2

1943: Oppenheimer designs Project Y on scrap of paper

e.g. **A. What is present knowledge of critical mass?**

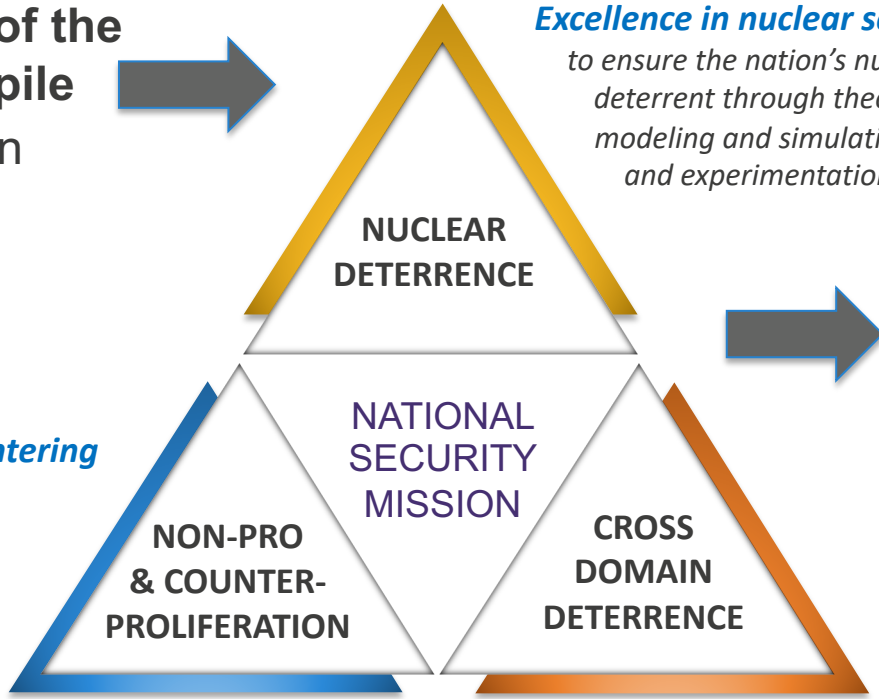


Our national security mission is broad and important — enabled by ST&E discovery

Ensure the safety, reliability, and performance of the U.S nuclear stockpile

- Physics & Design
- Engineering
- Production

Excellence in nuclear security *to ensure the nation's nuclear deterrent through theory, modeling and simulation, and experimentation*



Preventing and countering *efforts of proliferants to acquire, develop or disseminate materials and expertise necessary for nuclear weapons*

Energy security

- Sustainable Nuclear Energy
- Resilient Materials
- Complexity in Energy Systems

Supporting *the DoD, IC, and other national security partners to execute multidomain operations across land, air, sea, space and cyber*

Our "Pillars" in science, technology & engineering define LDRD-DR agenda

2/4/21: Pre-proposal due date
3/29: Call for full proposals by invitation
5/6: Full proposals due

Materials for the Future

Defects and Interfaces

Extreme Environments

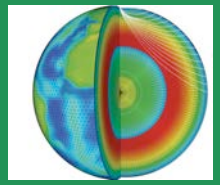
Emergent Phenomena

Science of Signatures

Nuclear Detonation

Nuclear Processing, Movement, Weaponization

Natural and Anthropogenic Phenomena



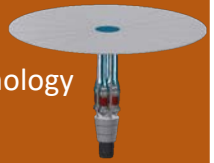
Nuclear and Particle Futures

High Energy Density Physics & Fluid Dynamics

Nuclear & Particle Physics, Astrophysics & Cosmology

Applied Nuclear Science & Engineering

Accelerator Science & Technology

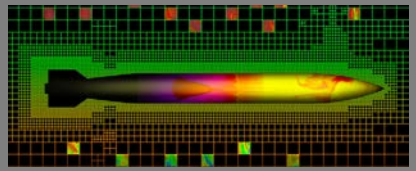


Weapons Systems

Design

Manufacturing

Analysis

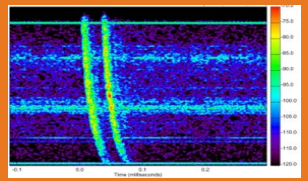


Integrating Information, Science, and Technology for Prediction

Computing Platforms

Computational Science

Data Science

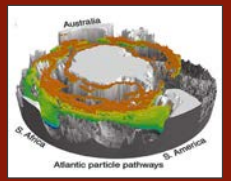


Complex Natural and Engineered Systems

Human–Natural System Interactions: Nuclear

Engineered Systems

Human–Natural System Interactions: Non-Nuclear



Balance between operations and mission defines the Lab Agenda

Design, produce, and certify current and future nuclear weapons and reduce global nuclear threats

Deliver scientific discovery and technical breakthroughs that support DOE & NNSA missions

Execute sustained operations that are reliable and responsive to mission needs

Sustain and enhance LANL's partnership with the community across Northern New Mexico

Culture Statement: HOW we do our work is as important as WHAT we do

FY21 Lab Agenda

SIMULTANEOUS EXCELLENCE	1.0 NUCLEAR SECURITY	2.0 MISSION-FOCUSED SCIENCE, TECHNOLOGY & ENGINEERING	3.0 MISSION OPERATIONS	4.0 COMMUNITY RELATIONS
Strategic Objective (10–20 years)	Excellence in Nuclear Security	Excellence in Mission-Focused Science, Technology & Engineering	Excellence in Mission Operations	Excellence in Community Relations
Critical Outcomes (5–10 years)	Design, produce, and certify current and future nuclear weapons and reduce global nuclear threats	Deliver scientific discovery and technical breakthroughs that support DOE and NNSA missions	Execute sustained operations that are reliable and responsive to mission needs	Sustain and enhance LANL's partnership with the community across the Northern New Mexico region

FY21 Lab Agenda

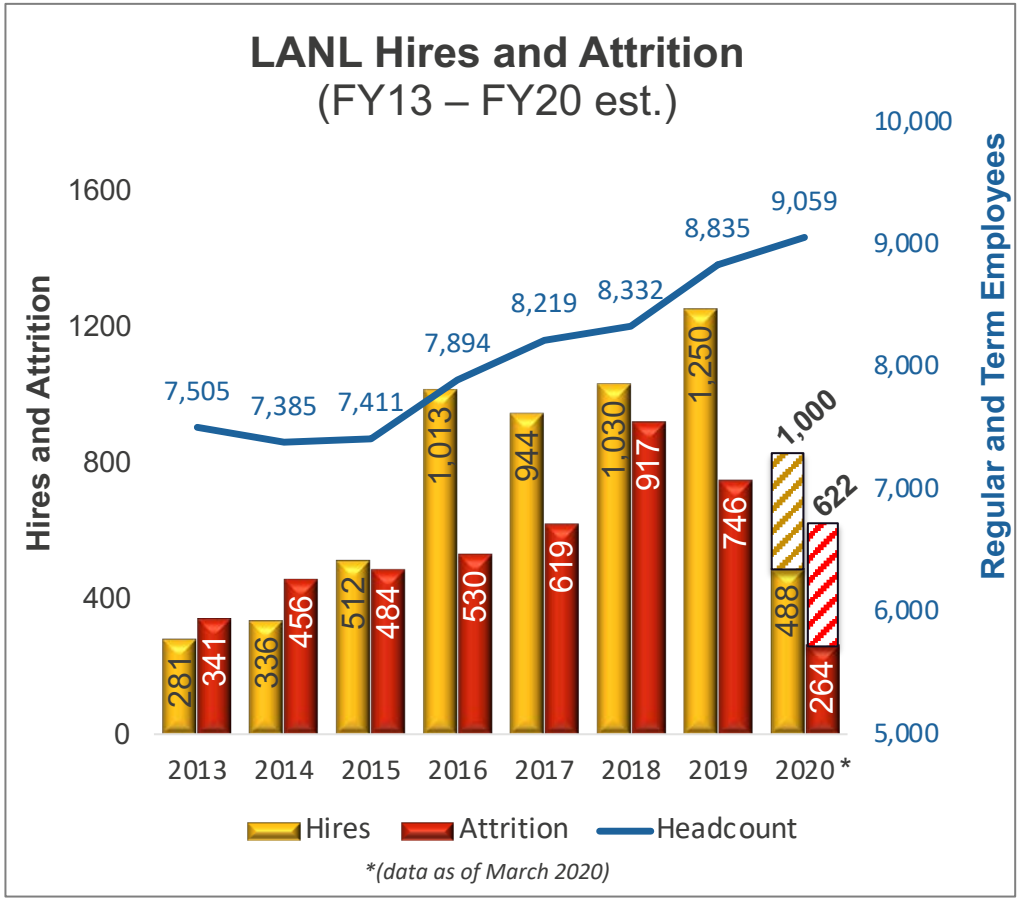
1.0 NUCLEAR SECURITY	2.0 MISSION-FOCUSED SCIENCE, TECHNOLOGY & ENGINEERING
Excellence in Nuclear Security	Excellence in Mission-Focused Science, Technology & Engineering
Design, produce, and certify current and future nuclear weapons and reduce global nuclear threats	Deliver scientific discovery and technical breakthroughs that support DOE and NNSA missions
1.1 Execute LANL's Manufacturing mission to deliver **30 plutonium pits per year** 1.2 **Transform nuclear weapons warhead design** and production 1.3 **Anticipate threats** to global security; **develop and deploy revolutionary tools** to detect, deter, and respond 1.4 Support **modernization of** LANL **warhead systems** 1.5 Assess the **stockpile** as it **ages** and project weapon system **lifetimes**	2.1 Refine and enhance the LANL capability pillar framework 2.2 Advance **accelerator science, engineering, and technology** to enable future stewardship capabilities 2.3 Advance the **frontiers of computing** to exascale and beyond 2.4 Assert leadership in the **national quantum initiative** 2.5 Develop and implement an integrated **nuclear energy and nuclear materials initiative** 2.6 Implement an **integrated initiative for plutonium and actinide missions** based on FY20 strategy 2.7 Implement a **national security life sciences** initiative

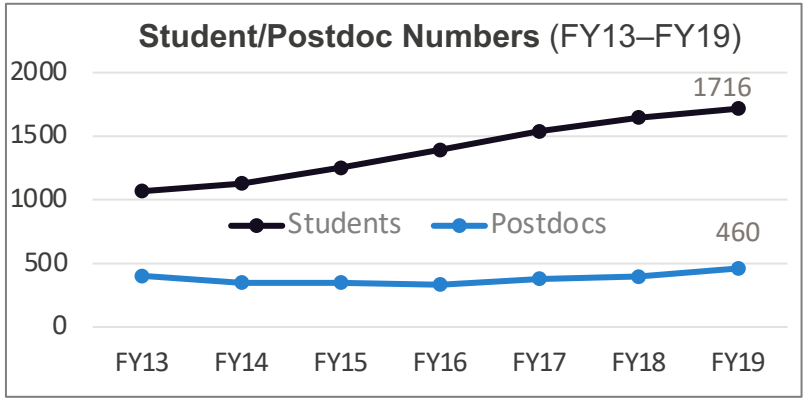
LDRD Exploratory Research Areas for 2021

- **Advanced Materials Science and Engineering (AMSE)**
- **Atomic, Molecular, Quantum and Optical Sciences (AMQOS)**
- **Biological Sciences (BIOS)**
- **Chemical Sciences (CHEM)**
- **Computational Methods and Computer Science (CMCS)**
- **Data Science and Mathematics (DSM)**
- **Earth and Space Sciences (EES)**
- **Emergent Materials Behavior (EMB)**
- **High-Energy-Density Matter, Plasma, Fluids, and Beams (HPFB)**
- **Quarks to the Cosmos (QTC)**
- **ER Seedlings**

2/9/21: pre-proposal deadlines
3/23: Call for full proposals by invitation
4/19: Full proposals due

Employee numbers continue to grow



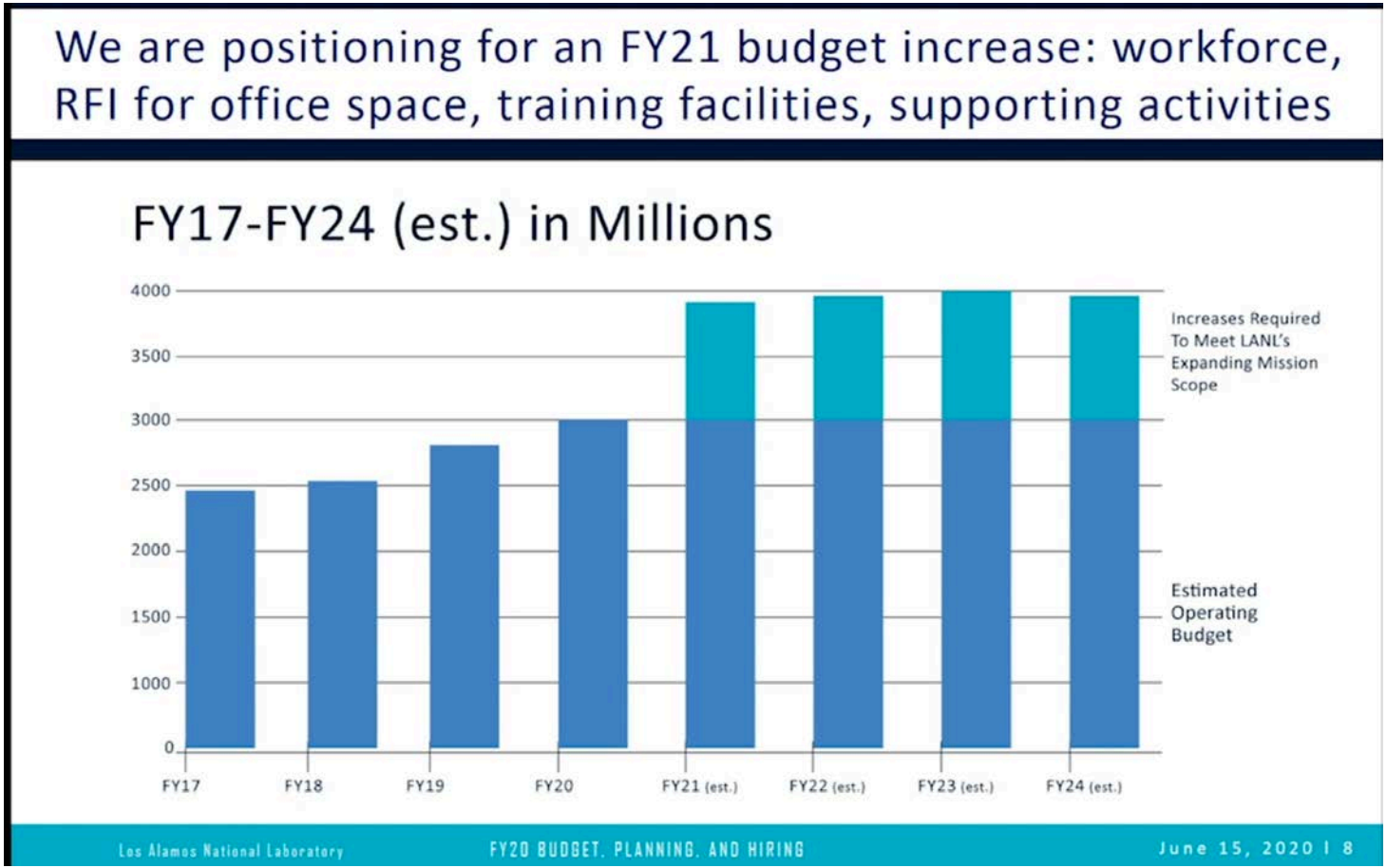


Postdoc Diversity*	LANL	DOE Nat'l Labs
Women	25%	24.4%
Under-represented minorities (URM)	6.4%	8.6%
Other people of color (OPC)	35.3%	36.5%

*2019 (URM: Hispanic, Black, Native American; OPC: Asian)

“High expectations” – Director Thom Mason

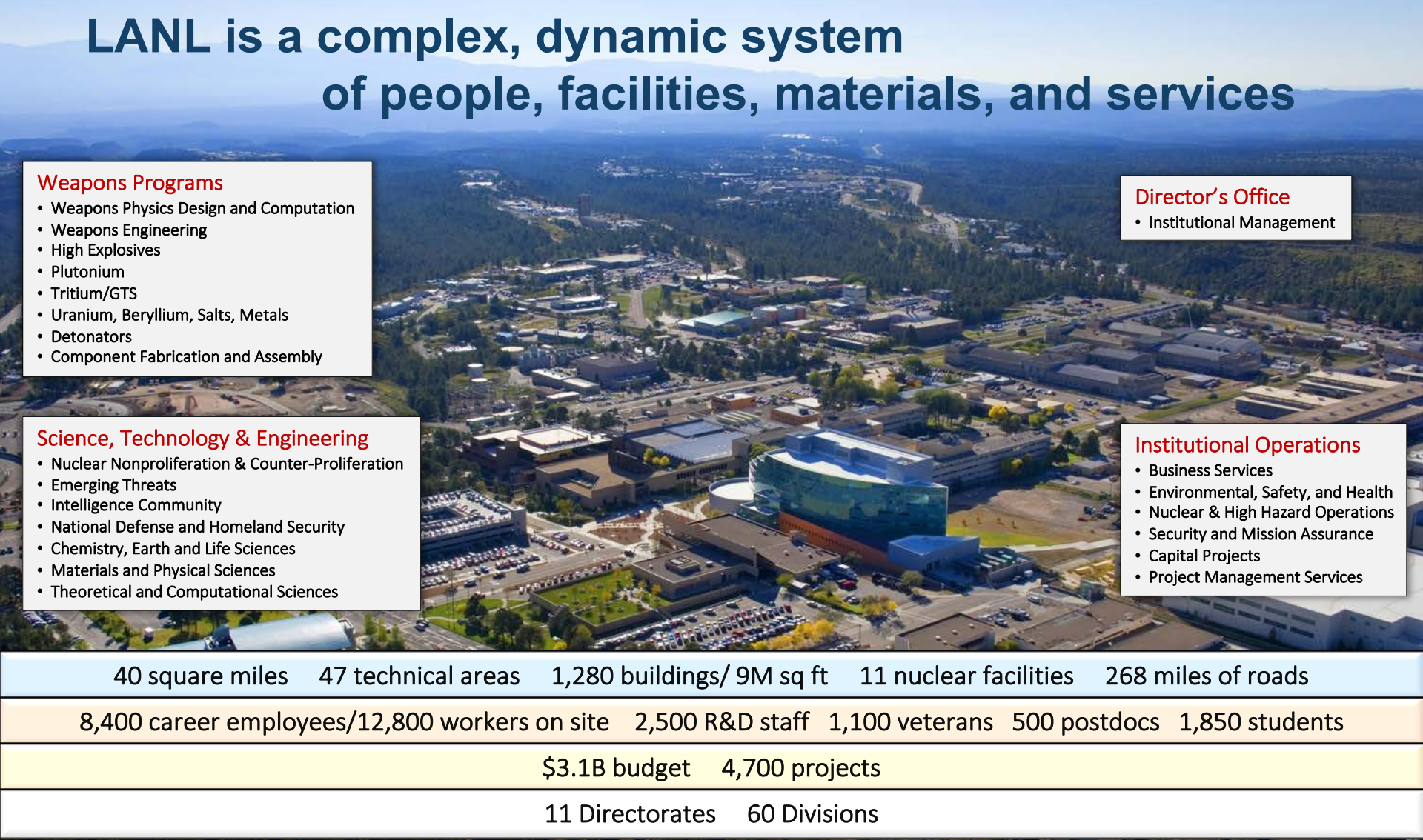
We are positioning for an FY21 budget increase: workforce, RFI for office space, training facilities, supporting activities



LANL Workforce Estimates 2020-2024

Job Group	Job Subgroup	Current Population	Total Estimated Need	Distribution of Degrees Among Current Employees				
				Other	Associates	Bachelors	Masters	Doctorate
LANL Total		9,385	7,054					
R&D		2,420	972					
	R&D Engineer	736	365	1%	0%	34%	40%	24%
	R&D Manager	241	97	2%	0%	12%	20%	66%
	Scientist	1,443	510	1%	0%	7%	11%	81%
Science & Engineering Support		1,445	1,198					
	Draft Design	51	30	29%	65%	6%	0%	0%
	Facilities Engineers	209	141	40%	26%	29%	5%	0%
	Mechanical Tecs	72	76	74%	24%	3%	0%	0%
	Research Technologist	262	169	23%	14%	32%	26%	5%
	Support Engineers	213	210	2%	0%	69%	28%	1%
	Support Tecs	638	572	53%	18%	20%	8%	2%
Operations		3,316	3,428					
	Craft	1,111	1,398	100%	0%	0%	0%	0%
	Env Safety Health	624	721	27%	10%	29%	29%	5%
	Facility	398	392	57%	10%	21%	12%	1%
	Operations Support	182	152	57%	5%	25%	8%	5%
	Project Mgmt	737	515	28%	4%	28%	27%	13%
	Security	224	197	32%	8%	28%	25%	6%
	Other	40	53	35%	13%	25%	28%	0%
Business Services		2,204	1,456					
	Admin Support	468	193	50%	11%	25%	14%	1%
	Finance & Accounting	236	89	13%	5%	33%	49%	0%
	Human Resources	102	42	23%	10%	32%	33%	2%
	Information Services	200	150	40%	11%	32%	17%	2%
	Information Technology	785	422	23%	11%	45%	19%	1%
	Market & Com	70	30	19%	6%	36%	31%	9%
	Procurement	134	213	36%	13%	36%	11%	4%
	Other	209	317	24%	8%	37%	27%	4%

LANL is a complex, dynamic system of people, facilities, materials, and services



Weapons Programs

- Weapons Physics Design and Computation
- Weapons Engineering
- High Explosives
- Plutonium
- Tritium/GTS
- Uranium, Beryllium, Salts, Metals
- Detonators
- Component Fabrication and Assembly

Director's Office

- Institutional Management

Science, Technology & Engineering

- Nuclear Nonproliferation & Counter-Proliferation
- Emerging Threats
- Intelligence Community
- National Defense and Homeland Security
- Chemistry, Earth and Life Sciences
- Materials and Physical Sciences
- Theoretical and Computational Sciences

Institutional Operations

- Business Services
- Environmental, Safety, and Health
- Nuclear & High Hazard Operations
- Security and Mission Assurance
- Capital Projects
- Project Management Services

40 square miles 47 technical areas 1,280 buildings/ 9M sq ft 11 nuclear facilities 268 miles of roads

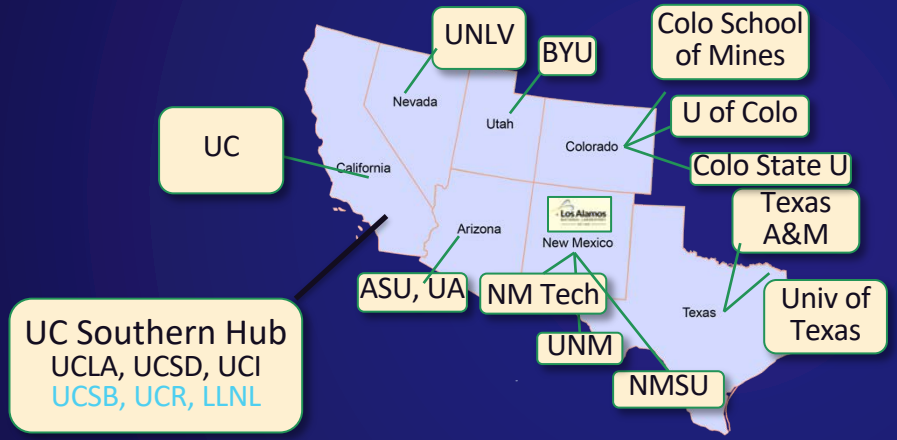
8,400 career employees/12,800 workers on site 2,500 R&D staff 1,100 veterans 500 postdocs 1,850 students

$3.1B budget 4,700 projects

11 Directorates 60 Divisions

Institutional Consortia

Regional Academic Collaborations (REACT)



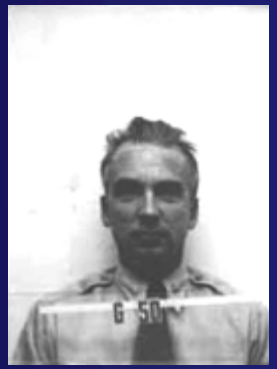
First Master Agreements Signed with NM Consortium (1) & NM Tech (2), UNM (3), NMSU (4)

Other major partners:

University of Alaska Anchorage
University of Alaska Fairbanks
University of Utah

RPI
Northeastern

1946:
Existential crisis year for Director Norris Bradbury



- **“There was one school of thought which held that Los Alamos should become a monument, a ghost laboratory, and that all work on the military use of atomic energy should cease.”**

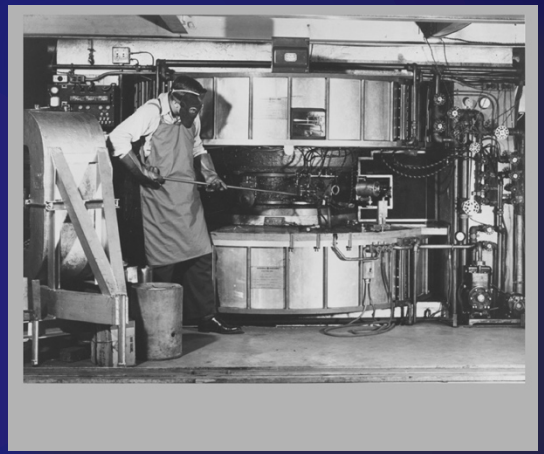
Early 1946: The water pipe to Los Alamos froze and the water had to be supplied by tanker trucks.

1946: Bradbury starts academic research program

Rosen

Rosen, Allred, et al took over the cyclotron

1943 Harvard Cyclotron arrives



Director Norris Bradbury on university cooperation (1946)

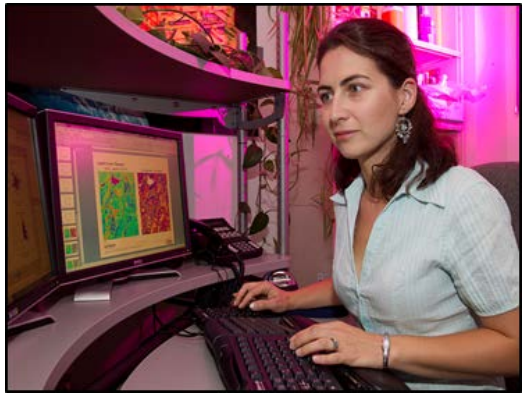
"…this Laboratory comprises one of the most excellently equipped physics laboratories in the country… the facilities which can be devoted to fundamental research should be fully employed in this pursuit."

The 1946 Conference resulted in today's robust student internship program serving ~2000 students per year

Fuller Lodge

Representative	Institution
Bonner, T. W.	Rice Institute
Brewster, Ray Q.	University of Kansas
Buchta, J. W.	University of Minnesota
Colby, M. Y.	University of Texas
Dempster, R. R.	Oregon State University
Dodson, Richard	California Institute of Technology
Gingrich, N. S.	University of Missouri
Glockler, George	University of Iowa
Gustavson, R. G.	University of Nebraska
Hughes, A. L.	Washington University of St. Louis, Missouri
Jacobs, James A.	University of Iowa
Kirkpatrick, Paul	Stanford University
Larsen, H. D.	University of New Mexico
Marvin, H. H.	University of Nebraska
Nielsen, Jens Rud	University of Oklahoma
Pietenpol, W. B.	University of Colorado
Regener, Victor	University of New Mexico
Smith, Sherman	University of New Mexico
Smythe, W. R.	California Institute of Technology
Stewart, M. A.	University of California
Suttle, John F.	University of New Mexico
Van Atta, C. M.	University of Southern California
Weniger, Willibald	Oregon State University
Worcester, P. G.	University of Colorado

LANL's Student Program Office oversees our Internships Opportunities



LANL has a variety of Student Internships

- High School Co-op Program
- Undergraduate Student Interns
- Graduate Research Associates
- Post-Bac and Post Masters Students who are looking to explore research!

Diversity Program Opportunities:

- Graduate Fellowships for STEM Diversity (GFSD Fellows)
- National Consortium for Graduate Degrees for Minorities in Engineering (GEM Fellows)
- DOE Minority-Serving Institution Partnership Programs (consortiums and internships)

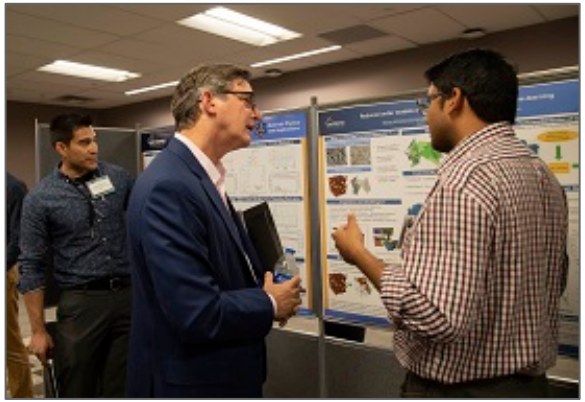
https://www.lanl.gov/careers/career-options/student-internships/index.php

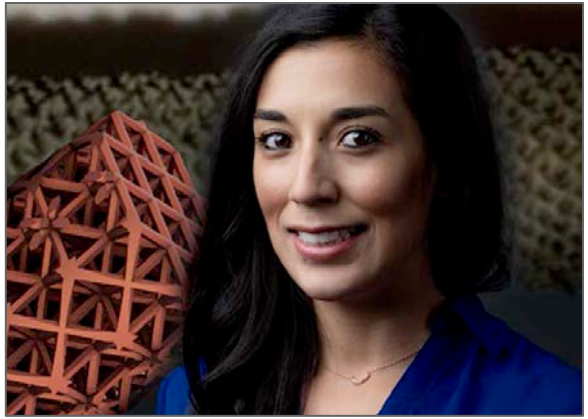
Supercomputer Institute class of 2020

Postdocs are hired by Staff in many LANL technical organizations

Postdoc Appointments include:

- **Postdoctoral Research Associates** pursue research as part of ongoing LANL science and engineering programs.
- **Director's Postdoctoral Fellows** are competitive fellowships based on academic and research accomplishments
- **Distinguished Fellows** must display extraordinary ability in scientific research and technical leadership
  - ***Robert Oppenheimer Fellow***
  - ***Richard P. Feynman Fellow in Theory and Computing****
  - ***Darleane Christian Hoffman Fellow***
  - ***Frederick Reines Fellow in Experimental Sciences***



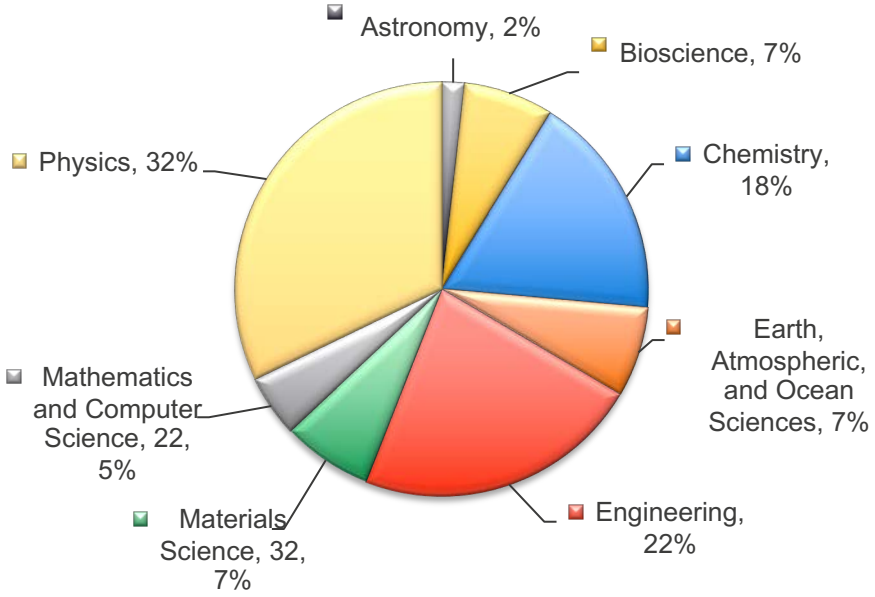


LANL currently has over 500 Postdoctoral Researchers

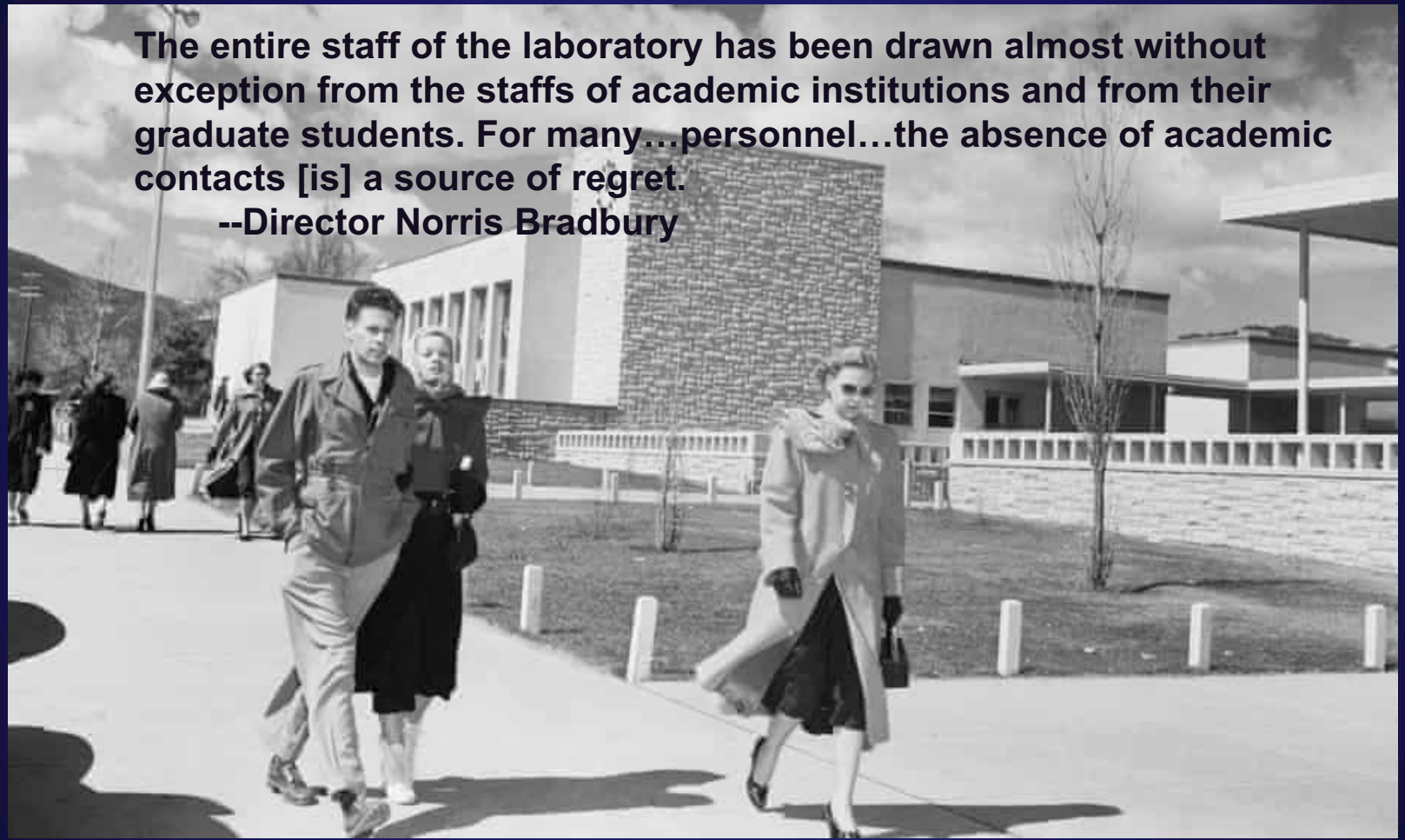
The Postdoc program is LANL's most utilized pipeline for our R&D staff

- Individual LANL staff recruit and hire Postdocs
- LANL has a Postdoc Fellows and also Postdoc Associates.
- The Laboratory converts about 50% of our Postdocs to technical staff at the Laboratory

Postdocs by Field of Study

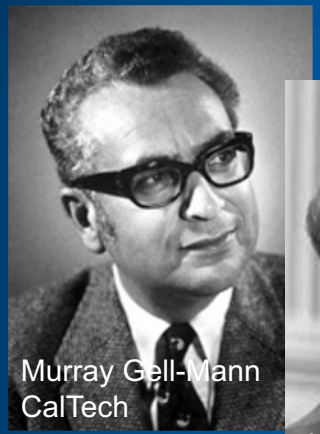


https://int.lanl.gov/employees/postdoc-program/index.shtml

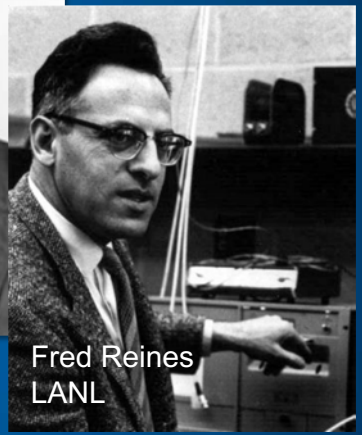

The entire staff of the laboratory has been drawn almost without exception from the staffs of academic institutions and from their graduate students. For many…personnel…the absence of academic contacts [is] a source of regret.
--Director Norris Bradbury

Your headline should be a full sentence summary

Joint Appointments have been the conduit to and from the Lab



INCOMING, often Summer Faculty



OUTGOING, often Sabbaticals

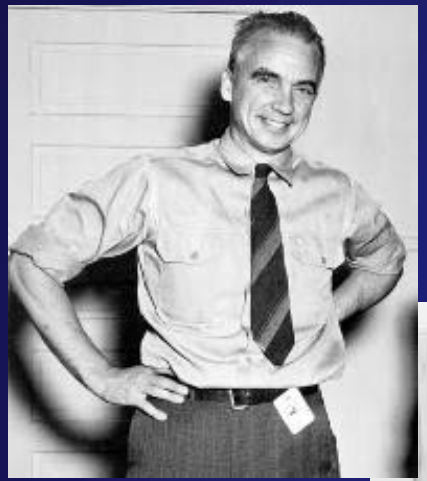
Retain, Research, Recruit, Recognize, Revitalize

Slide 2

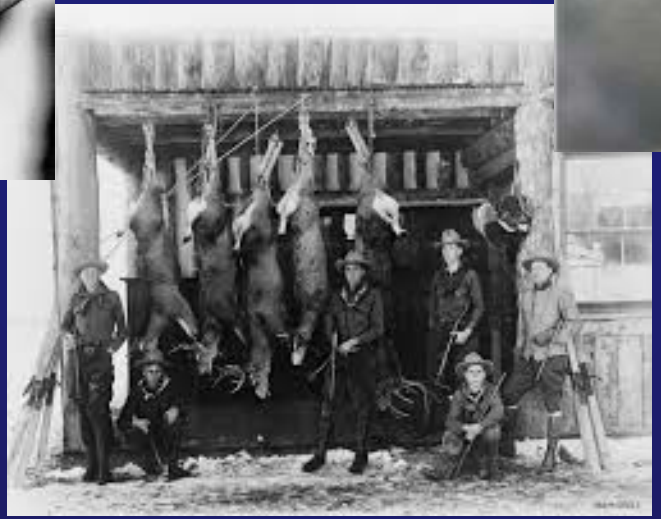
Slide 24

“Of Earth and Sky, A History of New Mexico Institute of Mining and Technology 1889-1964”

Paige W. Christiansen (University of New Mexico Press, 1964)



Norris Bradbury
LANL Director
1945-1970

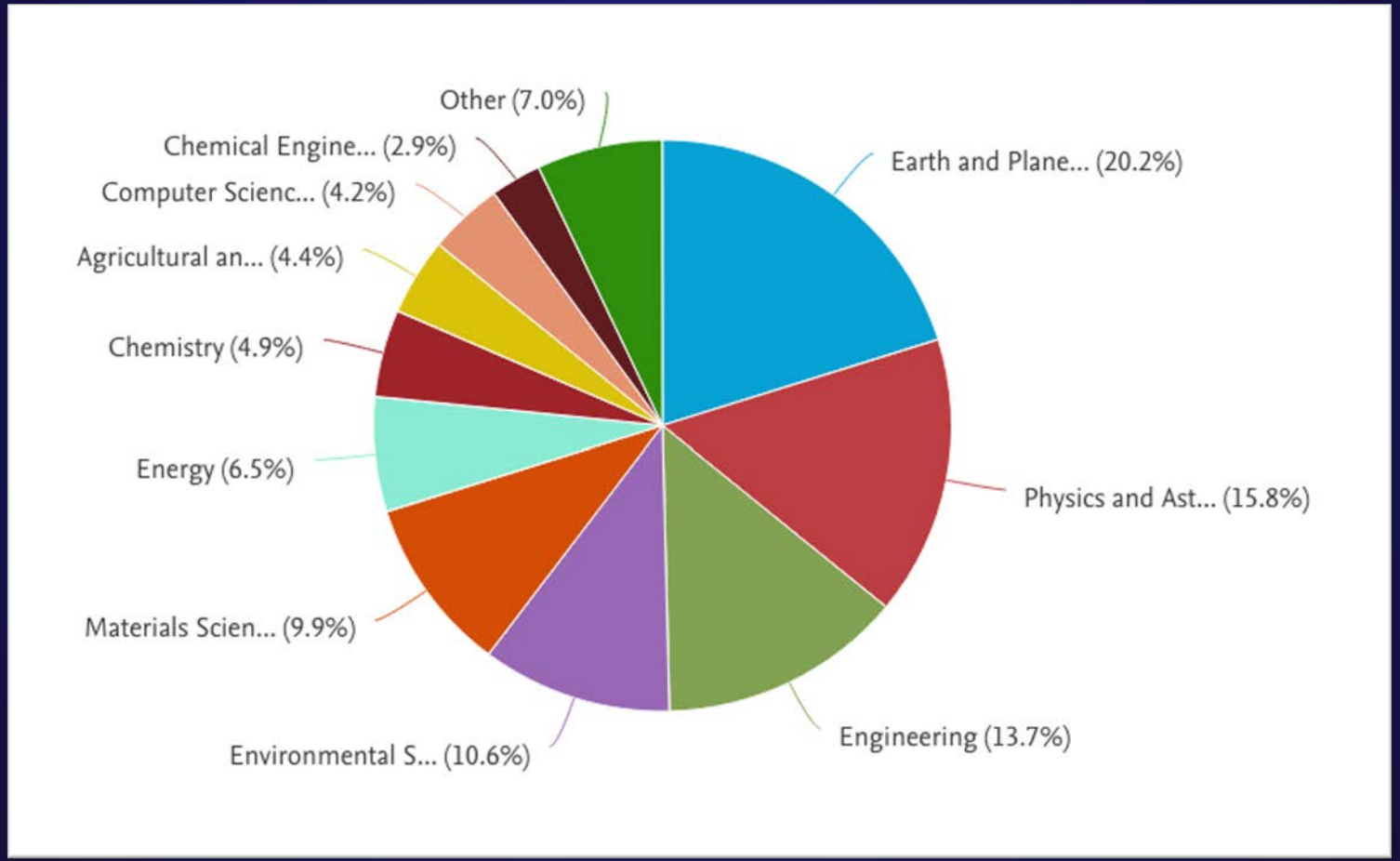


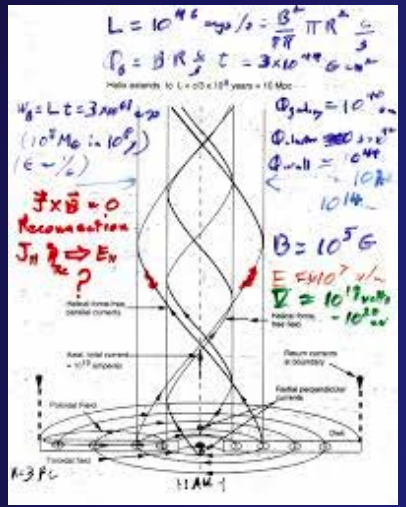
Los Alamos Ranch School

Sterling Colgate
NMIMT President
1965-1974

1946:

- **NMIMT established a graduate program**
- **Expanded STEM curriculum**
- **President E.J. Workman founded the Energetic Materials Research and Testing Center EMRTC**

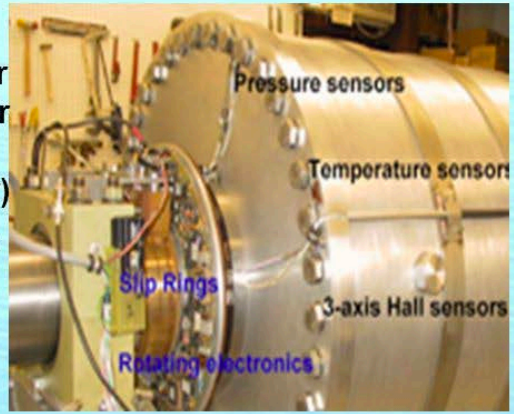

Other (7.0%)
Chemical Engine... (2.9%)
Computer Scienc... (4.2%)
Agricultural an... (4.4%)
Chemistry (4.9%)
Energy (6.5%)
Materials Scien... (9.9%)
Environmental S... (10.6%)
Engineering (13.7%)
Physics and Ast... (15.8%)
Earth and Plane... (20.2%)



KITP notes

Key parameters of the NM dynamo experiment

Outer cylinder: 0.6 meter diameter
Inner cylinder: 0.3 meter diameter
Working fluid: liquid sodium.
Speed: 17.5 (inner) & 70 Hz (outer)
Stable Couette flow, Re = 1.0×10^7,
Rm = 94 at T = 110°C.



$$\mathrm{Re} = (\omega_{in} - \omega_{out})(R_{in} - R_{out})^2 / \nu \qquad Rm = (\omega_{in} - \omega_{out})(R_{in} - R_{out})^2 / \eta_m$$

Colgate, Hui Li, Van Romero, Jiahe Si, Richard Sonnenfeld, David Westpfahl, and others

Partnerships & Pipeline Office (PPO) enhances external outreach

Pipeline

Partnerships

Pipeline Mechanisms:

- **Student Programs:** Education opportunities for high school, undergraduate, and graduate students
- **Postdoctoral Programs:** Postdocs contribute to research efforts, enhance our STE capabilities

Partnership Opportunities:

- **National Security Education Center Strategic Centers:** Scientific centers of excellence with high international visibility that innovate strategic new science and education programs
- **New Mexico Consortium Coordination:** Creative mechanisms for collaboration with NM research universities through joint appointments and unique facilities
- **Feynman Center for Innovation:** From “tech transfer”’ to innovation asset stewardship with strategy driven through Innovation Asset Strategic Council

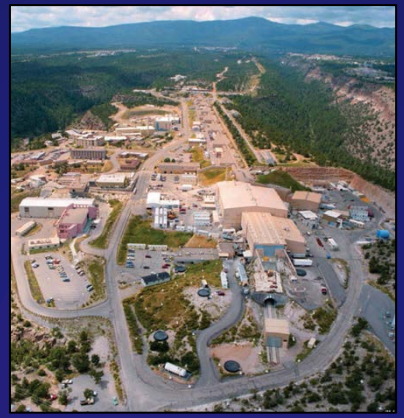
National Security Education Center Strategic Centers

Gateways for collaboration, education, and recruitment

- ***Center for Nonlinear Studies***
  complex systems
- ***Center for Space and Earth Science***
  Astrophysical, space, earth, & climate sciences
- ***Engineering Institute***
  Structural health monitoring, cyberphysical systems
- ***Information Science & Technology***
  Education, collaboration, research in IS&T
- ***Institute for Materials Science***
  Advancement of materials science
- ***Seaborg Institute***
  Actinide science & Plutonium Center of Excellence

Signature facilities are still the hallmark of Los Alamos

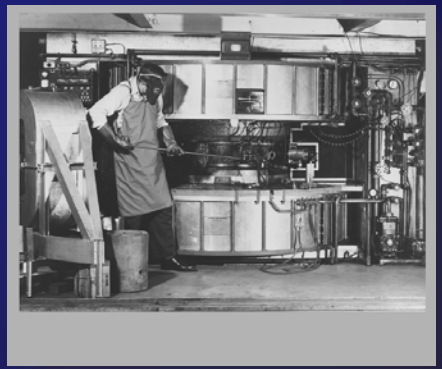
National High Magnetic Field Lab



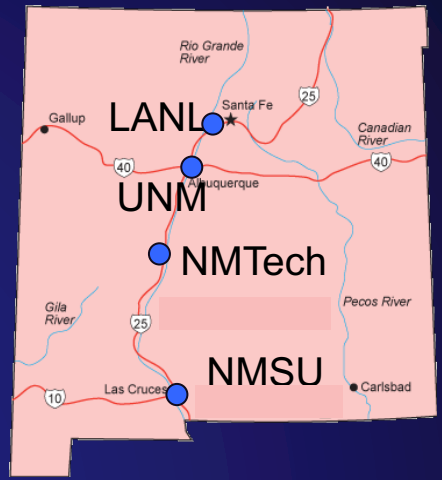
Los Alamos Neutron Science Center

Center for Integrated Nanotechnologies

Los Alamos Research Park



The New Mexico Consortium (NMC)
--Steve Buelow talk, March 3



A non-profit corporation formed by the three New Mexico research universities

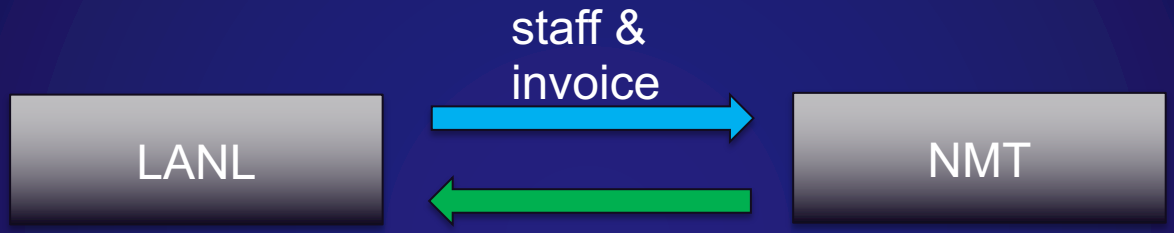
- Develop models for operating collaborative inter-disciplinary research across partner institutions such as start-ups.

*** http://newmexicoconsortium.org**

Joint Appointments with Academic Institutions

establish a relationship employing existing mechanisms

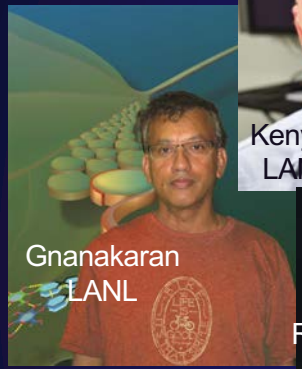
- Outgoing & Incoming JA.s are **“seconded” to the host,** can act as a Co-PI on a proposal, and both institutions are able to recover indirect costs.

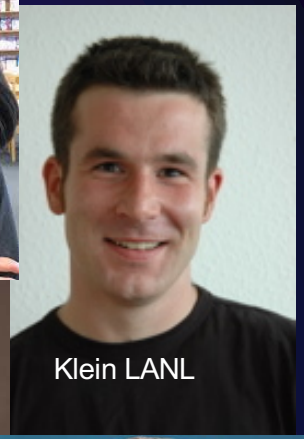


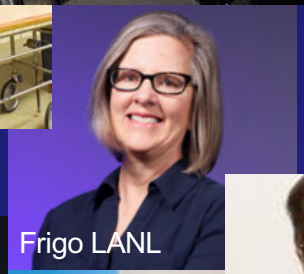
People are the basis of institutional relationships

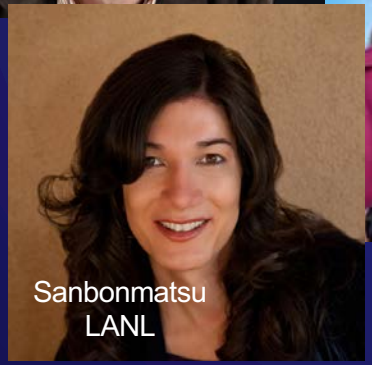
David Grow was the first NMT Joint Appointment

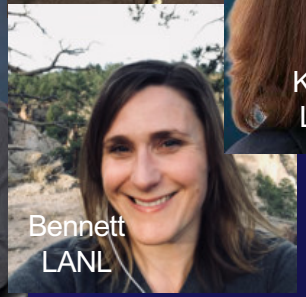
Staff Joint Appointments



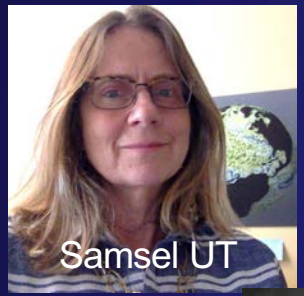


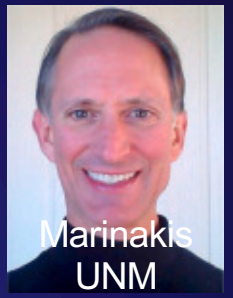






Faculty
Joint Appointments





Gates funded Bette Korber to design a mosaic HIV vaccine with Harvard now in testing. She is moving on to COVID-19.

The UK and California variants are here. Now what?

Do all you can to thwart disease spread

Bette Korber
2021 Los Alamos Medal Honoree

Theoretical biologist **Bette Korber** of T-6 recently told the Albuquerque Journal she wasn't surprised when the New Mexico Department of Health announced the state's first case of the B.1.1.7. coronavirus variant on Jan. 13. She encouraged New Mexicans to be "extra careful" given that this version is more transmissible than most forms of the virus.

Post-Pilot Joint Appointments, Status and Forecast

- **Dual paycheck** *Outside Activities* with NMC are straightforward
  - LANL-NMC average ~20 active and ~20 pending OAR's with NMC
- **Single paycheck *Joint Appointments*** are sometimes hard on cash-flow at NMC
  - LANL-NMC have ~21 active outgoing and ~10 active incoming JA's executed

Universities are larger and therefore better equipped for Joint Appointments than NMC

- Preferred indirect rate ~19% for JA program for *offsite* work
- Onsite use can be implemented through facility-use fees

Full cost recovery prevails at LANL and DOE

Mechanisms


Consortia (NMC, REACT, UC SoHub,…)
Institutional Agreements
Joint Appointments
Outside Activities
Contracts including IA funding agreements
EPSCoR and calls with lab
B.Zupp © 2018

Outcomes


Retention
Revitalization
Research
Recruitment (including two-body)
Recognition

Managed by Triad National Security, LLC
for the U.S. Department of Energy's NNSA

Los Alamos National Laboratory

Happy to Answer Questions!