



# *The Impact of Inter-Institutional Collaboration on Graduate Education*

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Materials Engineering Education  
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# Completing an undergraduate degree is a key transition point full of choices

backpack europe

law school

industry

finance & banking

medical school

entrepreneurship

paying bills

love

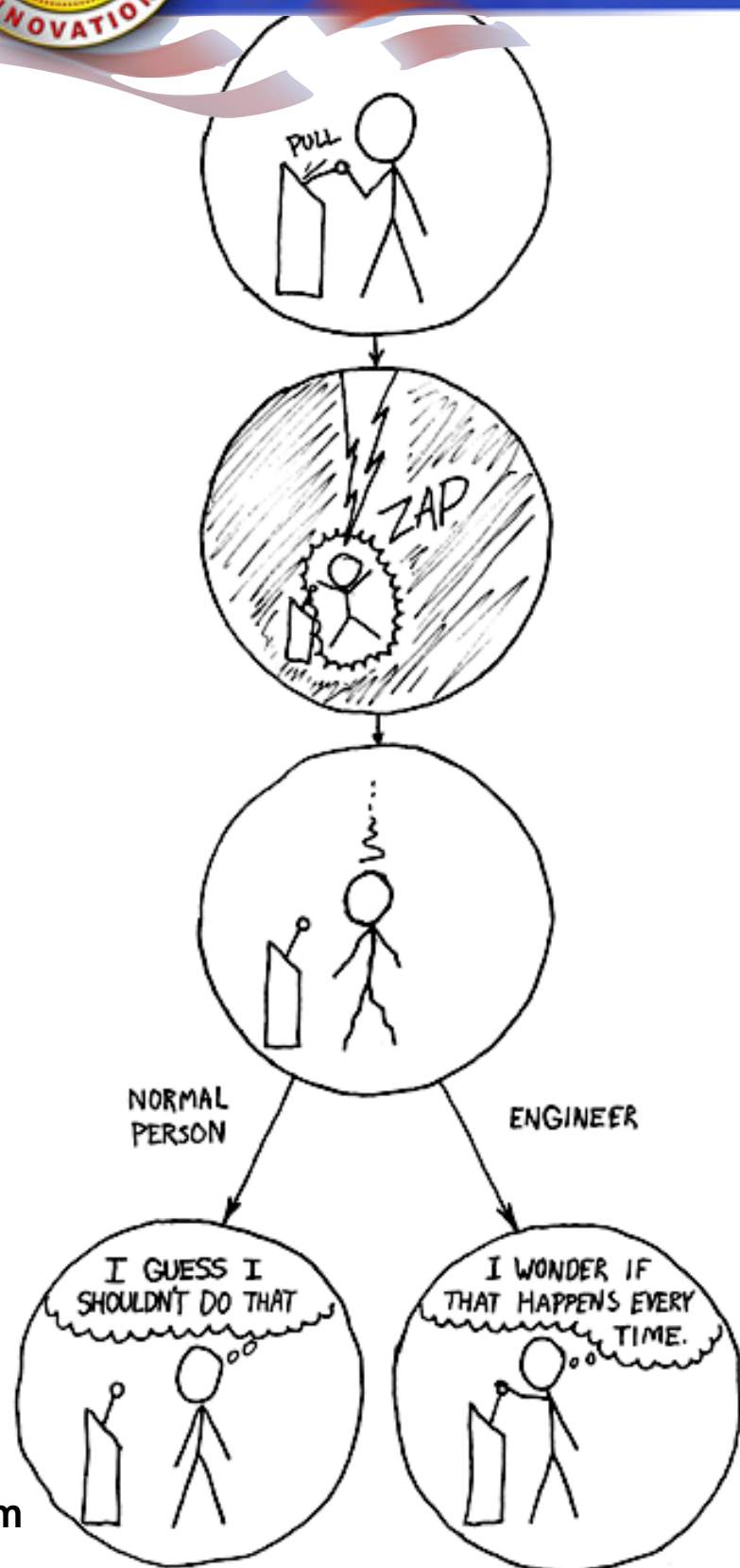
isn't 16 years of school enough?

video games

Today's task:  
Make a  
decision about  
grad school!



# Understanding today's student is an important first step



xkcd.com

Adults and students found these three messages to be “very appealing” (NAE 2008):

1. Engineers make a world of difference (all)
2. Engineers are creative problem-solvers (boys)
3. Engineering is essential to our health, happiness, and safety (girls)

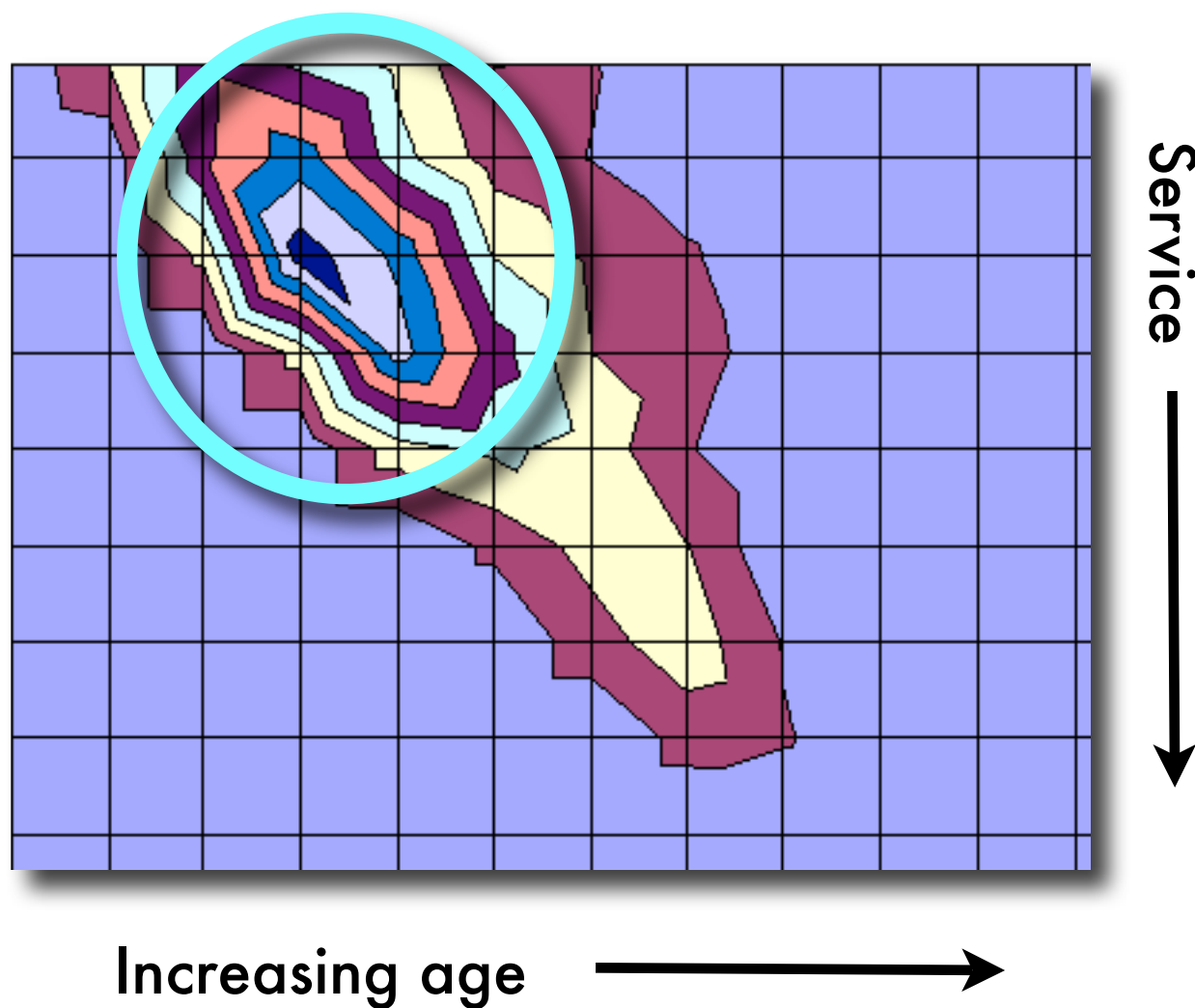
These are some of the same motivations that steer young professionals into medicine and politics, for example.

The lines are blurring between “normal person” and “engineer.”



# The changing faces of S&E @ Sandia: Baby Boomers

Sandia workforce circa 1998:

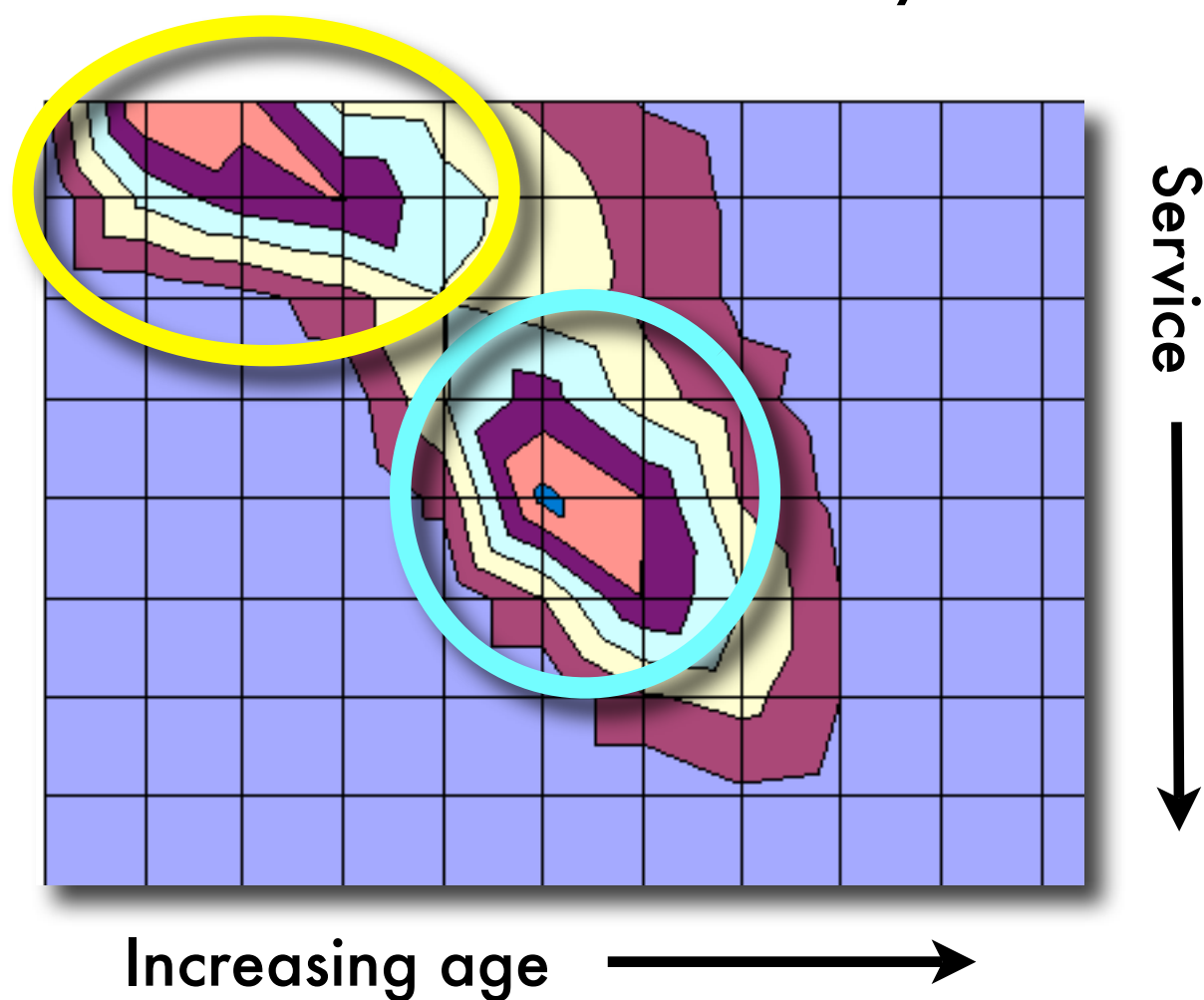


10 years ago, almost all of Sandia's technical workforce was between 30 and 55 years old.



# The changing faces of S&E @ Sandia: Generation Y

Sandia's workforce today:



Today we've seen our workforce of the nineties age...

... and a new generation arrive.

And they work differently.





R&D careers intersect important generational themes







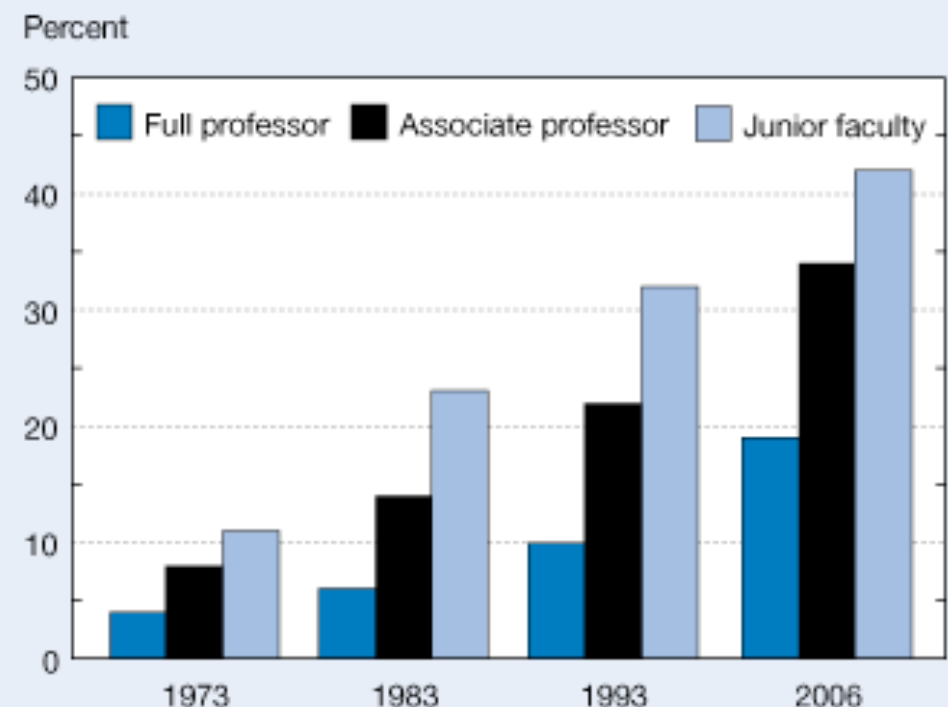
# The changing faces of S&E: Women

Women are making slow but steady progress and will continue to shape the landscape of domestic S&E.

The demographics of who is doing S&E is changing.

So we must also change the way that we do science and engineering if we are going to remain competitive.

Figure 5-19  
Share of doctoral S&E faculty positions held by women, by rank: Selected years, 1973–2006



NOTE: Junior faculty includes assistant professors and instructors.

SOURCE: National Science Foundation, Division of Science Resources Statistics, Survey of Doctorate Recipients, special tabulations (preliminary data for 2006).

*Science and Engineering Indicators 2008*



# Preparing our students for a career in the private sector is essential

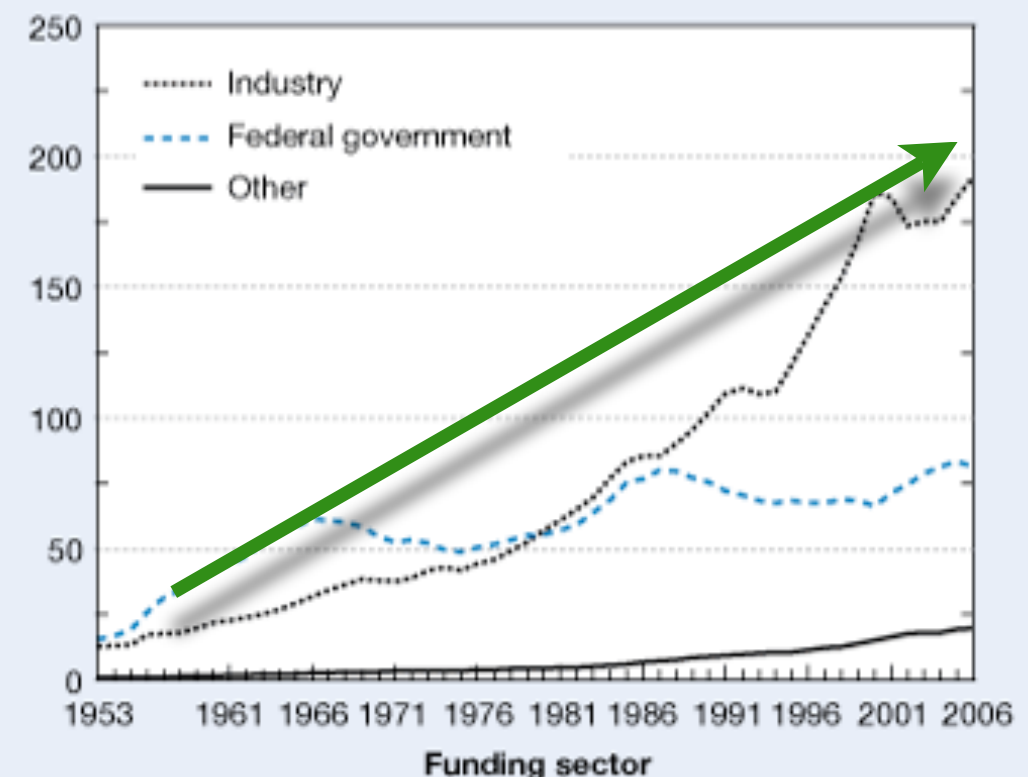
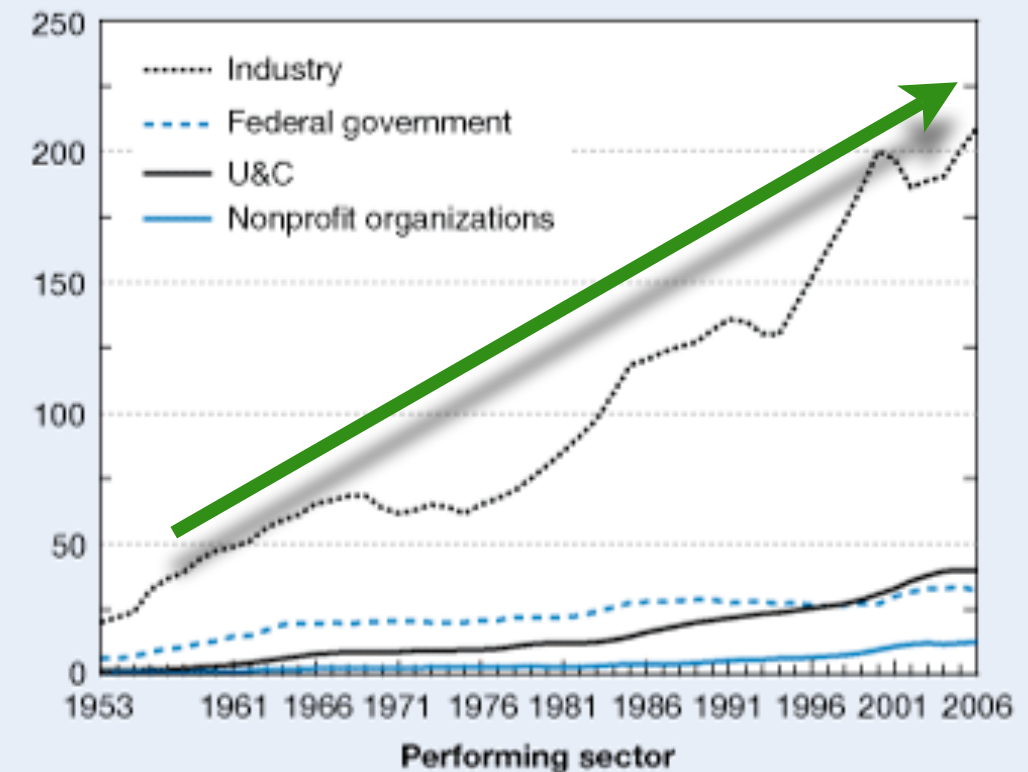
We have observed a steady increase in industry as both a funding source and performer of National R&D

... it's clear that Industry is a key driver of national R&D.

Our goal of preparing our students to work for and in industry is an imperative to maintain our position as a global leader in R&D.

Figure 4-1  
National R&D, by performing and funding sectors, 1953–2006

Constant 2000 dollars (billions)

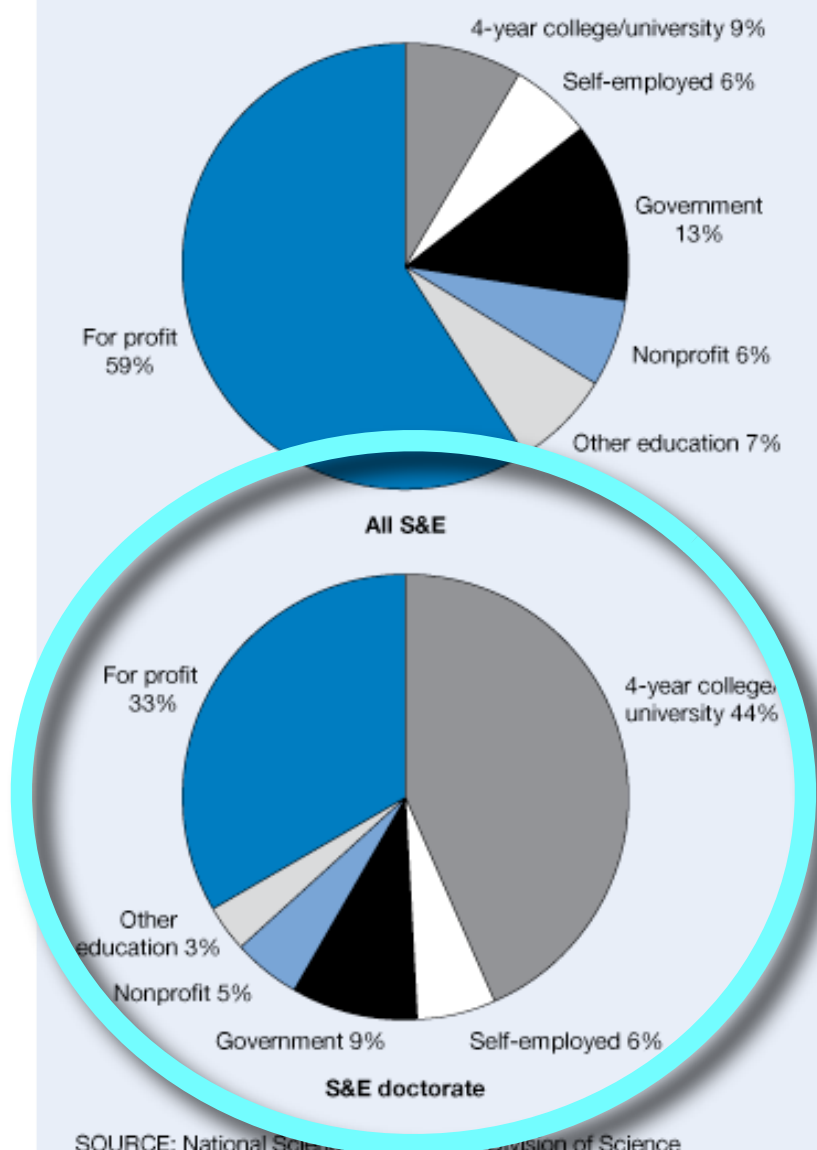






# Inter-institutional partnerships provides future career role models to our young scientists

Figure 3-16  
Employment sector for individuals with highest degree in S&E: 2003



SOURCE: National Science Foundation, Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT), 2003, <http://sestat.nsf.gov>.

Science and Engineering Indicators 2008

S&E Ph.D.'s are distributed across sectors: industry, academia, government and others.

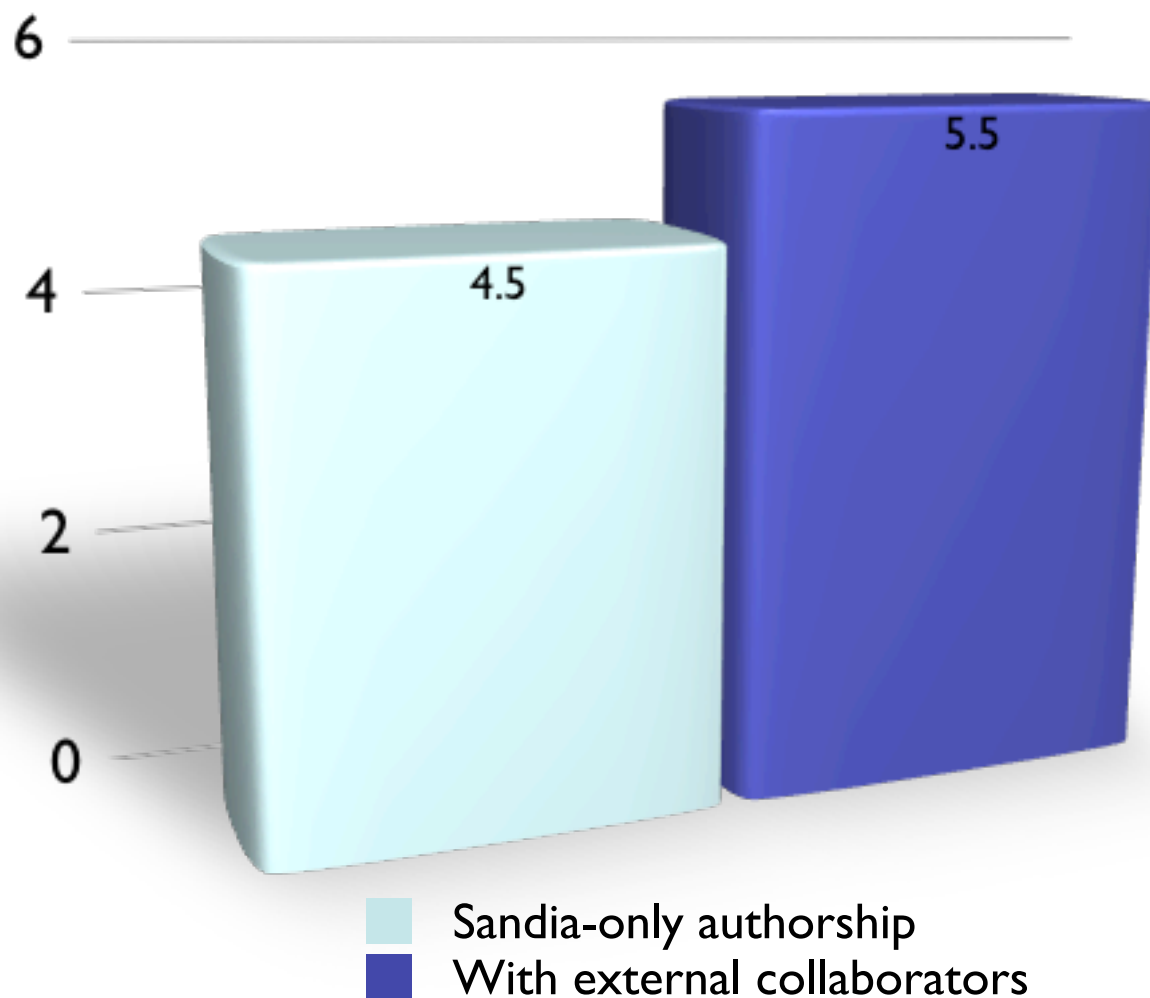
We can find capabilities and areas of expertise at universities, in industry, at labs, and non-profits.

Facilitating interactions between them as early as possible motivates students.



# Collaboration can lead to better scientists, better science

Average Number of Citations per Publication from Sandia



Students are accustomed to working in teams or within a research group in school.

We notice an increase in the average number of cites when we co-author with outside outside of our walls.





# Critical Skills Institutes are one way to motivate and prepare the next generation of scientists

Sandia's multidisciplinary Critical Skills Institutes prepare participants for careers in:

- ▶ Cyber defense
- ▶ Extreme environment research
- ▶ Predictive simulation
- ▶ National security engineering



Across the DOE complex, we have observed that participants in Critical Skills Institutes are highly likely to continue with a career in R&D.



# *NINE* is an educational partnership with national reach



NINE is developing a nanengineering curriculum and a new educational model

Government  
Academia  
Industry

Using nano-engineering to solve nationally important problems

Access to world-class research facilities

Working with researchers from labs and industry

Working with students from across the nation





# NINE is an educational partnership with national reach



Sandia  
National  
Laboratories



CORNING

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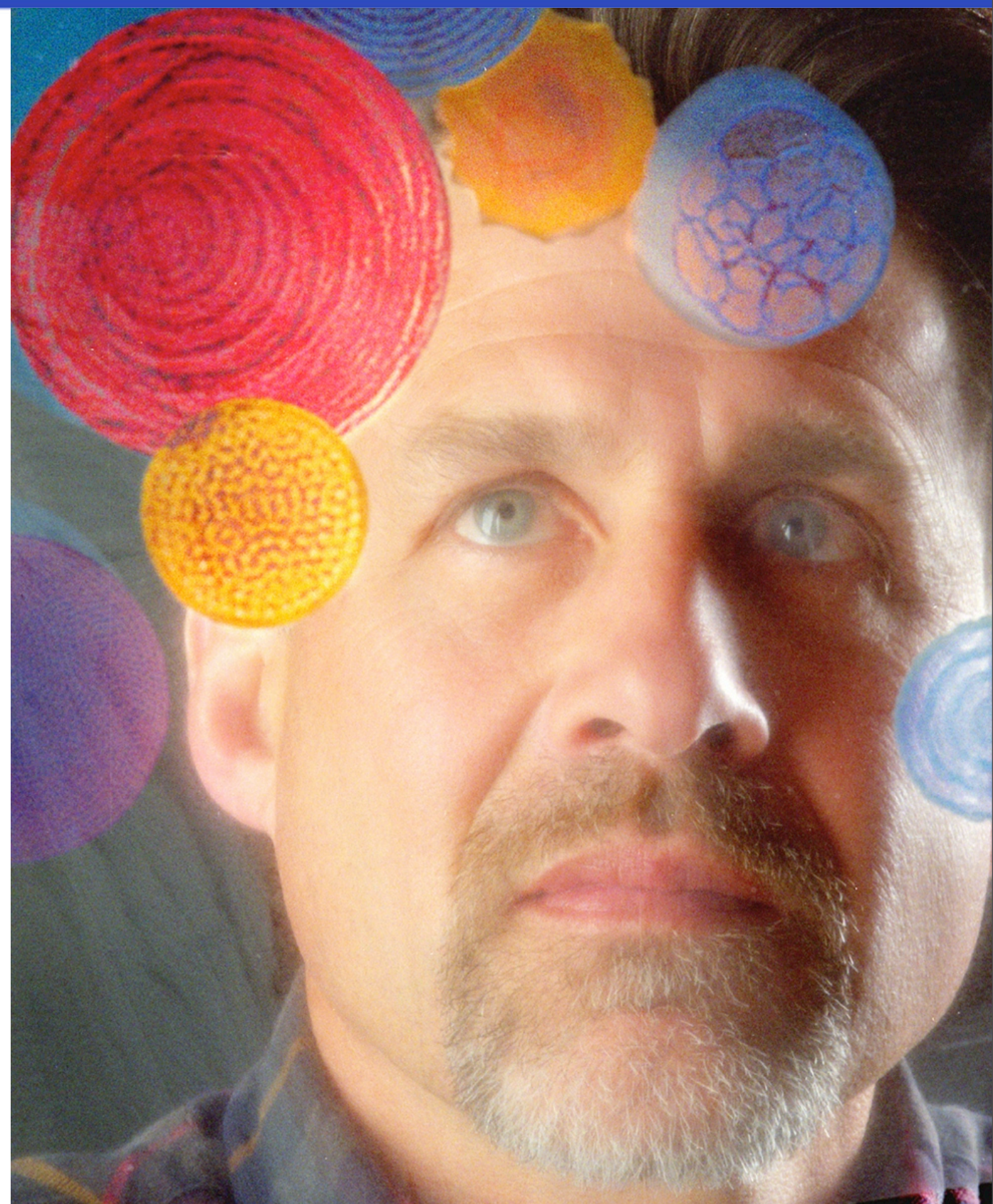
# Sandia's Advanced Materials Laboratory (AML)

Our Advanced Materials Laboratory sits adjacent to the University of New Mexico main campus in Albuquerque.

Currently leverages 20 regular employees to a population of 112 students/post-docs/visiting faculty.

Students work on Sandia projects synergistic with their academic research.

This blending fits with how today's young scientists choose to work.







# A success story: Bernadette Hernandez-Sanchez

Bernie:

- ▶ First arrived at our AML in 1994 as a high school intern
- ▶ B.S. from NM Tech & Ph.D. from Colorado State
- ▶ Completed Post-Doc at Sandia
- ▶ Now full time Technical Staff
- ▶ Mentor and inspiration to students at all levels: elementary to graduate school



*"Working at the AML was exhilarating! The hands on activities and my contribution to applied research sparked my interest to continue my education. I learned from my experience at SNL that I loved the thrill of discovery and that I wanted to be a chemist."*



# (PD)<sup>2</sup>P: Preparing our post-docs for a career in R&D



Established in March 2007, Sandia's (PD)<sup>2</sup>P:

- ▶ Connects post-docs to other researchers in the internal and external scientific community
- ▶ Hosts workshops to teach soft skills like presentation and technical writing
- ▶ Organizes social events
- ▶ Catapulted Sandia into *The Scientist's* "Top 10 Places to Work" for post-docs in 2008





# Reach across institutions and sectors to motivate students because

They will make a difference in the world.

They will get a relevant research experience appropriate to their stage of development.

They will love the collaborative environment.

They are more likely to pursue a graduate degree.

And you will benefit far beyond your initial goals.