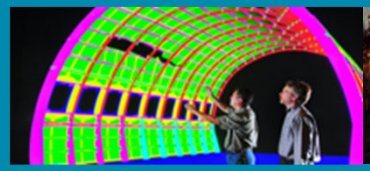
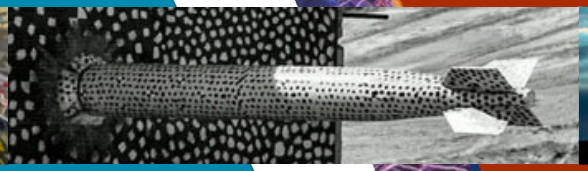
Sandia National Laboratories

Exceptional service in the national interest

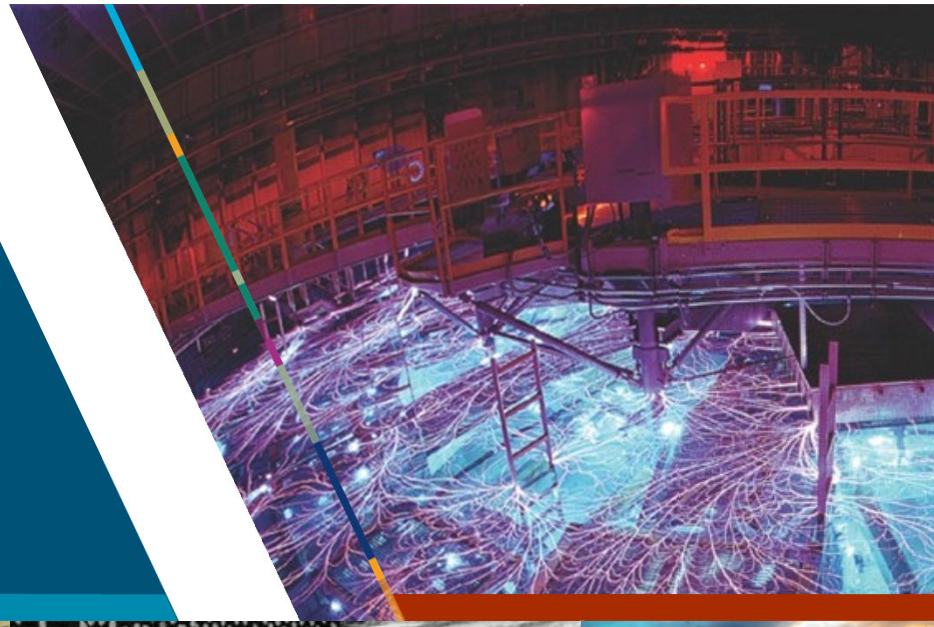







X V G R H Q D W LR Q D O O D E R U D W R U LH V

Working at SNL as a Physicist



X SG D WHG #X Q H#534<

U.S. DEPARTMENT OF ENERGY | NNSA

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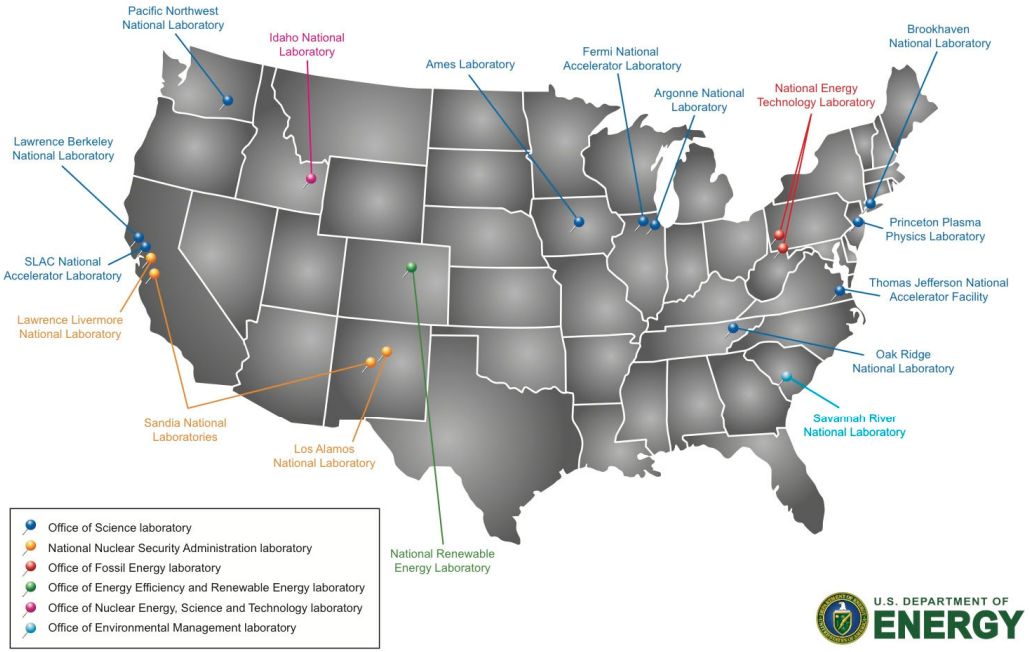
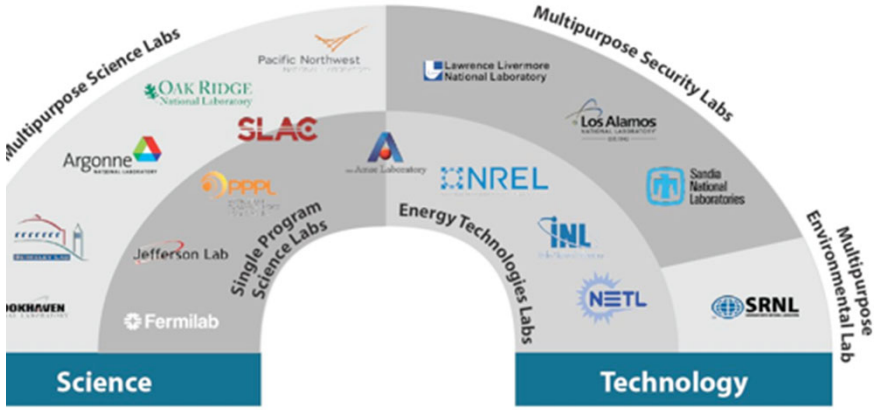
Department of Energy National Laboratories





Lqwurgxfwru|#ylghr#e|#G R H#Vhfuhwdu|#Ulfn#Shuu|

Wkh#Q Q VD #uxqv#wkh#X V#Q xfohdu#Z hdsrqv#F rp sdn{

SOURCE: National Nuclear Security Administration

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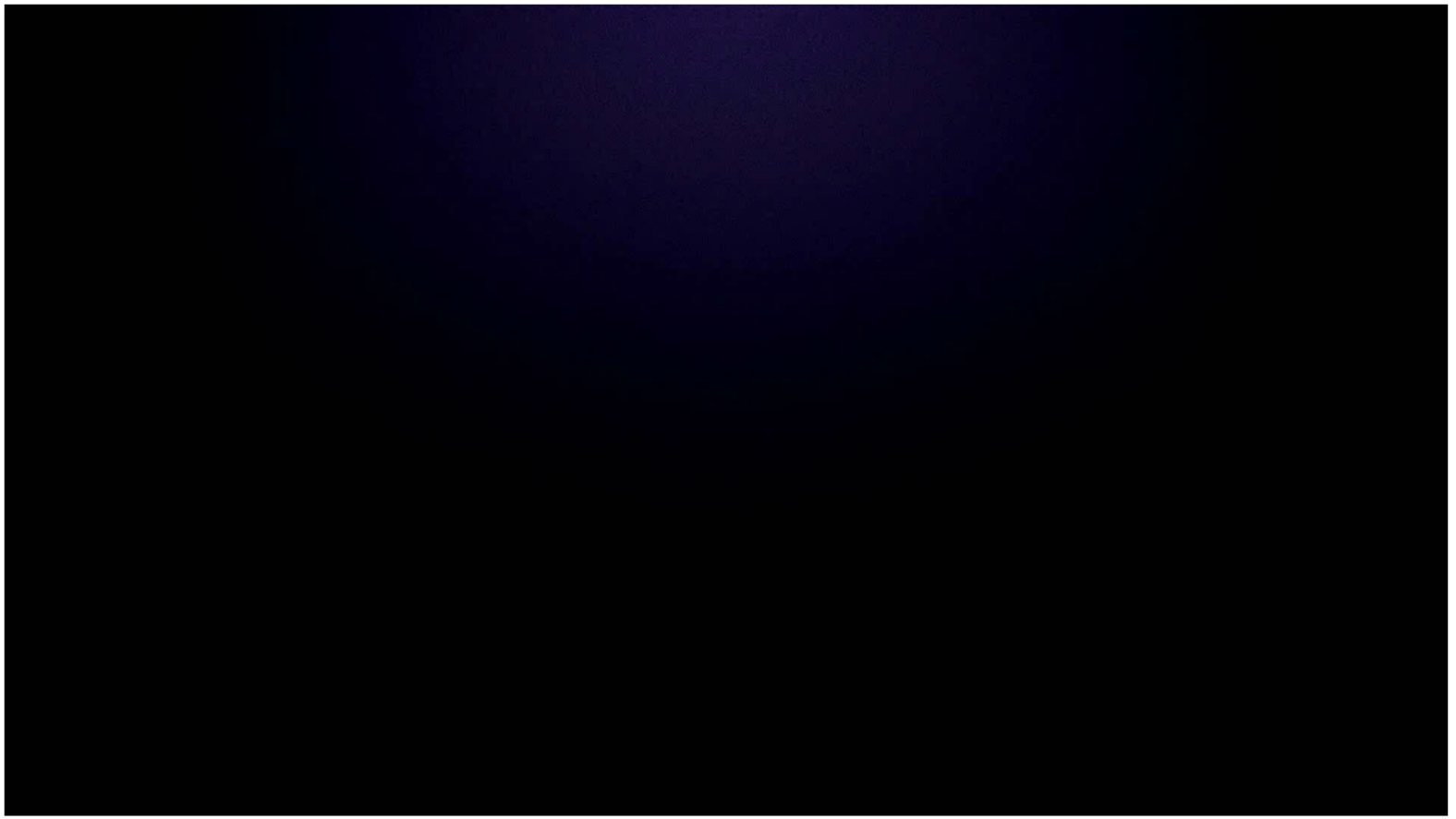


VDQGLD#KDV#LDFLOLWLHV#DFURVV#WKH#QDWLRQ

Activity locations

- Kauai, Hawaii
- Waste Isolation Pilot Plant, Carlsbad, New Mexico
- Pantex Plant, Amarillo, Texas
- Tonopah, Nevada

Main sites

- Albuquerque, New Mexico
- Livermore, California

VDQG IID #DG G UHVVHV#Q DWIR Q DO#VHF X ULW\ #F KDOOHQ J HV

1950s

Q X F OHD U#
Z HD SR Q V#
HQ J IQ HHUIQ J #
D Q G #WHVWIQ J

Dup v#udfh

1960s

Q Z #
VWR F N SIOH##
G IY HUVIW\ #D Q G #
EX IOG OX S#

F xedq#p lvvlbh#
fulvlv#) #Ylhwqdp #
Z du

1970s

Q Z #.#HQ HUJ \ =#
P X OWLSUR J UD P #
OD E R UD WR U\ #

Hqhuj|#fulvlv

1980s

G R H#
P X OWLSUR J UD P #
.#P IVVIOH#
G HIHQ VH#
D Q G #R WK HU#
G rG #Z R UN#

Hqg#ri#
F rog#Z du

1990s

G R H#
P X OWLSUR J UD P #
.#G rG /#
HF R Q R P IF #
F R P SHWIWIYHQ HVV

Vwrfnslbh#
whz dugvkls

2000s

H [SD Q G HG #
Q D WIR Q D O#
VHF X UIW\ #UR OH
SR VW ##<2 44

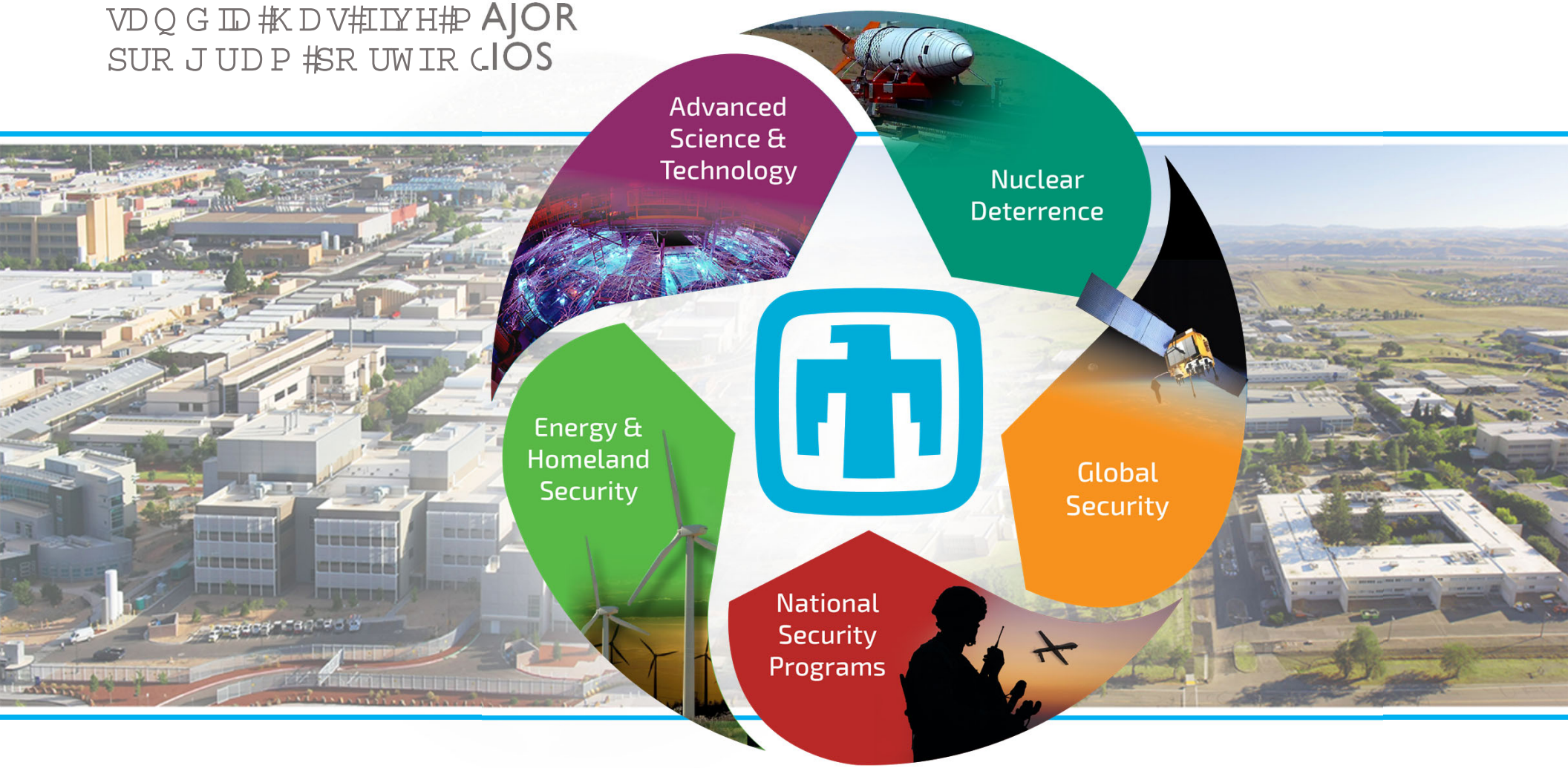
Eurdghu#
qdwlrqdd#
vhfxulw|

2010s

P X OWIP IVVIR Q #
OD E =#OHSv
F \ EHU /#EIR /#
VSD F H/
WHUUR UIVP

Hyroylqj#
qdwlrqdd#
vhfxulw|#
fkdoohqjhv

VDQG ID#KDV#ILYH#P AJOR SUR JUDP #SR UWIR CIOS



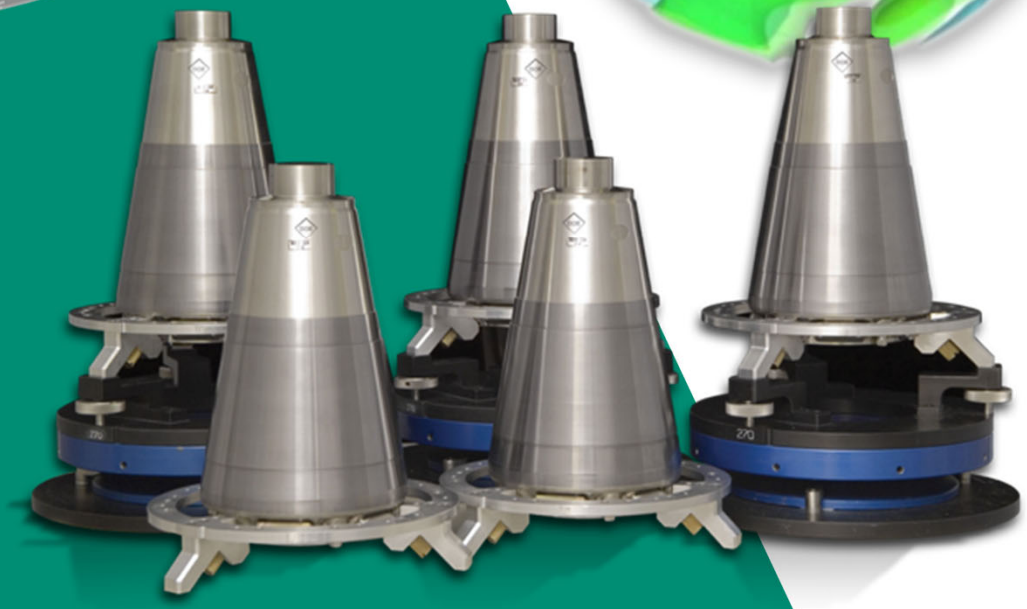
NUCLEAR DETERRENCE

Responsibilities form a critical mandate

Warhead systems engineering & integration

Design agency for nonnuclear components

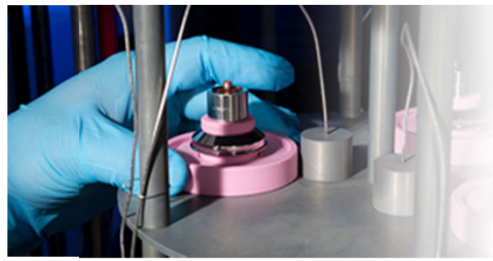
- Gas transfer systems
- Radar
- Safety systems
- Arming, fuzing & firing systems
- Neutron generators



Multidisciplinary capabilities

Required for design, qualification, production, surveillance, computation/ experimentation

- Major environmental test facilities & diagnostics
- Materials sciences
- Light-initiated high explosives
- Computational analytics



Production agency

- Neutron generators
- Sandia external production
- Microelectronics
- Thermal battery backup

J OR ED O#VHF X UIW\

s at home and abroad

Develop space- and ground-based sensor systems for monitoring emerging threats

Supply technology, crisis response, and training to respond to a crisis associated with weapons of mass destruction

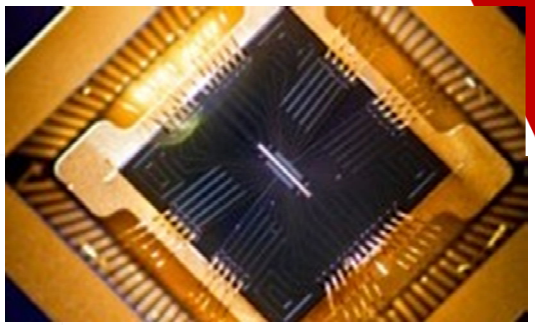
Provide capabilities for protecting U.S. nuclear weapons and materials at fixed sites and in transit

Produce systems that deter proliferation and verify compliance with international agreements using space-borne and ground-based sensing technology

Lead global technical engagement to prevent the misuse of nuclear, chemical, biological, and radiological materials

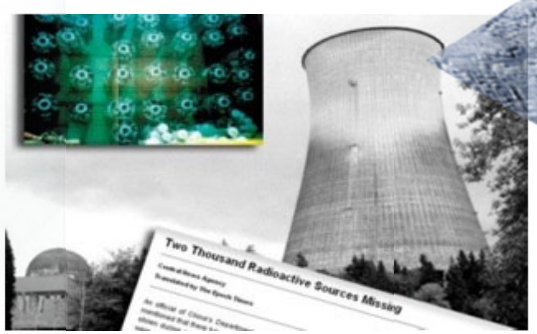
Q DWLR Q DO#VHF X UL W \ #SUR J UD P V
Strengthens our nation's defenders

Information operations



Science & technology products

Integrated military systems



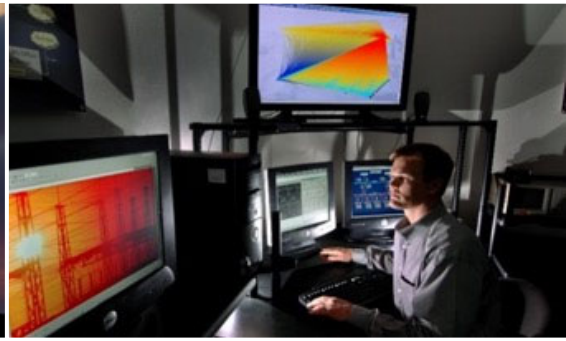
Proliferation assessment

Surveillance & reconnaissance

HQ HUJ \#) #K R P HOD Q G #VHF X UI W \

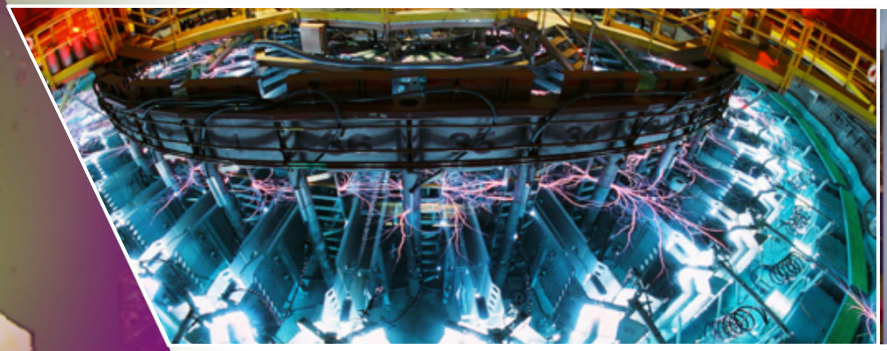
Innovates for a secure future

- Perform fundamental and applied R&D to support the resilience and security of the nation's energy system
- Provide protection for our nation's digital and physical critical infrastructures
- Reduce U.S. vulnerability to chemical, biological, radiological, and nuclear threats
- Accelerate transformative innovations in the transportation sector through foundational physical and computational research

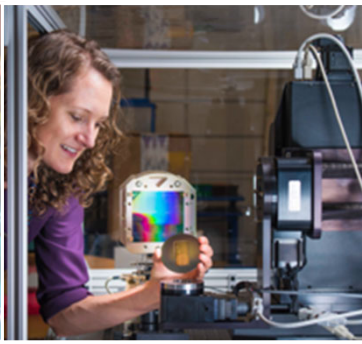


DGYDQFHG #VFLHQFH#) #WHFKQRORJ\
Research Foundations play an integral role in mission delivery

Nanodevices & Microsystems



Radiation Effects & High Energy Density Science



Materials Science

Computing & Information Science

Engineering Science

Geoscience

Bioscience

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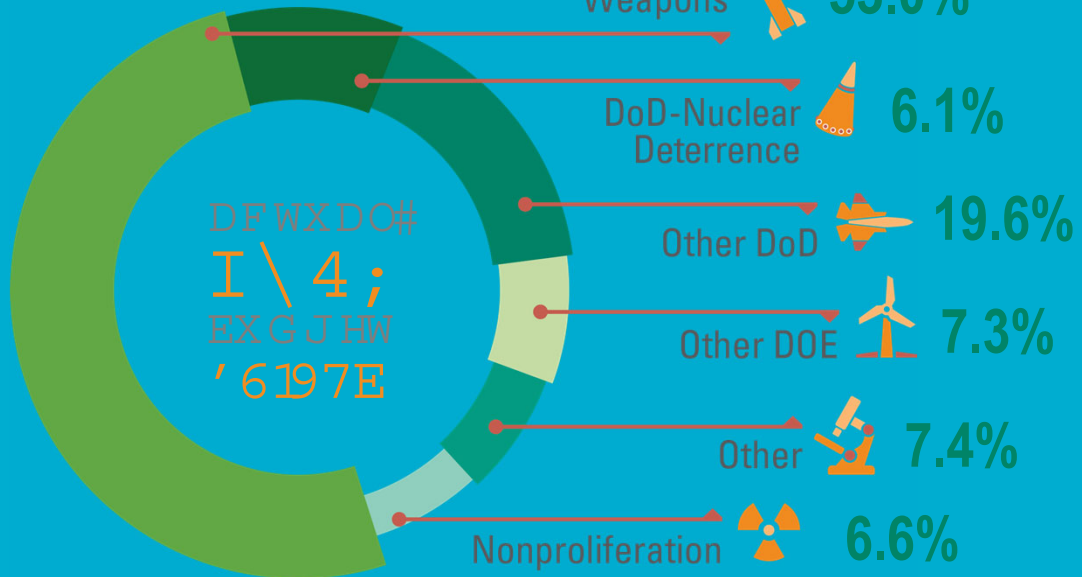

DoD
Air Force | Army | Navy
Defense Threat Reduction Agency
Ballistic Missile Defense Organization
Office of the Secretary of Defense
Defense Advanced Research Projects Agency
Intelligence Community

OTHER DOE
Science
Energy Efficiency and Renewable Energy
Nuclear Energy
Environmental Management
Electricity Delivery and Energy Reliability
Other DOE

OTHER
Department of Homeland Security
Other federal agencies | Nonfederal entities
CRADAs, licenses, royalties | Inter-entity work

NONPROLIFERATION
NNSA/NA20 | State Department

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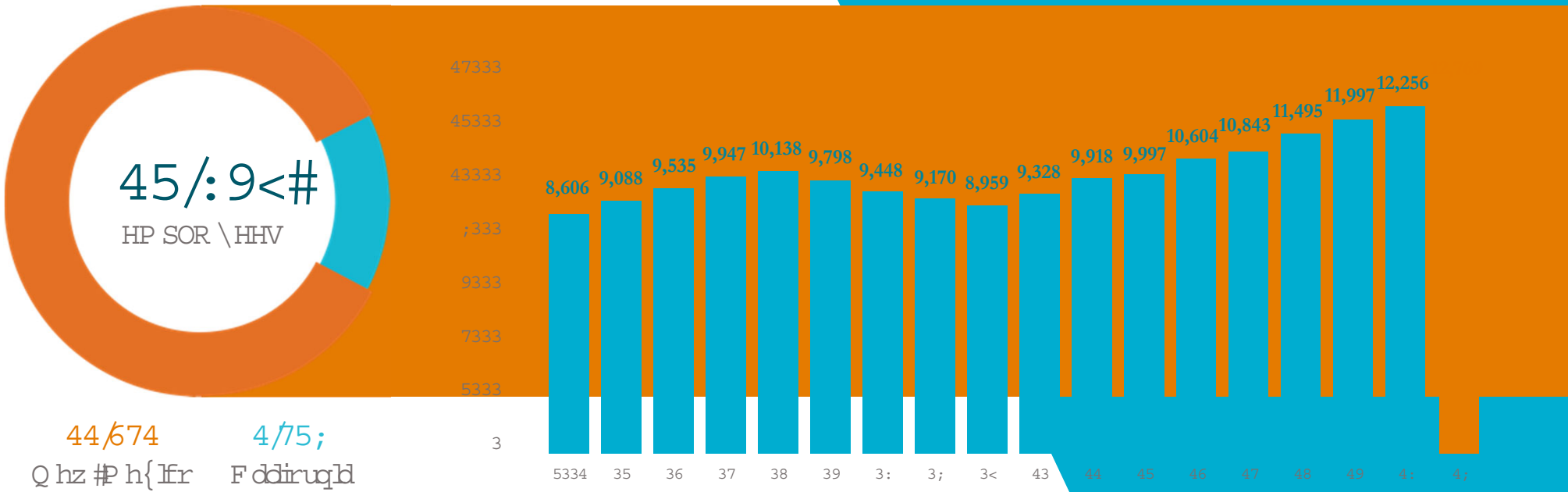
Staff has grown by over 3,800 since 2009 to meet all mission needs



How to get a Career Discussion

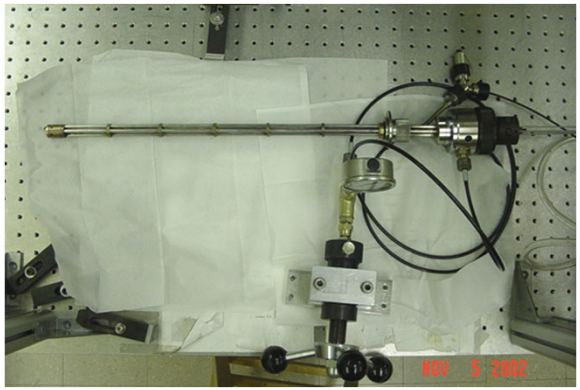
- Have a Career Discussion with a Sandia on-campus Recruiter
- Together discuss interests, location preferences, and career goals
- All hires start with applying online to an existing posting
  - Sandia.gov\careers
  - Let the Recruiter know about all positions you've applied to. The recruiter can contact the hiring manager and share all of your strengths and advocate for you.
  - Recruiters can't share your resume directly with a hiring manager.
- Be patient
- Apply to lots of positions

Shuvrqdo#Edfnjurxqg

- Southern California native
- Decided to major in physics in High School because I read Popular Science
- BS, MS Brigham Young University in Physics
- PhD with Lance Cooper in 2003

Graduation Day

P |#Uhvhdufk#dw#X LX F



- Strongly correlated electron systems
- High-pressure Raman scattering at low-T and B-Field

Pressure-Tuned Collapse of the Mott-Like State in $Ca_{n+1}Ru_nO_{3n+1}$ (n=1,2): Raman Spectroscopic Studies

C.S. Snow,[1] S. L. Cooper,[1] G. Cao,[2,3] J.E. Crow,[3] H. Fukazawa,[4] S. Nakatsuji,[3,4] Y. Maeno[4]
[1]*Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801*
[2]*Department of Physics and Astronomy, University of Kentucky, Lexington, Kentucky 40506*
[3]*National High Magnetic Field Laboratory, Tallahassee, Florida 32310*
[4]*Department of Physics, Kyoto University, Kyoto 606-8502, Japan, and CREST, Japan Science and Technology Corporation, Japan*
(Dated: September 26, 2002)

We report a Raman scattering study of the pressure-induced collapse of the Mott-like phases of $Ca_3Ru_2O_7$ (T_N=56 K) and Ca_2RuO_4 (T_N=110 K). The pressure-dependence of the phonon and two-magnon excitations in these materials indicate: (i) a T ~ 0 pressure-induced collapse of the antiferromagnetic (AF) insulating phase above P*~55 kbar in $Ca_3Ru_2O_7$ and P*~ 5-10 kbar in Ca_2RuO_4; (ii) a surprising insensitivity of the exchange interaction to pressure in both systems; and (iii) evidence for persistent AF correlations above the critical pressure of Ca_2RuO_4, suggestive of phase separation involving AF insulator and ferromagnetic metal phases.

PACS numbers: 71.30.+h 75.30.Kz 75.50.El 78.30.-j

Quantum Melting of the Charge Density Wave State in 1T-$TiSe_2$

C. S. Snow, J. F. Karpus, S. L. Cooper*, T. E. Kidd+, and T.-C. Chiang
Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801
(Dated: June 19, 2003)

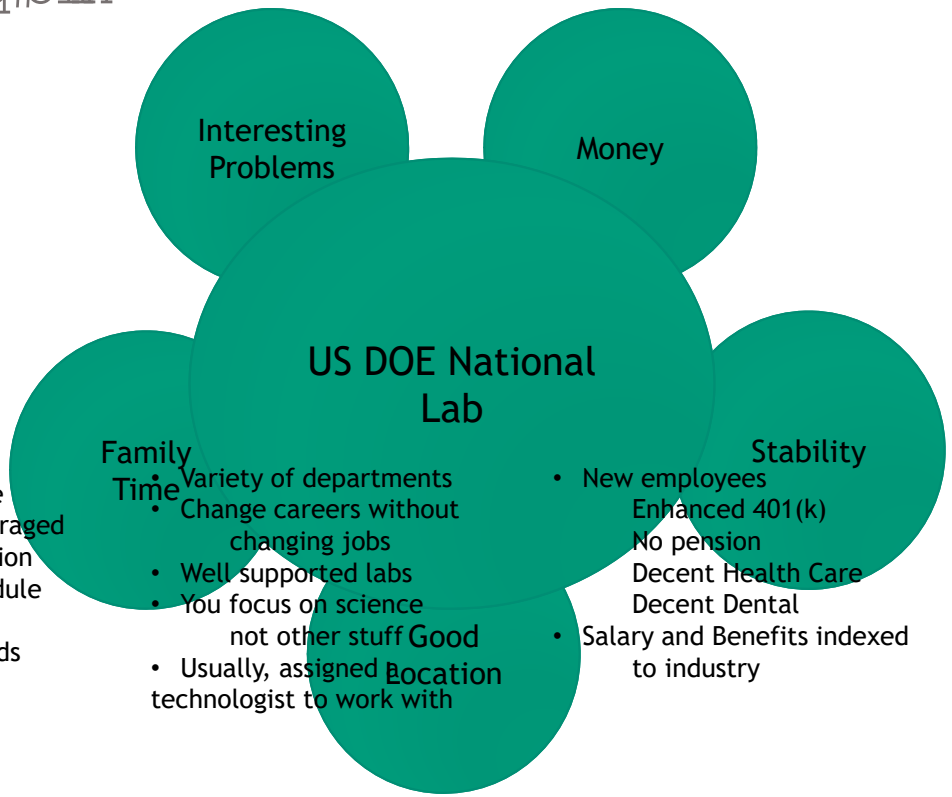
We report a Raman scattering study of low-temperature, pressure-induced melting of the CDW phase of 1T-$TiSe_2$. Our Raman scattering measurements reveal that the collapse of the CDW state occurs in three stages: (i) For P<5 kbar, the pressure dependence of the CDW amplitude mode energies and intensities are indicative of a "crystalline" CDW regime; (ii) for 5 < P < 25 kbar, there is a decrease in the CDW amplitude mode energies and intensities with increasing pressure that suggests a regime in which the CDW softens, and may decouple from the lattice; and (iii) for P>25 kbar, the absence of amplitude modes reveals a melted CDW regime.

PACS numbers: 71.30.+h; 71.45.Lr; 78.30.-j

Z kdw#Lz lvk#Lnqhz #dqg#z kdw#Lglg#uljkw

- Know what defines success and completion. What are you trying to do? What is your goal?
- Focus on problem and not technique. You can be an expert at a technique but you solve problems.
- Give more presentations, always defending work, reporting on it, etc.
- Help with proposal writing. We have to write a lot, proposals, reports, etc.

Z kdw#L#z dqwhg#lq#Olih



- 9/80 work schedule
- Volunteering encouraged
- Start 15 days vacation
- Flexible work schedule
- Very rare late nights/weekends

- Variety of departments
- Change careers without changing jobs
- Well supported labs
- You focus on science not other stuff
- Usually, assigned a technologist to work with

- New employees
  - Enhanced 401(k)
  - No pension
  - Decent Health Care
  - Decent Dental
- Salary and Benefits indexed to industry

- Staff lay-offs not since 90's
- Whims of politics

Vrp h#ri#p |#uhvhdufk#surmfw#dw#Vdqgld##Udgldwlrq# gdp djh#lq#p dwhuldov

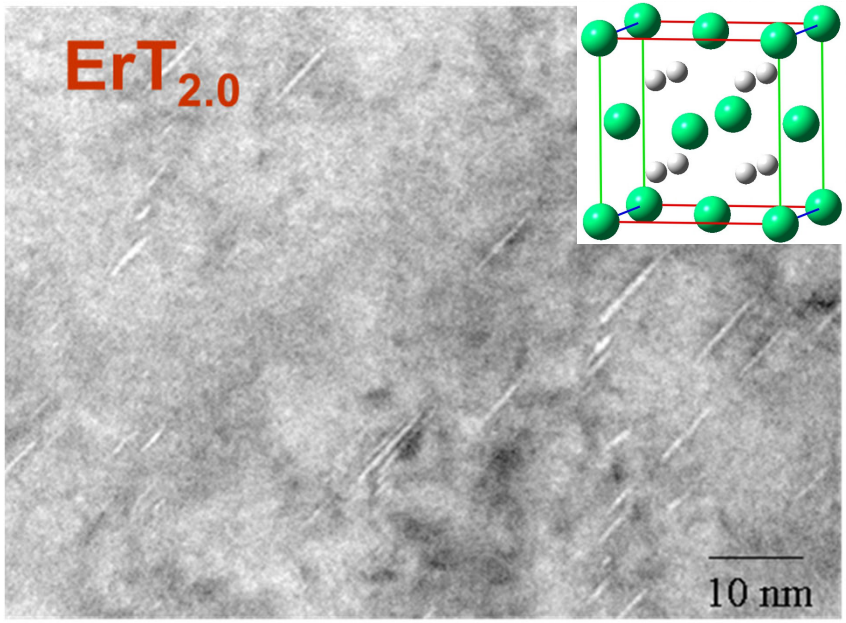
Metal hydride with hydrogen replaced with tritium

Tritium decays into helium

- $_1H^3 \rightarrow {}_2He^3 + {}_{-1}e^0$
- Half-life = 12.3 years

Why does this matter?

- $_1H^2 + {}_1H^3 \rightarrow {}_2He^4 + {}_on^1 + 17.6$ Mev
  - Energy production
  - Neutron generating devices
    - Nuclear weapons
    - Homeland security
    - Oil well logging
    - Medical applications



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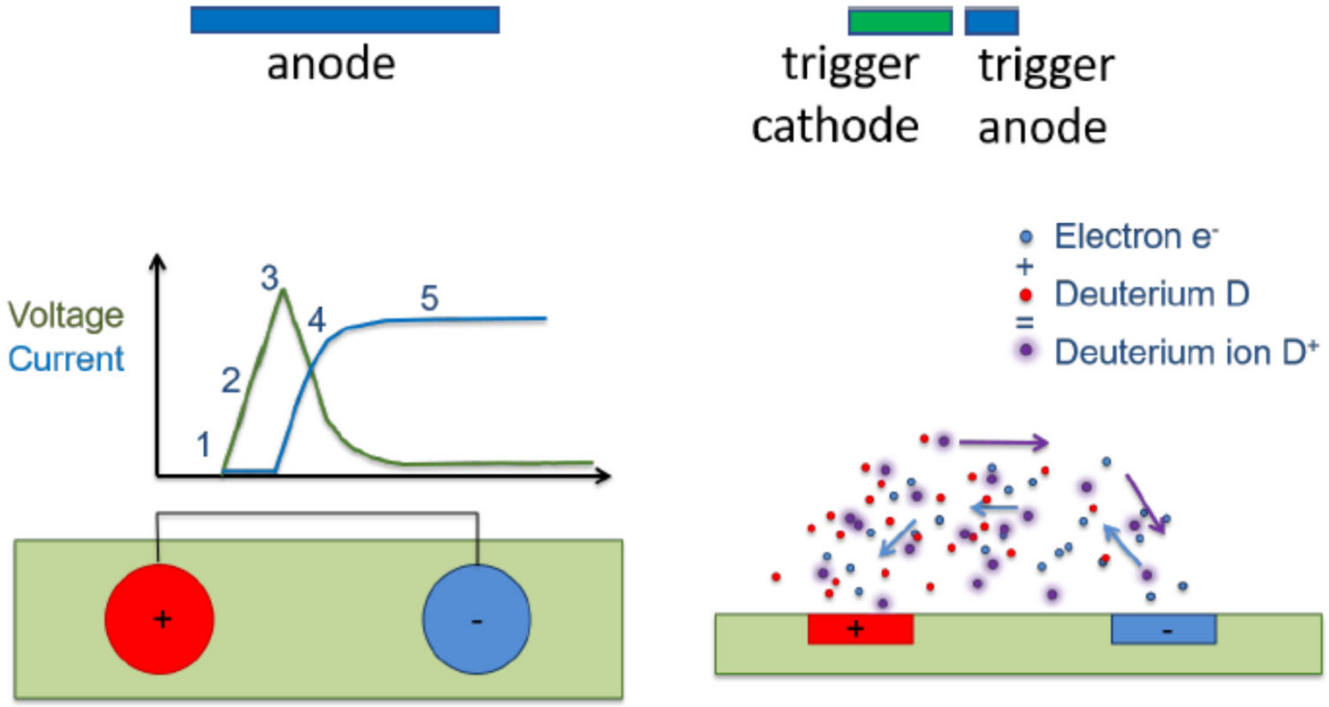
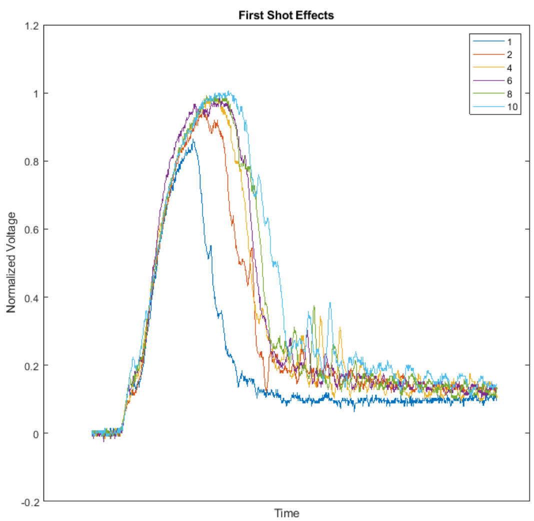
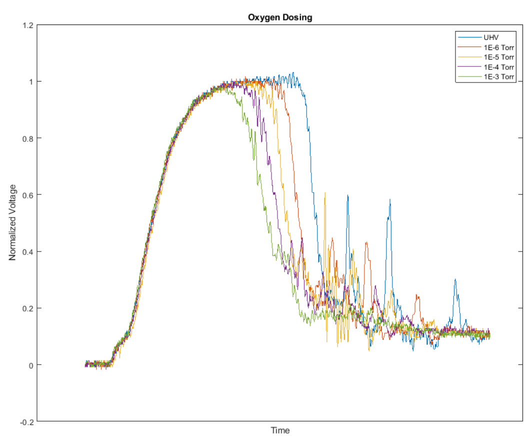


Vrp h#ri#wkh#uhvhdufk#surmhfw#dw#Vdqgld##D uf#Lqvwdelolwlhv





1-D Simulation of Carbon Contamination on Electrodes

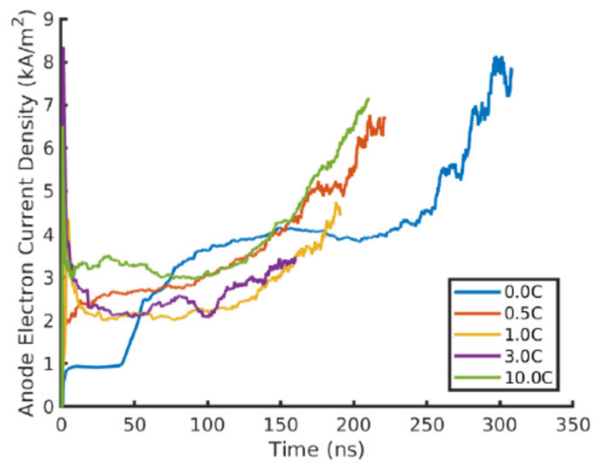
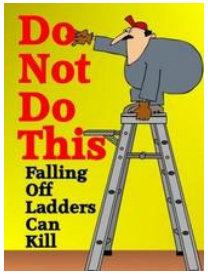


Figure 7-11. Electron current density at the anode for the various cases during the early phases of arc initiation. The legend show the equivalent number of carbon monolayers that were placed in the gas phase in the region close to the anode.

Vdqgld#Z run#Iarz

Security

OUO/ECI, Classified
Much of the work at SNL is controlled to some level. Usually able to massage to be releasable to the general public.



Training

Whatever you want to do, you need to be trained. Can be an simple 30 minute online training or a multi-day course. Lots and lots of training.

Work you want to do

Funding

Doing the Work

Training

Report Out

Repeat

Security

Safety

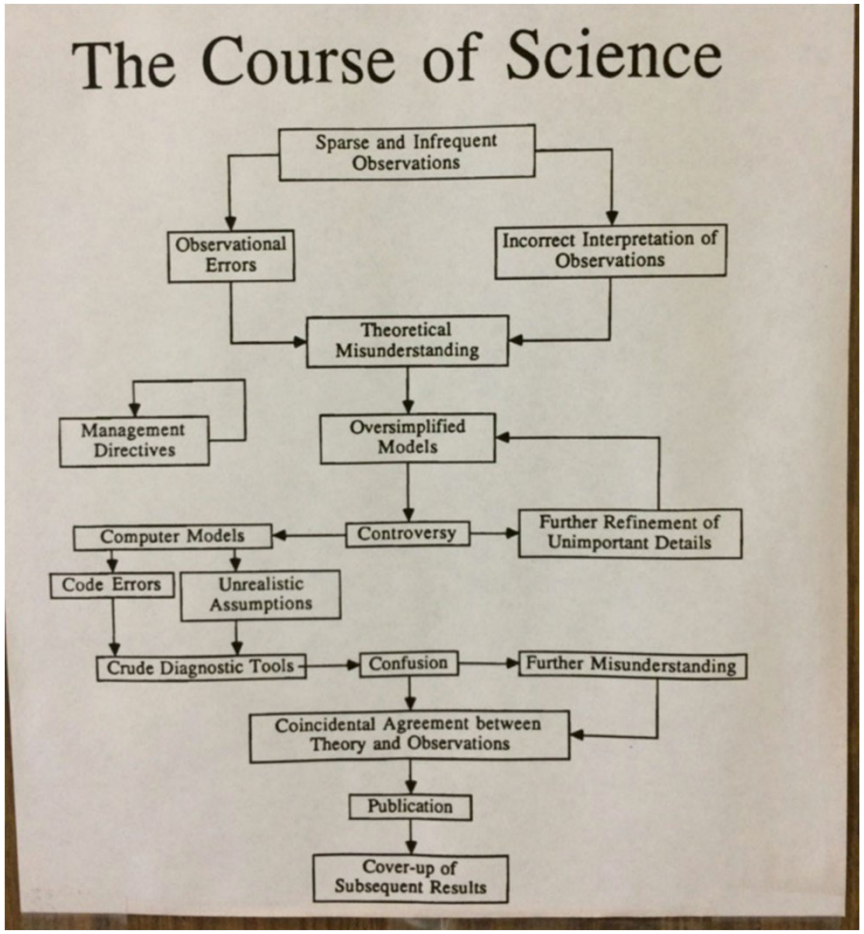
Funding

LDRD, SPP, or Programmatic. Budgets are allotted and tracked very tightly. Can't go over or under.

Safety

Any new change in your lab needs to be analyzed and approved. PHS, PSDP, TWD.

Wkh#Frxuvh#ri#Vflhqfh#lv#dovr#dolyh#dqg#Zhoo#dw#wkh#XVG RH#Q dwlrqdo# Odev



Sandia National Laboratories

Exceptional service in the national interest