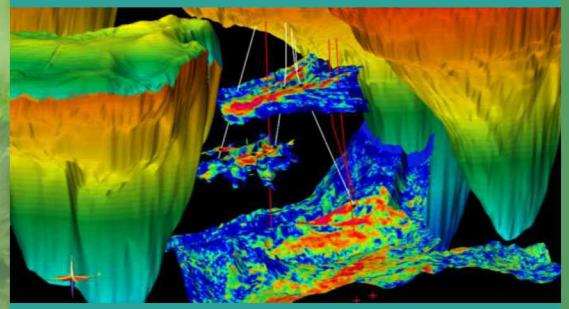
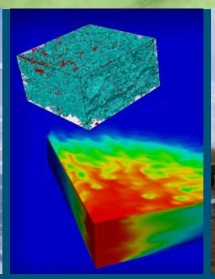
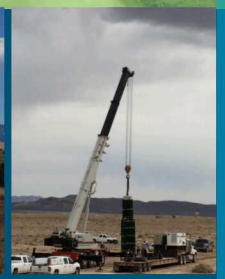
The Earth Science Research Foundation:
An Evolution







PRESENTED BY

Carol Adkins | Director, Earth Science Research Foundation | 1/29/19

SAND2019-0844PE

WELCOME BOARD MEMBERS

Dr. Kaye Shedlock – Chair, Independent Consultant

Dr. Thomas Ackerman – Director, Joint Institute for the Study of the Atmosphere and Ocean

Dr. Lawson Brigham – Distinguished Fellow, Center for Arctic Policy Studies

Dr. Darryl P. Butt – Dean, College of Mines and Earth Sciences, University of Utah

Dr. Sean McKenna – Senior Research Manager, IBM Ireland Research Lab

Dr. Joaquin Ruiz – Thomas R. Brown Distinguished Professor, University of Arizona

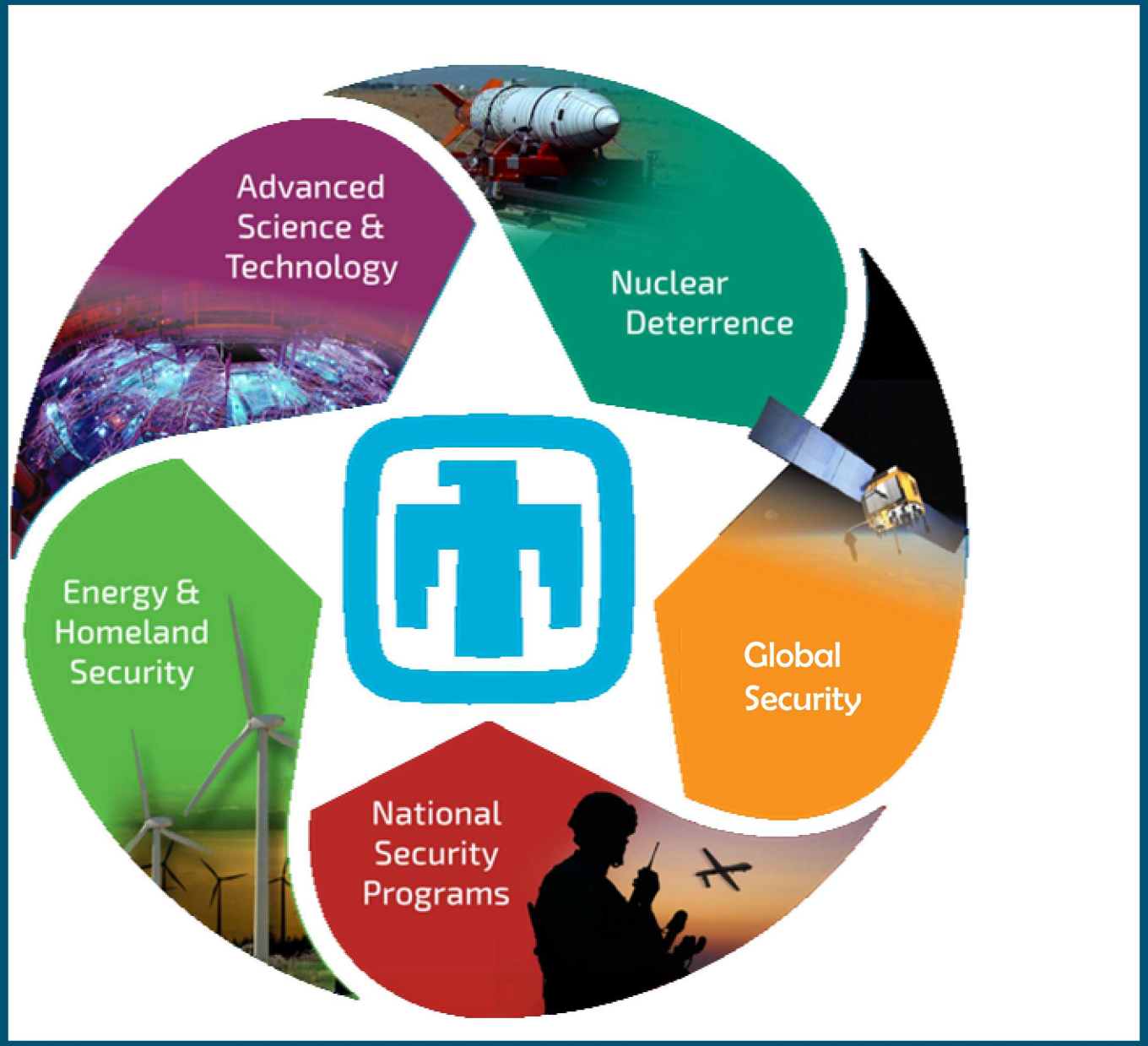
Welcome new Earth Science Research Foundation board member, Darryl Butt!

- Dean, College of Mines & Earth Sciences, University of Utah
- Distinguished Professor of Materials Science & Engineering, Boise State University
- Dr. Butt has held numerous leadership positio in academia, industry and R&D including A.P. Green Industries, LANL & University of Florida
- Ph.D., Materials Science, Penn State Universit

THE UNIVERSITY OF UTAH

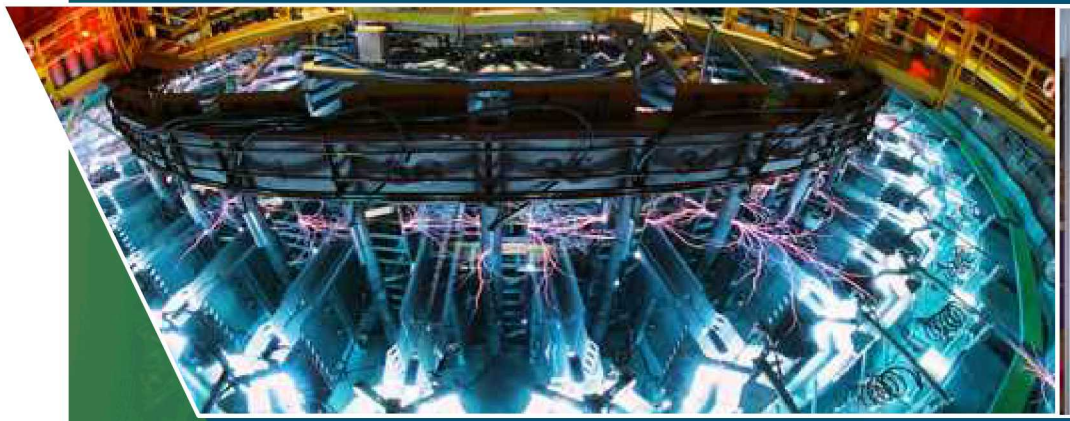
one color red

SANDIA HAS FIVE MISSION AREAS

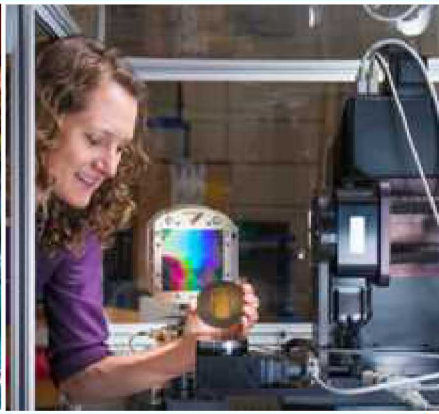


RESEARCH FOUNDATIONS ARE INTEGRAL TO MISSION EXECUTION

Nanodevices
Microsyste

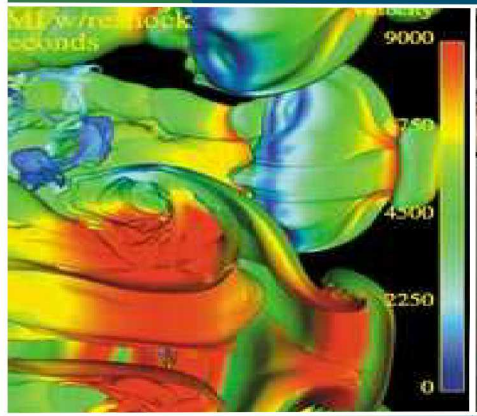


Radiation Effects & High Energy Density Science



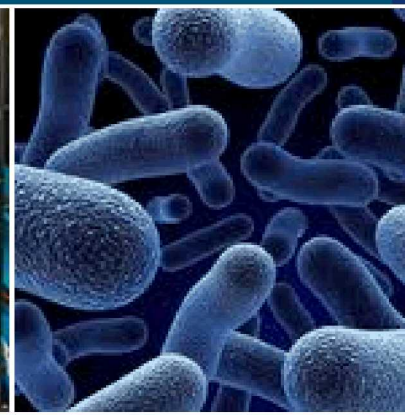
Materials Science

Computing & Informa



Engineering Science

Earth Science



Bioscience

Board of Managers

Independent Audit

NTESS

Labs Director's Office

Labs Director
Dr. Stephen Younger

Deputy Labs Director
David Douglass

Advanced Science & Technology
Dr. Susan Seestrom

Nuclear Deterrence
Dr. Steve Girrens

HR & Communications
John Myers

Infrastructure Operations
John Clymo

National Security Programs
Mike Burns

Defense Nuclear Nonproliferation
Doug Bruder

Integrated Security Solutions
Dori Ellis

Mission Assurance
Mark Sellers

Mission Services
Scott Aeilts

General Counsel
Will Elias

INTEGRATED SECURITY SOLUTIONS (ISS) LEADERSHIP TEAM

- ENERGY & HOMELAND SECURITY
- OPERATIONS
- NUCLEAR DETERRENCE
- ADVANCED SCIENCE & TECHNOLOGY
- DEFENSE NUCLEAR NONPROLIFERATION
- CROSS DIVISION INITIATIVES

Dori Ellis
Associate Labs Director
Integrated Security Solutions

Andy McIlroy
Director
Energy & Homeland Security Program Management
CALIFORNIA & NEW MEXICO

Mike Hardwick
Director
CA Weapon Systems Engineering
CALIFORNIA & NEW MEXICO

Bob Hwang
Director
Chemical, Combustion, & Materials Science
CALIFORNIA

Mike Hardwick
**Acting Director*
CA Weapon Components Engineering
CALIFORNIA & NEW MEXICO

David Gibson
Director
CA Site Operations
CALIFORNIA & NEW MEXICO

Anup Singh
Director
Chemical, Biological, Radiological, Nuclear Defense & Energy Technologies
CALIFORNIA & NEW MEXICO

Heidi Ammerlahn
Director
Homeland Security & Defense Systems
CALIFORNIA

Carol Adkins
Director
Energy & Earth Systems
NEW MEXICO

ENERGY & EARTH SYSTEMS LINE STRUCTURE

Carol Adkins • *Director*

8800 | Energy & Earth Systems

Susan Altman • *Deputy*
8801 | Energy & Earth Systems

Charles Hanley
Senior Manager
8810 | Grid Modernization & Resilient Infrastructures

Amy Halloran
Senior Manager
8820 | Renewable Energy Technologies

Evaristo Bonano
Senior Manger
8840 | Nuclear Energy Fuel Cycle Programs

Richard Griffith
Senior Manager
8850 | Nuclear Energy Safety Technologies

Erik Webb
Senior Manager
8860 | Geoscience Research & Applications

Paul Shoemaker
Senior Manager
8880 | Defense Waste Management Programs

Babu Chalamala
8811 *| Energy Storage Technology & Systems*

Abraham Ellis
8812 *| Renewable & Distributed Systems Integration*

Raymond Byrne
8813 *| Electric Power Systems Research*

Geoffrey Klise
8821 *| Wind Energy Technologies*

Peter Kobos
8822 *| Water Power Technologies*

Paul Gauche
8823 *| Concentrating Solar Technology*

Anthony Martino
8824 *| Photovoltaics & Materials Technology*

Margaret Gordon
Acting Manager
8825 *| Energy Water Systems Integration*

Gary Rochau
8841 *| Advanced Nuclear Concepts*

Kevin McMahon
8842 *| Nuclear Waste Disposal Research & Analysis*

Geoffrey Freeze
8843 *| Advanced Nuclear Fuel Cycle Technologies*

Robert MacKinnon
8844 *| Applied Systems Analysis & Research*

Sylvia Saltzstein
8845 *| Storage & Transportation Technologies*

Mitch McCrory
8851 *| Risk & Reliability Analysis*

Randall Gauntt
8852 *| Severe Accident Analysis*

Patrick Mattie
8853 *| Structural & Thermal Analysis*

Scott Sanborn
8854 *| Environmental Safety & Testing*

Steven Vigil
8861 *| Geophysics*

Donald Conley
8862 *| Geotechnology & Engineering*

Lori Parrott
8863 *| Atmospheric Sciences*

Moo Lee
8864 *| Geomechanics*

Nancy Brodsky
8865 *| Geochemistry*

Giorgia Bettin
8866 *| Geothermal Research*

Chris Camphouse
8881 *| Performance Assessment & Decision Analysis*

Charly Sisk-Scott
8882 *| Repository Performance*

Sean Dunagan
8883 *| Special Projects / Remote Site Support*

Christi Leigh
8888 *| Environmental Restoration & Stewardship*

ENERGY & HOMELAND SECURITY PORTFOLIO STRUCTURE

Dori Ellis
Associate Lab Director

Energy and Homeland Security

Anup Singh
Director

8600 | Biological & Material Science

CBRN DEFENSE

Heidi Ammerlahn
Director

8700 | DHS & Defense Systems

HOMELAND INFRASTRUCTURE SECURITY & RESILENCE

Bob Hwang
Director

8300 | CA Energy & Transportation Technology

TRANSPORTATION & ENERGY SYSTEMS

Carol Adkins
Director

8800 | New Mexico Energy & Geoscience

ENERGY & GEOSCIENCE

SANDIA PROGRAMS

- Chem / Bio National Security
- Nuclear & Radiological Security
- Weapons Remediation
- Aviation & Explosives Security
- Borders & Maritime Security
- Cyber
- Disaster Management & Resilience
- Resilient Infrastructure Systems
- Mobility Systems
- Propulsion & Storage
- Fuel Cells/Hydrogen Technology
- Biomass Technology
- ARPA-e
- Renewable Systems & Energy Infrastructure
  - Renewable Energy
  - Energy Efficiency
  - Grid Mod/Energy Storage
- Engineered Earth Systems
  - Energy & Water
  - Fossil Energy
  - Back End of the Fuel Cycle
  - DOE Managed Nuclear Waste
- Nuclear Energy & Fuel Cycle Programs
  - Nuclear Energy Safety & Security
  - Commercial Nuclear Power Generation

Susan Seestrom
Associate Lab Director

Advanced Science & Technology

Advanced Science & Technology Division
ALD: Susan Seestrom

SCIENCE PROGRAMS

Programs under the Undersecretary for Science and Energy: Office of Science

- BER/Bio
- BER/Climate
- BES/GEO

SECURE ENERGY & EARTH SYSTEMS PROGRAM

BUSINESS OFFICE

Michele Chary
Business Partner

Nichole Jaramillo
Business Partner

Erik Ridley
Government Relations

Maelyn Melville
Business Development

Carol Adkins
Program Area Director

Susan Altman
Deputy

Denise McCabe
Senior Management Assistant

SUB-PROGRAMS

Amy Halloran
Program Manager
RENEWABLE ENERGY

Evaristo Bonano
Program Manager
NUCLEAR ENERGY FUEL CYCLE

Richard Griffith
Program Manager
NUCLEAR ENERGY SAFETY & SECURITY

Erik Webb
Program Manager
FOSSIL ENERGY

Charles Hanley
Program Manager
GRID MODERNIZATION & ENERGY STORAGE

Paul Shoemaker
Program Manager
DOE MANAGED NUCLEAR WASTE

Jeff Nelson
Program Manager
ENERGY EFFICIENCY

FOCUS AREAS

RESILIENT ENERGY SYSTEMS

Richard Griffith
Focus Area Manager

ENERGY AND WATER

Amy Halloran & Jeff Nelson
Focus Area Managers

LIASON TO HISR CYBER AND THREAT-INFORMED MODELING AND SIMULATION

Dean Jones
Focus Area Manager

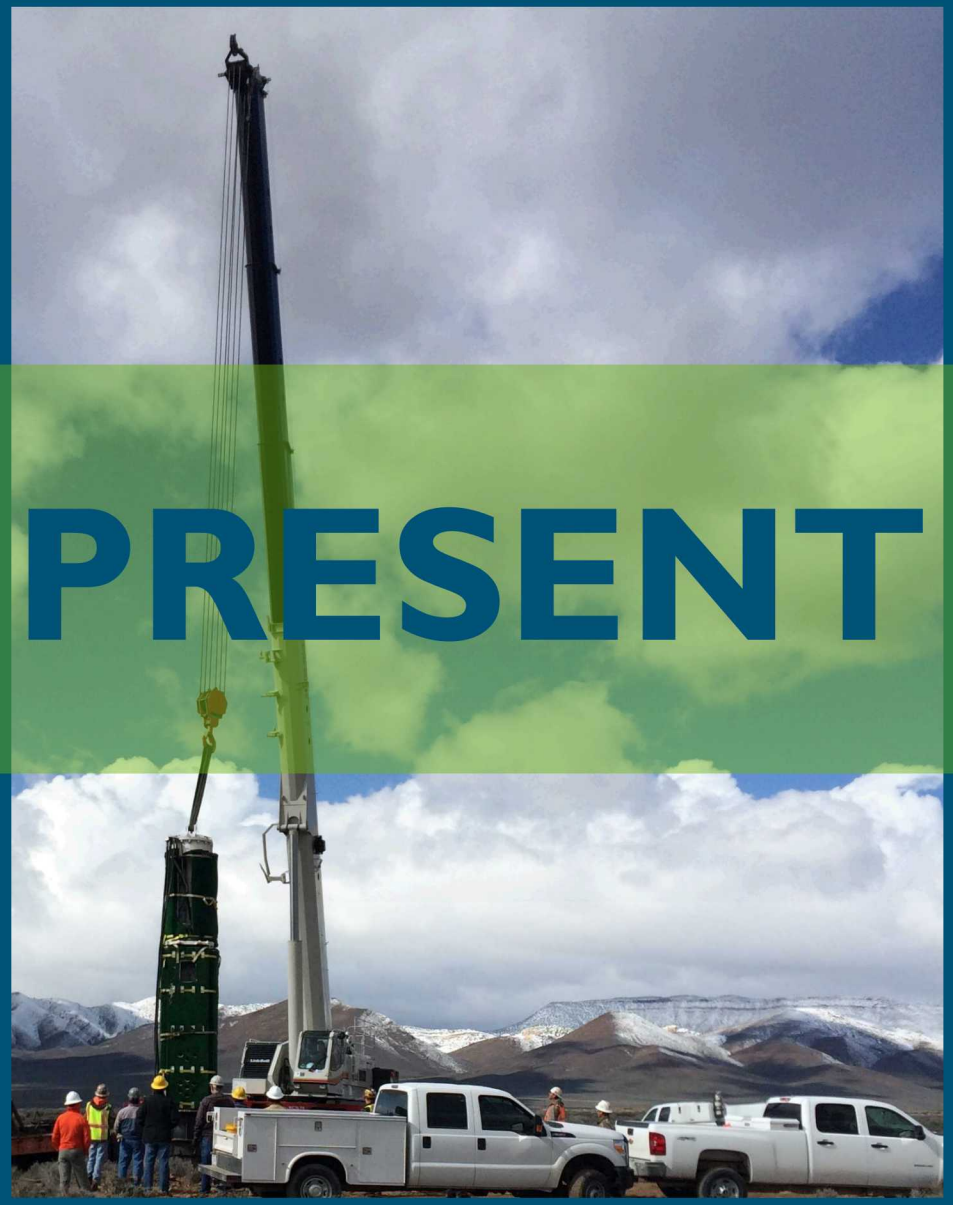
INITIATIVES

Erik Webb
Arctic Initiative Lead

Lori Parrot
Arctic Program Manager

Arctic Science & Security Initiative

EARTH SCIENCE AT SANDIA: A RETROSPECTIVE



FY20 Investment Objective

Quantitative Earth Science for National Security

The Earth Science Research Foundation investment goals are to:

- Expand our basic understanding and reduce uncertainty of Earth systems
- Develop sensors and systems to interrogate Earth systems
- Analyze and experiment to characterize, quantify, and manipulate Earth properties
- Couple earth science and engineering tools
- Develop and test simulation tools for predicting Earth system behavior over orders of magnitudes in space and time for solid earth, oceans, hydrosphere, or atmospheric materials at in situ conditions.

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New start investments will have a strong bias to projects with value to multiple Sandia missions.

A FEW OF OUR NEW EARTH SCIENCE STAFF MEMBERS


Sarah Albert


Dan Bowman

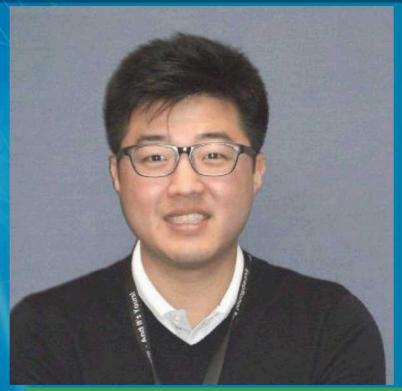

Charles Choen


Joe Hogge


Austin Holland


Lisa Linville


Melissa Mills

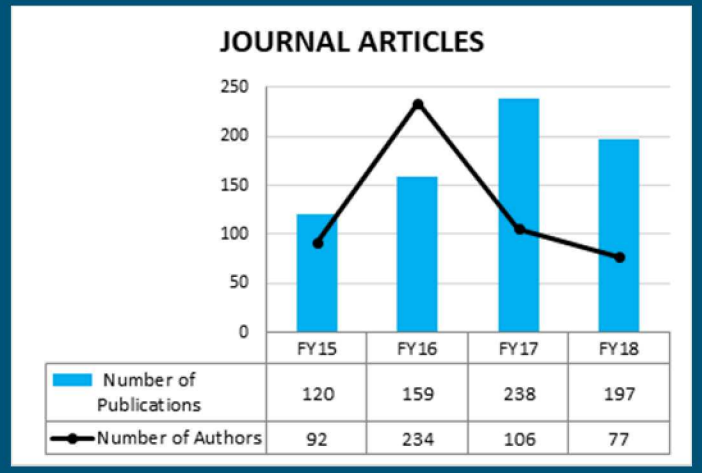

Heeho Park

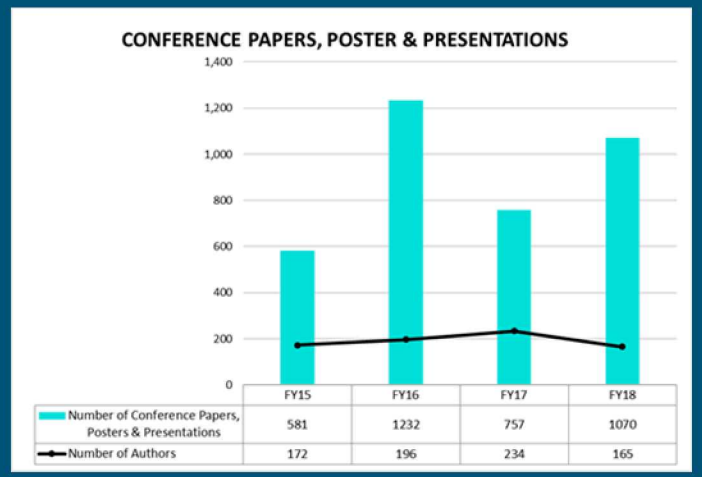

Paul Schwering

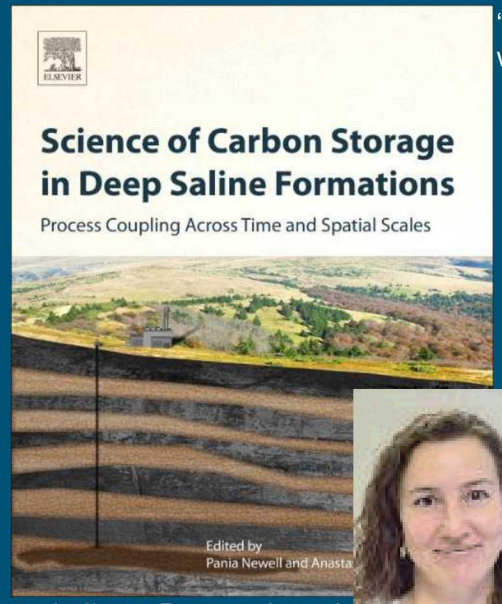

Lauren Wheeler

EARTH SCIENCE IMPACT

PUBLICATIONS/POSTERS/PRESENTATIONS/JOURNALS

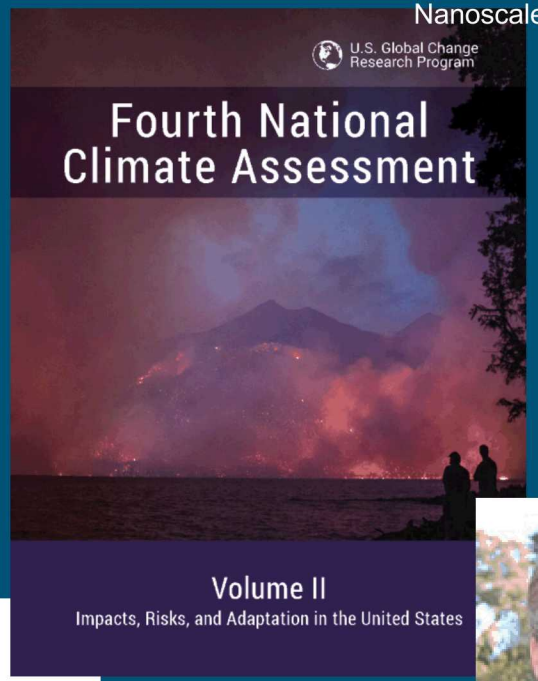


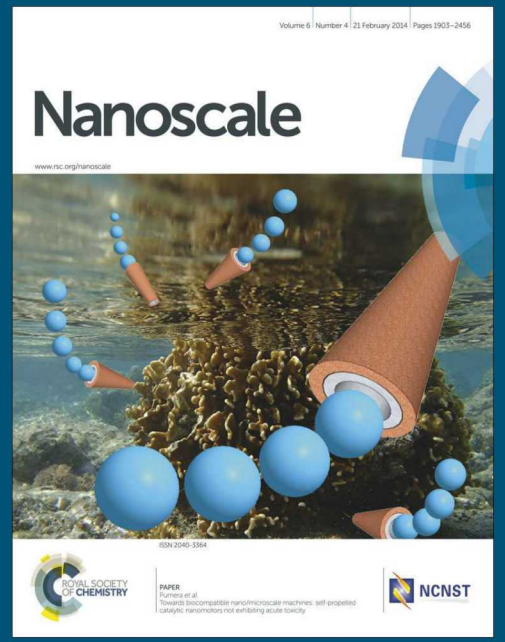


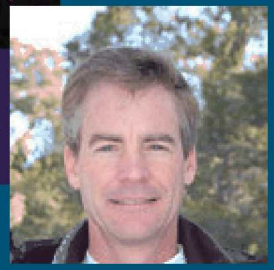


Anastasia Ilgen: Peer-reviewed book published by Elsevier, September 2018

Yifeng Wang, Anastasia Ilgen, Louise Criscenti, and Craig Tenney: Manuscript entitled: "Supercritical CO2-induced atomistic lubrication for water flow in a rough hydrophilic nanochannel" has been accepted for publication in the journal Nanoscale.







Vincent Tidwell: Lead author for Energy, Water and Land Use Chapter of the Fourth National Climate Assessment, November 2018.

Institution of MECHANICAL ENGINEERS

Jason Heath and Richard Jensen: co-authors of a paper that was the winner of the 2017 Thomas Lowe Gray Prize from the Institution of Mechanical Engineers for the Paper "Verification of a rapid mooring and foundation design tool" in Proceedings of the Institution of Mechanical Engineers.

EARTH SCIENCE IMPACT

Sandia recently celebrated twenty years of the Sandia-managed Atmospheric Radiation Measurement (ARM) Center in Utqiġvik (formerly Barrow), Alaska Atmospheric Science in the Arctic (ARM site program manager, Mark Ivey shown).

Anaya Luketa, shown here in the Thermal Test Complex control room, was instrumental in enabling Sandia to successfully execute a first-of-its-kind fireball test to measure the burn properties of crude oils.

Chen Wang, Jill Hruby Fellow, is pursuing the understanding of pollution from combustion engine systems to help improve energy efficiency and safety, and reduce environmental impact. .

Sandia is taking part in the Year of the Polar Prediction (YOPP), a large international effort taking place from 2017-2019. YOPP seeks to collect atmospheric observations that will help improve modeling and forecasting capabilities around the poles (staff member Dari

KOGAS

Sandia successfully uses sensor placement optimization tool, Chama, for collaboration with KOGAS (staff member Kate Klise shown).

TODAY'S AGENDA

- 10:15 Break
- 10:30 Earth Science History Project Video
- 11:00 Earth Science Strategy & Rebranding
- 12:00 Board Lunch with Early Career Staff
- 12:45 PFLOTRAN
- 1:45 Break and Depart to Tours
- 2:00 Atmospheric Tours
- 5:00 Board Executive Session
- 6:00 Adjourn and Depart to Dinner
- 6:30 Executive Dinner

EARTH SCIENCE IS EMBEDDED IN SANDIA'S FIVE MISSIONS

Understand nano-microscale to the macroscale, multi-physics view of the earth and its processes and climate change monitoring, modeling and geo-engineering

Emergency response activities for the Department of Homeland Security, nuclear waste disposal, geothermal energy and Fossil Energy production and optimization, managing dee subsurface energy storage

readiness and weapon to osphere, ocean and solid Earth raction

ect and Characterize underground ctures and support effective ntermeasure planning; sea floor racterization; energy harvesting and ar accuracy

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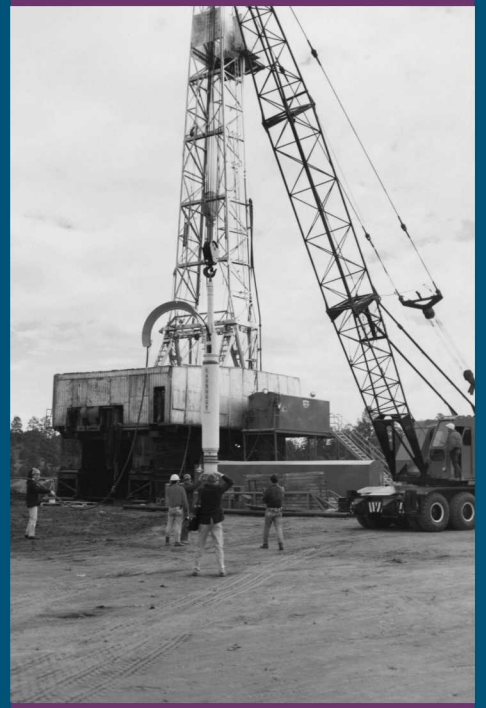
ADVANCED SCIENCE & TECHNOLOGY



- Plowshare (peaceful uses of nuclear weapons
- Beginning in the 1970's, support of shock physics
- 1972: Sandia provided scientific packages and experiments for unmanned balloon studies for the Army's Atmospheric Sciences Laboratory
- 1980's: Rock Mechanics Lab installed

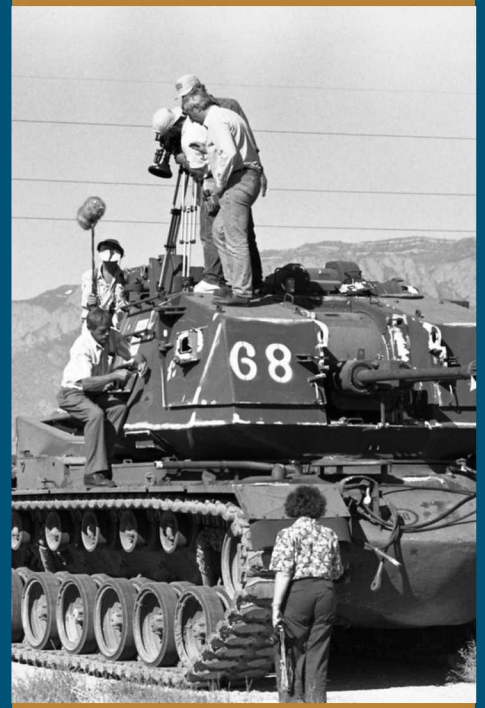
ENERGY & HOMELAND SECURITY

- Sensors for Vietnam (acoustic & seismic capability)
- Energy Programs
  - FY75 18 proposals in energy work, 8 of which directly evoked earth science capabilities
- Management of DOE's Multiwell Experiment
- Strategic Petroleum Reserve

NATIONAL SECURITY PROGRAMS

- International Arms Control Treaty Support
  - Since 1959, Sandia was involved in the VELA program which included satellite and underground testing of nuclear weapons
- U.S. Arms Control & Disarmament agency funded Sandia to develop unmanned seismic observatories

GLOBAL SECURITY



- Nuclear test detection
  - Unattended Seismological Observatory
  - National Seismic Station
  - Treaty Verification Research
  - Regional Seismic Test Network

NUCLEAR DETERRENCE

Sandia's earth science capability originated and grew with the original nuclear weapons mission. Activities include:

- Support of nuclear testing
  - Meteorology
  - Seismology
- Support of weapon design capability
- Readiness