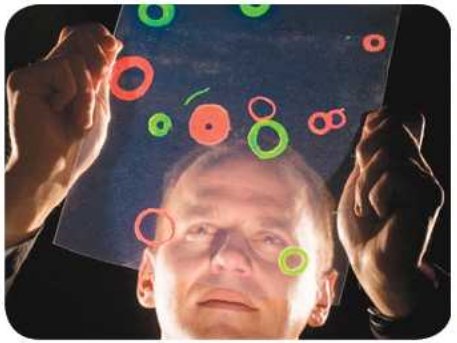
SAND2013-7557C

Exceptional service in the national interest

Sandia National Laboratories



Sandia National Laboratories

Chris Jenkins, Ben Yang, Terry Hendricks

Life after graduation: Where do I fit in?

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND #: 2013-7557C

Executive Summary

- SNL specific stuff
  - Background
  - Employment opportunity at SNL
- What is life like at SNL?
  - Chris, Ben, Terry
    - Background & job specifics
    - Responsibilities & lessons learned
- How to get plugged in?
  - Upcoming interviews
  - Careers Website
  - Social Meeting
  - Ipad App

Important Sites
http://www.facebook.com/SandiaLabs
http://www.flickr.com/photos/sandialabs
http://www.youtube.com/sandialabs
https://twitter.com/sandialabs
www.sandia.gov/careers

Sandia's Sites

Sandia National Laboratories

Albuquerque, New Mexico

Livermore, California

Tonopah, Nevada

Waste Isolation Pilot Plant, Carlsbad, New Mexico

Pantex, Texas

The Mission Has Evolved for Decades

Sandia National Laboratories

1950s	1960s	1970s	1980s	1990s	2000s
Production engineering & manufacturing engineering	Development engineering	Multiprogram laboratory	Research, development and production	Post-Cold War transition	Broader national security challenges

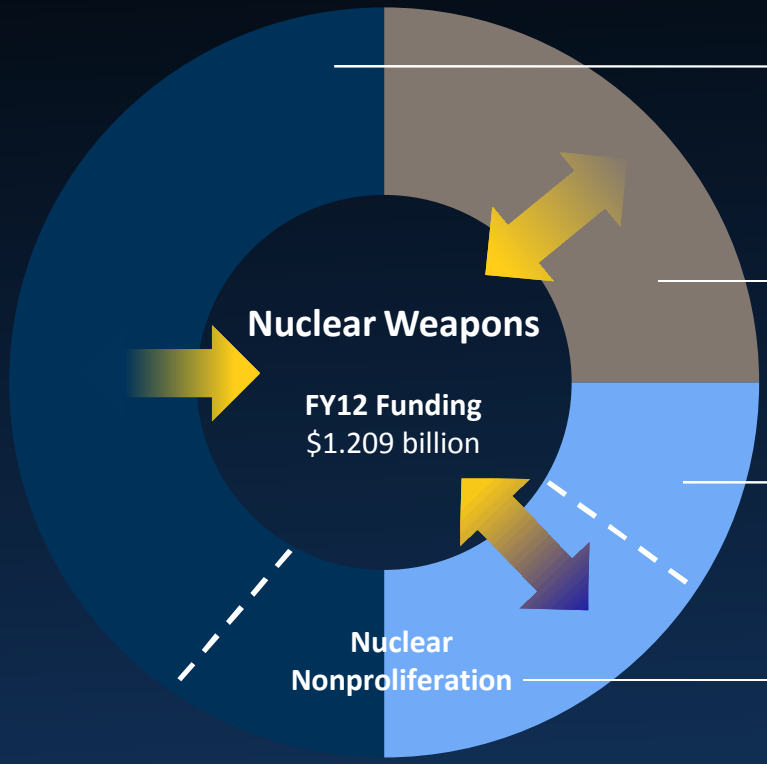
Sandia - *Today*

Sandia National Laboratories

As a multi-faceted national security laboratory, Sandia has delivered essential science and technology for more than 60 years and plays a critical role in ensuring U.S. technical superiority.

At Sandia, you can become part of something more—and contribute to our quest to render exceptional service in the national interest.

Sandia's Funding



Department of Defense
$562M + $120M (Nuclear Nonproliferation) = $682M

Department of Energy (DOE) Energy Programs
$197M

Department of Homeland Security & Department of Defense Infrastructure Security
$99M

NNSA Nuclear Nonproliferation
$177M

Note: **Other DOE and non-DOE Funding**
$200M

High reliability, high consequence of failure, challenging environments, and technology solutions

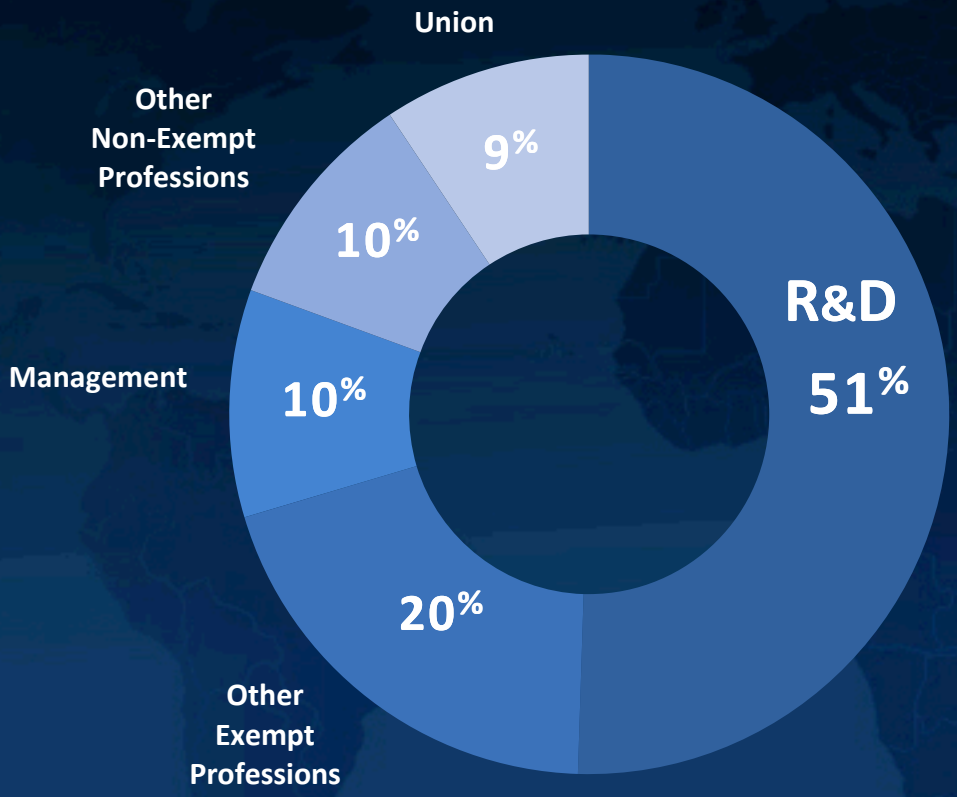
Our Workforce

Regular Employees	Highest Degree
1,728	PhD
3,580	Masters
1,721	Bachelors
8	Doctor of Medicine
31	Doctor of Law

Regular Employees	Years of Service
3,098	Less than 5 years
1,554	5–9 years
2,541	10–19 years
1,652	20–29 years
766	30–39 years
25	40+ years

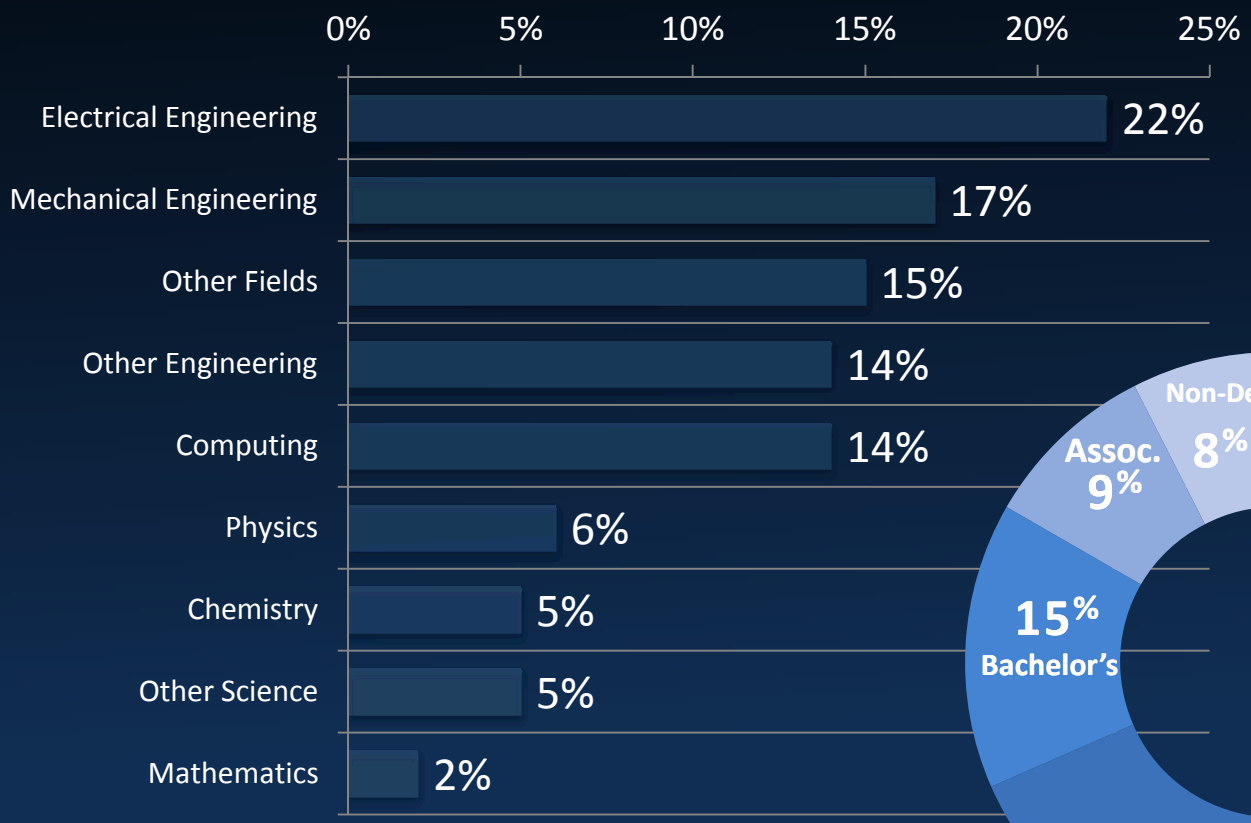
9,633 Regular employees

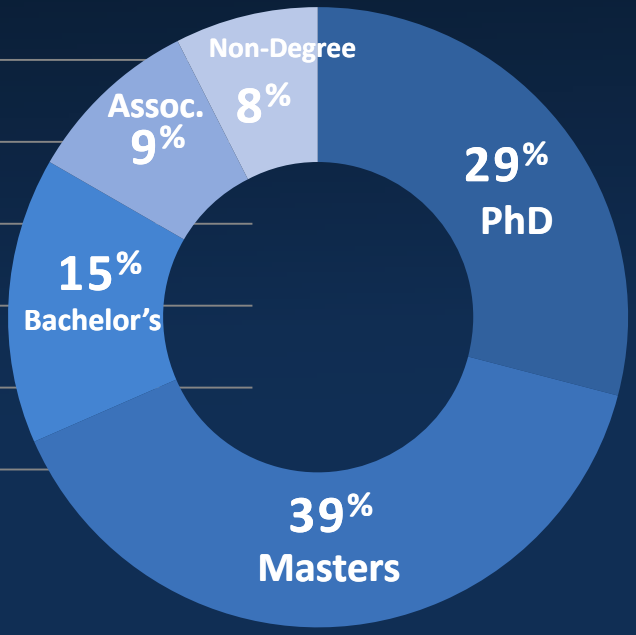
1,743 Temporary employees and contractor associates



Data as of July 15, 2013

R&D by Discipline & Degree





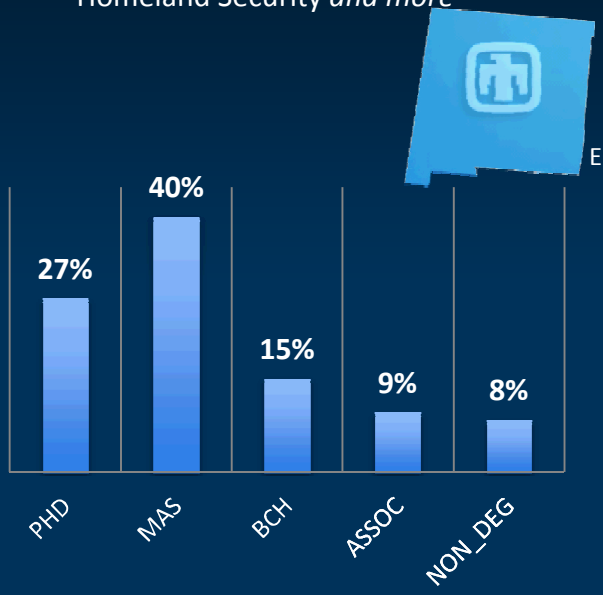
Sandia New Mexico - *Albuquerque*

On-site workforce: ~8,500

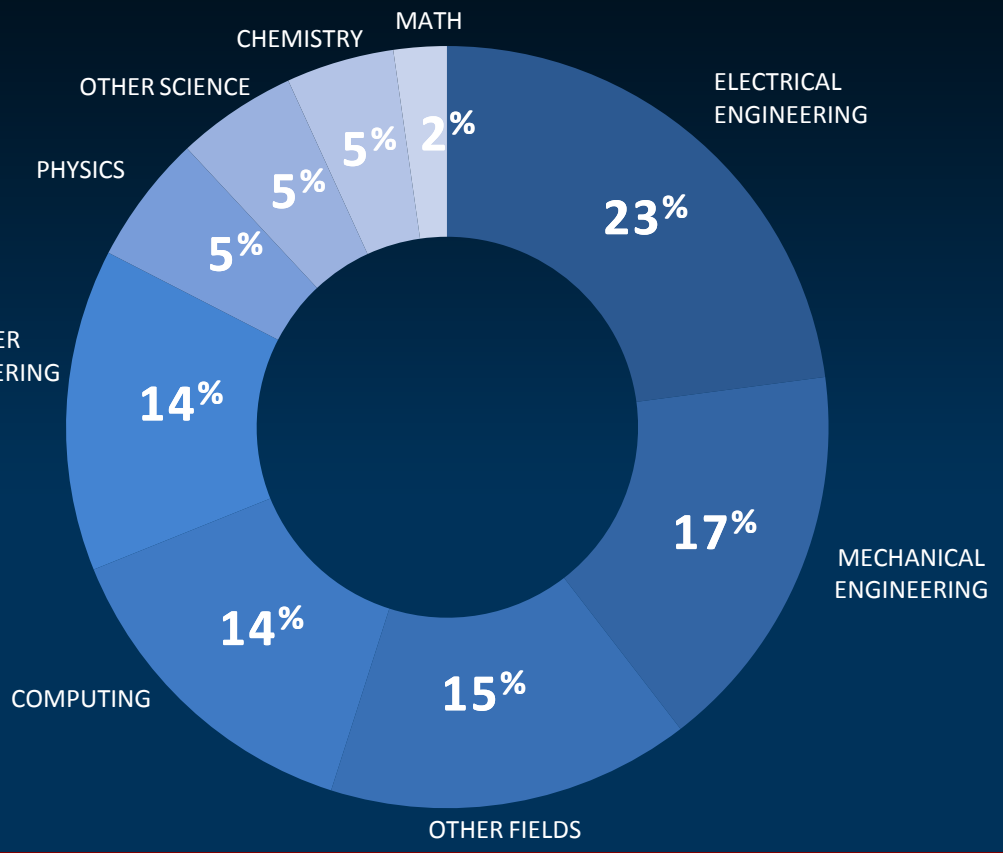
R&D staff: ~4,000

Distinguishing research capabilities:

- Renewable Energy
- Micro-electronics/Semiconductors
- Cyber Security
- Homeland Security *and more*



R&D Staff by Discipline



Sandia California - *Livermore*

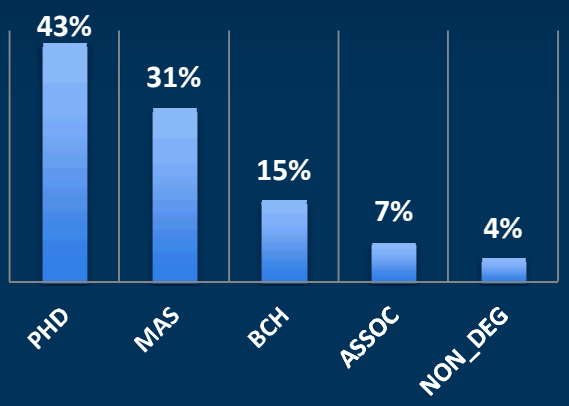
On-site workforce: ~1,000

R&D staff: ~550

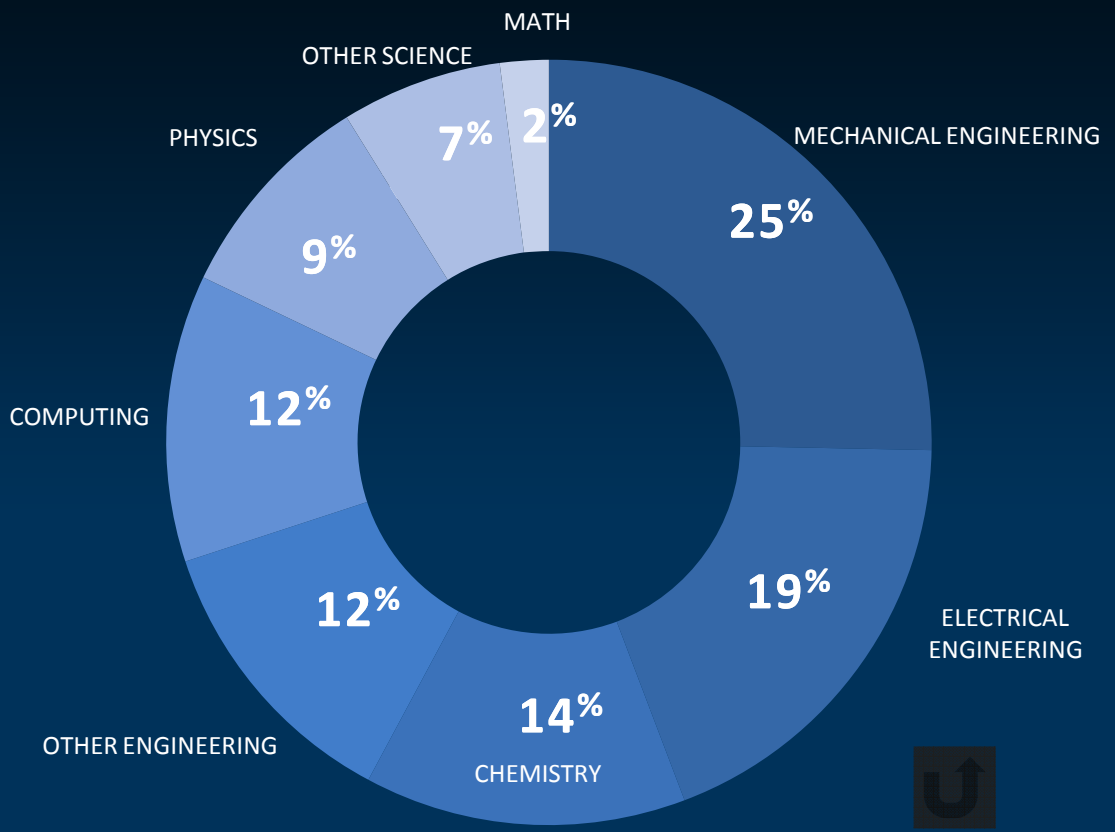
Distinguishing research capabilities:

- Applied Biosciences
- Combustion Research
- Information Systems
- Micro & Nano Technologies and *more*

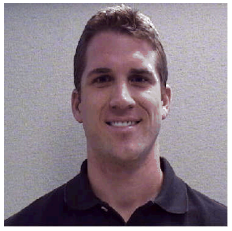
Degree Level



R&D Staff by Discipline



Alumni at the lab

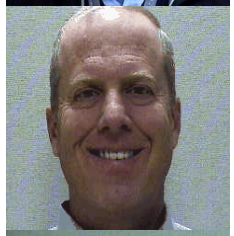


95 alumni work at Sandia, including 5 post-docs, 3 graduate interns and 1 undergraduate intern

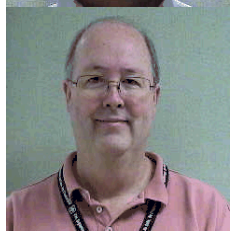
2 doctoral grad fellows: Kyle Rupnow, Electrical and Computer Engineering; Christopher Weber, Nuclear Engineering/Engineering Physics

Campus Executive:Paul Hommert, Executive Vice President, Deputy for Nuclear Weapons

Deputy Campus Executive: Mark Allen, Manager, IP Management, Alliances & Licensing



Team Lead: Randall Summers, Manager, Comp. Shock & Multiphysics



Opportunities at Sandia National Labs

Sandia National Laboratories

Opportunities

- 16+ to PhD
- Variety of majors
- Technical institute programs (8)
  - Internships
  - SEE
- Fellowships
  - Harry S. Truman Fellowship
  - Salary: 110K
- Full-time / Post-doc
- Wounded-Warrior

Requirements

- Most require U.S. citizenship
- 3.5+ graduate GPA
- 3.2+ undergrad GPA
- Some projects may require clearance
- Focus in areas of interest to national security

Chris Jenkins (Ph.D., EE, Class of 2011)

Sandia National Laboratories

- Hometown: Peoria, IL
- Undergraduate work: UIUC
- Graduate work: UW Madison
  - Thesis: Cryptographic Primitives for Secure Software Defined Radio Platforms
- Previous internships
  - Caterpillar (1998 – 2005)
  - GE Healthcare (2006)
  - Qualcomm (2008 – 2009)
- Current focus at SNL
  - Virtualization platforms and techniques
  - Publications and giving lectures
  - Cloud architecture assessment

Where I fit in

Sandia National Laboratories

- Org breakdown
  - Defense Systems & Assessments (5000)
  - Information Systems Analysis (5600)
  - Computer Systems & Technology (5620)
  - Network Systems Survivability & Assurance (5629)
- Degrees (2011, CTR 5600)
  - PhD: 37, MS: 147, BS: 43, Other: 17
- Major (2011, CTR 5600)
  - Comp Sci: 92, Comp Eng: 21, Elec. Eng: 56

Full-scope cybersecurity addresses all systemic vulnerabilities *and* the insider threat.

Sandia National Laboratories

HMI
Perception
Cognition
Experience

Authorities
Expectations
Incentives

15	Human
14	Cultural Norms
13	Social Norms
12	Organizational Roles
11	7.) Application
10	6.) Presentation
9	5.) Session
8	4.) Transport
7	3.) Network
6	2.) Data Link
5	1.) Physical
4	System Hardware (Motherboard, etc.)
3	Component (ICs…)
2	Semiconductor Physics
1	Atomic

Less predictable
Larger Error Bars
Less Deterministic

Example Layer 12-15 Vulnerabilities:
- Spear-phishing
- Social engineering

Traditional, *limited-scope* cybersecurity

More Certain
Smaller Error Bars
More Deterministic

Example Layer 1-4 Vulnerabilities:
- Supply Chain

Basics about my work

Sandia National Laboratories

- 2 projects currently (6 total)
  - Security-architecture assessment
    - Cloud
    - Mobile
  - Early-Career Laboratory-Directed Research & Development (ECLDRD)
- Self-picked projects
- Matrix organization (specific to 5600)
- Project lead vs. Line manager
- Misc.
  - Outreach project with scratch programming
  - Lecture series: Virtualization on ARM Architecture

My Research Project (ECLDRD)

Sandia National Laboratories

- Accepted my proposal
  - Initial / Full
  - Investment Area Review
  - Mentor, Sr. Scientist
- Enhancing the integrity of computing systems
- Independent funding and direction
  - Conferences
  - Software / Hardware
  - Other employees / interns

This summer

Sandia National Laboratories

- 2 interns (NC A&T, Univ. of Arizona)
  - Continue to work on project as year-round interns
- Software design / integration
- Languages : Python, C, ARM assembly, XML
- Tools
  - Eclipse, gedit, Git
  - QEMU, Busybox, Linux, Xvisor
- Knowledge
  - Lists, Hash table, memory management, api design, system call, interrupt vector table, page tables
- Working on 1 - 3 publications

Typical Day

- Morning
  - Check tech sites
  - Review calendar and to-do list
  - Choose work from existing projects
- Afternoon
  - Network lunch once a week
- Daily
  - Read whitepapers, research papers, journal articles
  - Google/Bing relevant data
  - Monitor email and attend project meetings
  - Coding, design doc (visio), documentation, presentations

Did academia prepare me?

Sandia National Laboratories

Skills I acquired during pursuit

- Tech skills
  - Programming
  - Computer architecture
  - Web Design
  - Networking
  - Scripting
  - Version Control
- Soft skills
  - Organization and leadership
  - Communication skills

Skills I had to acquire at work

- Tech skills
  - Operating system design
  - Linux Kernel
  - Virtual Machines
  - ARM architecture
  - Version Control (git)
- Recruiting
- Soft skills
  - Manage my manager
  - Maintain project outlook
  - Understand financial implications

One year, seven months and still counting

Sandia National Laboratories

- Things I enjoy about work
  - Consistent work schedule
  - Weekends off
  - Evenings off (pseudo off)
  - Per diem & Paycheck
  - Independence
- Things I miss about academia
  - Wake up when I want to
  - Time flexibility
  - Colleague interaction (Student Lab)

Ben Yang (EE, 2011)

- Hometown: Taipei, Taiwan

- Education/Specialization History:

Go Utes!

Go Badgers!

EE	Photonics	THz EM	CMOS	Microsystems
Math	MEMS		FA	PV
				PV Systems

University of Utah (BS EE/Math)

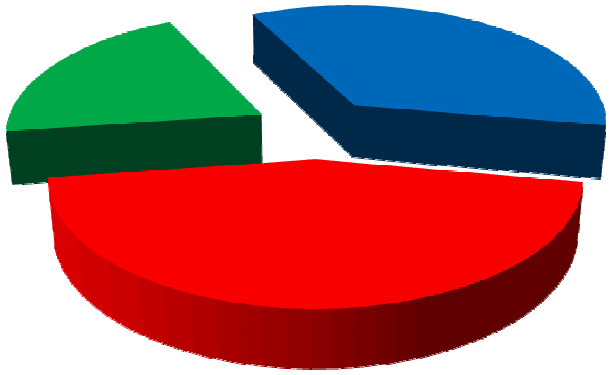
University of Wisconsin (Ph.D. EE)

Sandia Labs (2011-present)

Sandia Work Portfolio

- 2011-2012

Photovoltiac Systems Reliability



Anticounterfeit Technology

CMOS Failure Analysis

- 2012-2013

Photovoltaic Systems Reliability

Novel Photovoltaic (MEPV) Failure Analysis Development

Other Activities

- Wide-band gap power electronics
- Anticounterfeit technology
- CMOS failure analysis

CMOS Failure Analysis

Sandia National Laboratories

Microfabrication Plant

Reliability

Failure Analysis

Inspection and characterization

⇩

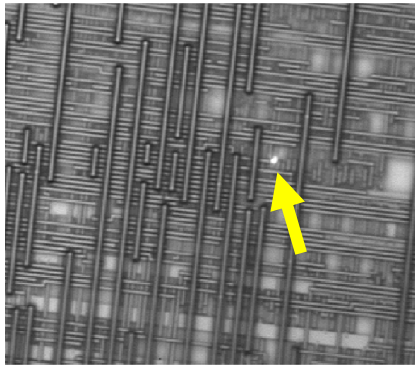
Defect localization

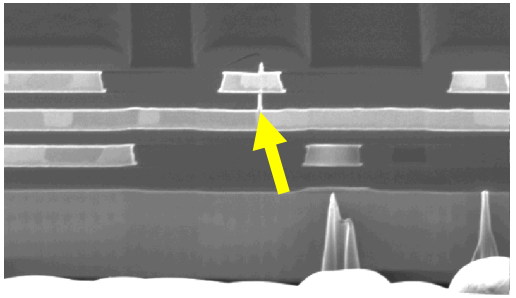
⇩

Defect characterization

⇩

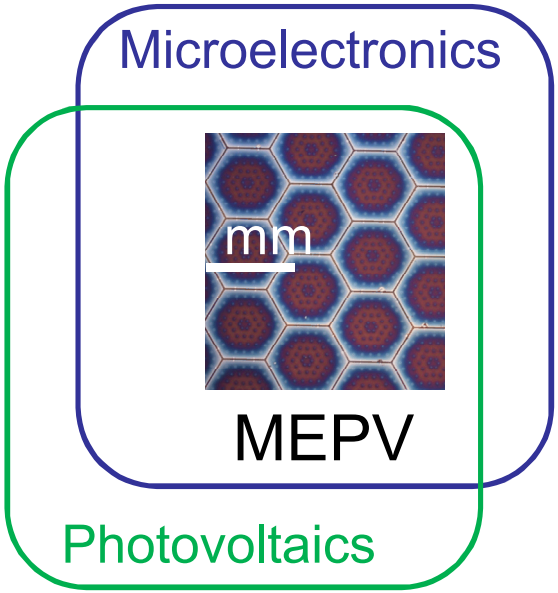
Physical Analysis

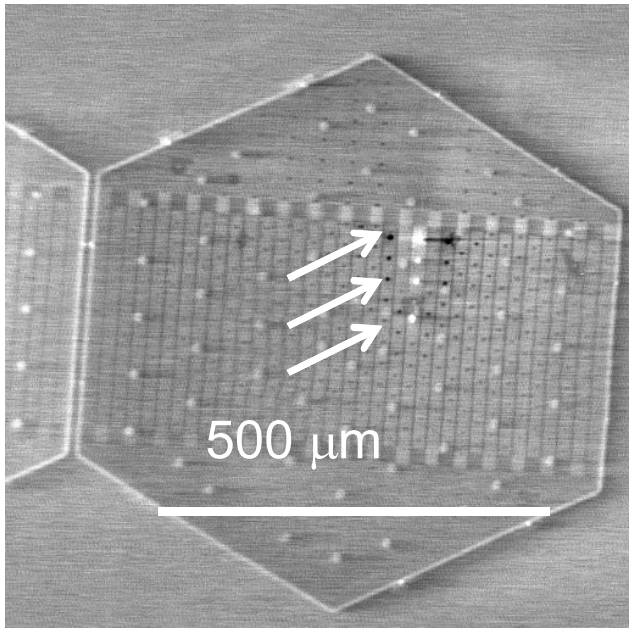


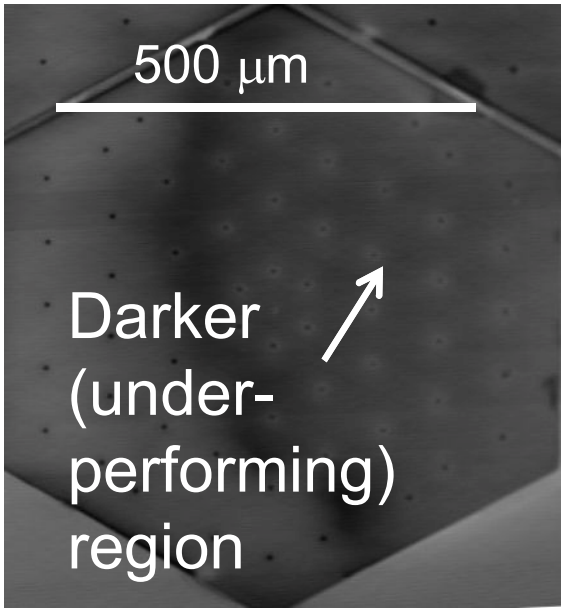


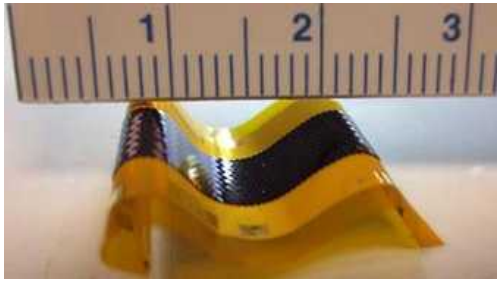
MEPV Failure Analysis

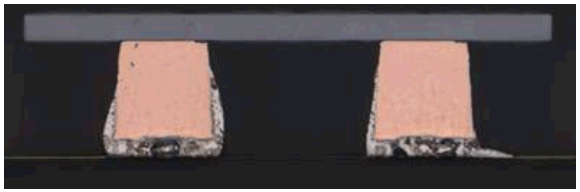
- MEPV
  = Microsystems-Enabled Photovoltaics
  = Microfabricated solar cell arrays
- Adapt CMOS failure analysis techniques to MEPV









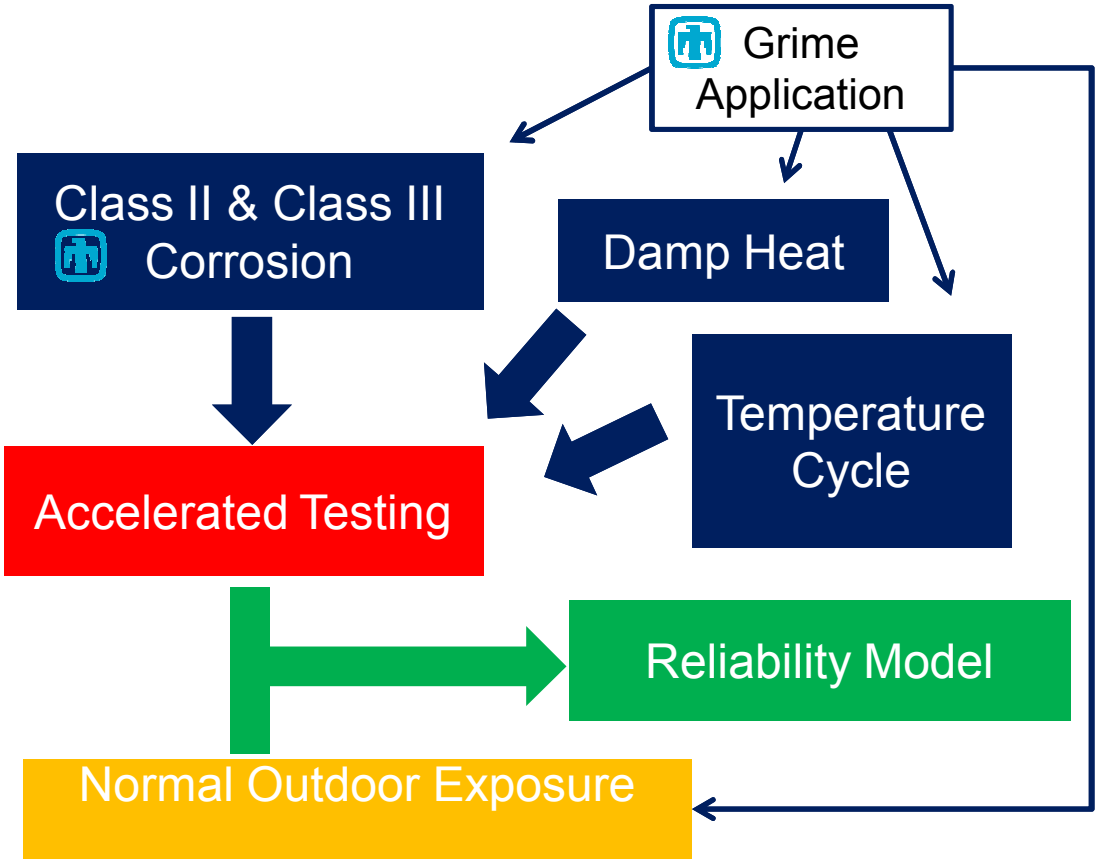


Photovoltaic Systems Reliability - Connectors

Connector costs relatively low but losses are estimated to be up to 140 Wh/string

- Three kinds of accelerated testing
- Develop reliability model through comparison with outdoor exposure

(= Sandia differentiating capability)



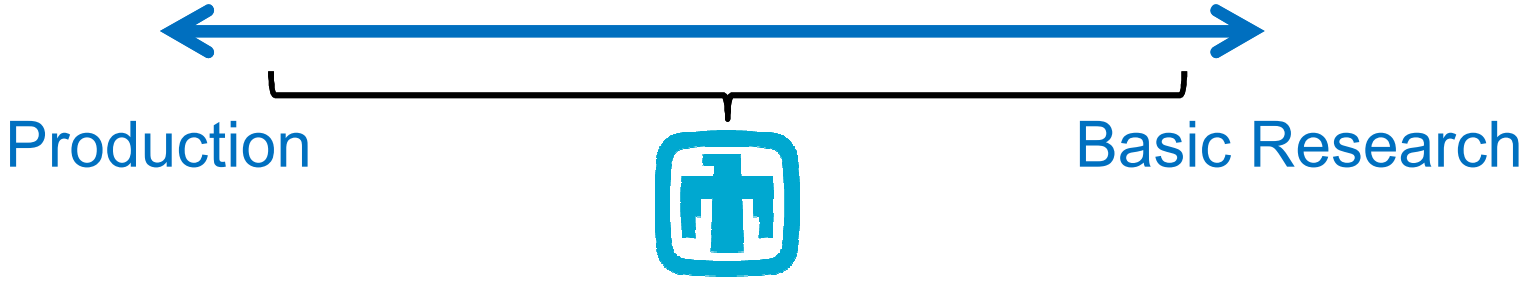
Sandia vs. Graduate School

Sandia National Laboratories

Graduate School	Sandia
100% Hands on	50% hands on: Must learn to work through technologists
Time > $	$ > Time
Do It Yourself	Work with experts
1 group, 1 meeting	N groups, N meetings

Why You Should Consider Sandia

- You are undecided between academia and industry



- You wish to continue building your human capital

Corporate Learning & Professional Development
Chart your course.

AST

THE UNIVERSITY of NEW MEXICO

- You wish to work for an organization driven by societal impact over profits

Terry L. Hendricks (2011)

- Hometown: Milwaukee, WI
- Education: 11 years at UW-Madison
  - Ph.D Dissertation: Instantaneous Heat Flux Measurements in Internal Combustion Engines
- Work Experience:
  - Automotive mechanic
    - Hot rod shops, transmission repair
  - General Electric
    - Combustion lab (Greenville, SC)
    - Steam Turbine Test Laboratory (Schenectady, NY ZIP: 12345)
  - Work at Sandia
    - Nuclear Weapons Engineering
    - Aerospace Mechanical Systems

What I did at Sandia Nat'l Labs

- Design engineer for explosive components in the Nuclear Weapons Division @ SNL
- Sandia is the weapons integrator for LANL/ LLNL
  - Also work on R&D for explosives, propellants, pyrotechnics
  - Work with other organizations and groups on other projects

B83 Strategic Bomb - 6,519 Total parts
Sandia developed - 3,922; Sandia specified - 2,378

What I now do at Sandia Nat'l Labs

- Aerospace Mechanical Engineer for Missiles and Strike Systems
  - We fly RVs
  - We also fly MARVs
    - Like the AHW
  - And we also do missile defense work in support of MDA
    - Countermeasures
    - Interceptor/ kill vehicle

So what does that mean….

- Things I get to do…
  - Determine if an object will burn-up upon re-entry
  - Analyze heat transfer and ablation rates for many ‘shapes’
  - Design payloads (satellites too) and payload separation systems
  - Design, develop, and test rocket motors / engines
    - Hypergolic, electrothermal, solid composites
  - Design, develop, and build actuator components for maneuvering vehicles
- Things I wish I didn’t have to do….
  - Calculus…yes you need to know vector calc
  - Meetings and schedules

Example of End Use Application (NW and RVs)

- Trident II

https://w GvnAGQ

Current Work / Research (As of Sept 13)

Sandia National Laboratories

- Work
  - Evaluate explosive gas generators for staging systems for CPGS
  - Shock and Vibe testing for mechanical aerospace structures
  - Evaluate a heat sink for a cube sat
  - Evaluate a thermal conditioning blanket for use at the Kodiak, AK launch facility
- Research
  - Completing work on an inverse heat transfer / ablation code to evaluate materials for use in a high enthalpy environment
  - Developing a 'Extended Kalman Filter'-type data processing code for high speed (~1 ns) thermocouples
  - Working with a consortium* on developing a high speed heat flux sensor for use in a wide-variety of applications
  - Developing a 'green' propellant combustion analysis lab

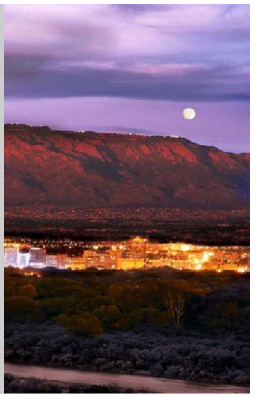
* Consortium includes UW-Madison, LANL, AFRL, ARL, LLNL, SNL(Livermore)

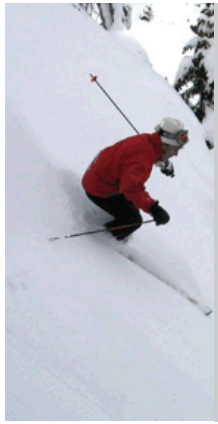
Life at Sandia

- I cant believe they pay me to do this…
  - When in meetings, the corollary applies
- School taught me the basics, Sandia taught how to be an effective engineer
  - Fast paced, less-than-perfect data at times, you need to come up with an answer that gets the job done
- I don’t worry about ‘the sequester’ or an economic calamity
  - Sandia is great at taking care of their staff members
  - Sometimes you wish a day was twice as long
- No place on Earth will let you do the things we do

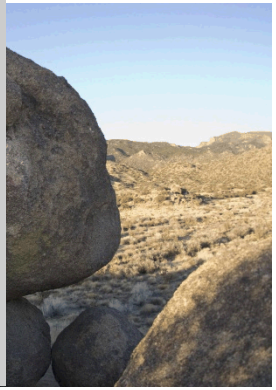
Working at Sandia / Living in New Mexico

- Working at Sandia:
  - Diversified portfolio and work opportunity
  - Great amount of freedom
  - Many opportunities for self-investment
  - Meaningful work
  - Good work-life balance





- Living in New Mexico
  - Gorgeous scenery and year-round outdoors activities
  - 300 days of sunshine
  - Unique culture



Work with top minds & be recognized

Sandia National Laboratories

Our unique work requires the collective minds of the nation's top scientists, engineers, and support staff. Each year, Sandians are recognized for developing a range of breakthrough technologies with commercial applications of global importance.

Nancy Jackson
2013 Science Diplomacy Award
American Association for Advancement of Science

Dennis Owens
J. Anthony Wingate
Carl Rhinehart
2013 National Black Engineer Award Recipients

Jeffrey Y. Tsao
2013 Asian American Engineer of the Year

Steve Castillo
2012 HENAAC Engineer of the Year
Hispanic Engineering National Achievement Awards Conference

How to get plugged in?

1. Speak to us after the presentation
2. Interview (October time frame)
3. Create an account, and identify job opportunities.
4. Apply
5. If not graduating, focus on internships
6. If graduating, focus on fellowships, postdocs, and full-time

Questions?

Sandia National Laboratories

Sandia National Laboratories

SNL Ipad Site

YouTube Site

Facebook Site

Careers Site

Twitter Site

LinkedIn Site

Internships

Sandia National Laboratories

Features

- 16+ to PhD
- Variety of majors
- Technical institute programs (8)
  - Perform leading-edge research
  - Guidance of a Sandia research mentor
  - State-of-the-art equipment and facilities
- Tours, workshops, seminars

Requirements

- U.S. citizenship
- Full-time enrollment status
- GPA: 3.5 grad, 3.2 undergrad
- Some projects may require clearance

Fellowships & Postdocs

Sandia National Laboratories

Features

- Ph.D.-level candidates
- Harry S. Truman
  - Salary: 110K
- Alexander Hollander Distinguished
  - Focus on life, biomedical, and environmental sciences
- John Von Neumann Postdoctoral
  - One-year
  - Applied/computational mathematics

Requirements

- U.S. citizenship
- GPA: 3.7 grad, 3.5 undergrad
- Obtain clearance
- Research in areas of interest to national security

Full-time

- US citizenship (but check posting)
- 13 majors listed on website
- Work-life balance
- Diversity programs, community outreach, 401(k) matching, patent royalties, wellness programs,

Wounded Warrior Career Development Program

Sandia National Laboratories

- A unique limited-term career development employment opportunity that enables veterans to acquire career-based skills at Sandia through training, mentoring and real-world work experience while supporting mission success.

- Actively pursue an appropriate college degree
- Continue to develop and refine job related skills through training
- Share experiences to improve understanding of combat theater and enhance connections with Sandia work