How an NSF-funded nanotechnology program help lead and nucleate the broader national nanotechnology infrastructure ecosystem

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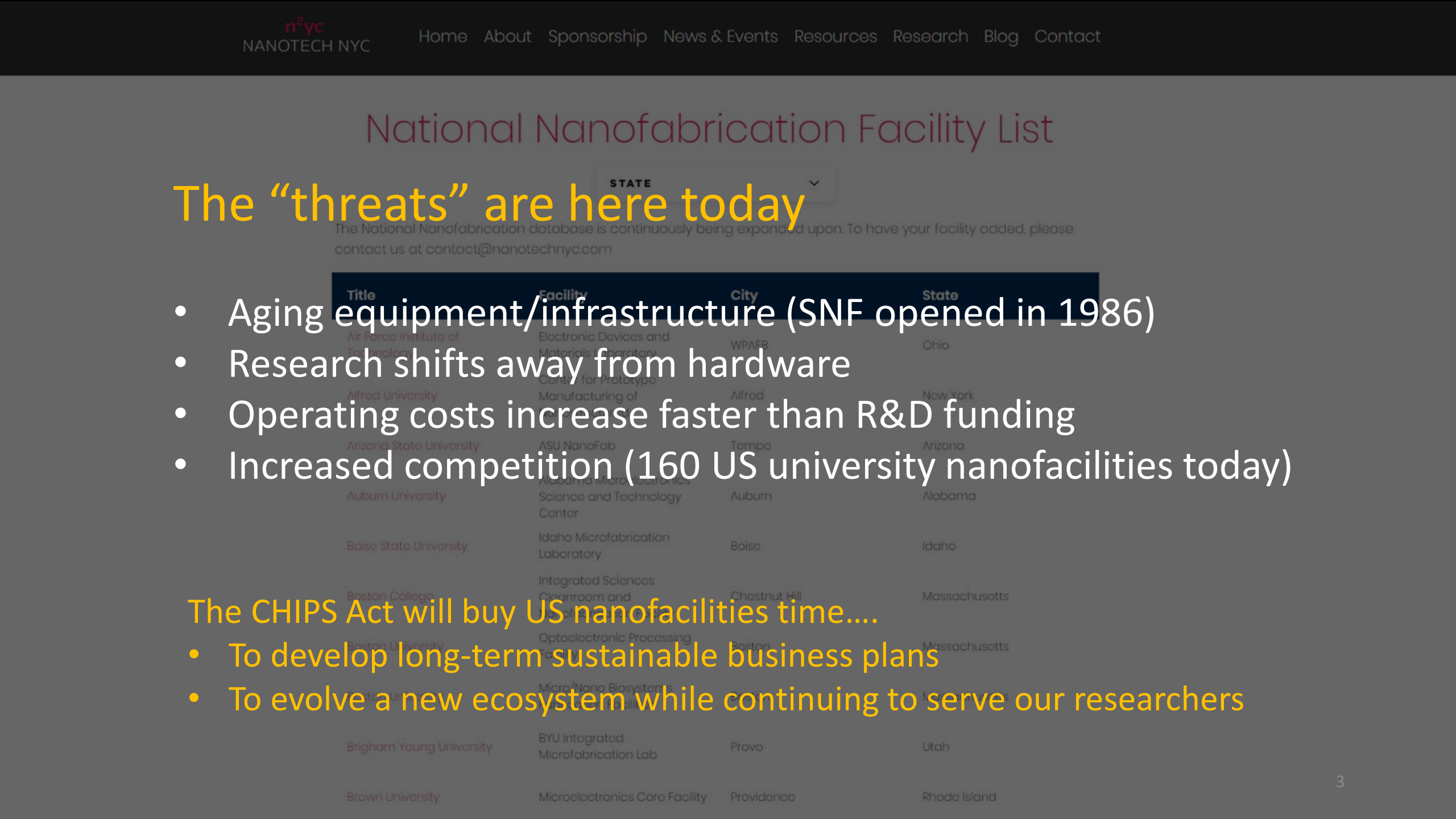
Caveat:

This is a perspective from someone in “traditional” fabrication at Stanford



The “threats” are here today

- Aging equipment/infrastructure (SNF opened in 1986)
- Research shifts away from hardware
- Operating costs increase faster than R&D funding
- Increased competition (160 US university nanofacilities today)

The CHIPS Act will buy US nanofacilities time….

- To develop long-term sustainable business plans
- To evolve a new ecosystem while continuing to serve our researchers

Our peers

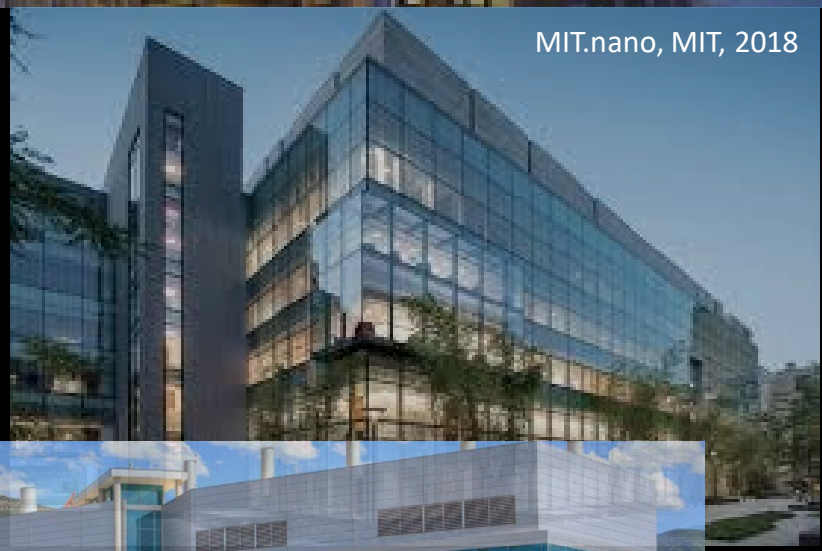
Bigger.

Scifres/Birck Nanofabrication Lab, Purdue University, 2007

Marvell Nanofabrication Laboratory, UC Berkeley, 2009

Cleaner.

Singh Center for Nanotechnology
University of Pennsylvania, 2013



MIT.nano, MIT, 2018

Center for Nanoscale Systems Harvard University, 2007

Can we make an impact without a new building?

SMBB University of Utah, 2014

Goal #1: Predictable operations

We don’t want:

- To run out of process gases & chemicals
- To discover a machine is broken AFTER it has broken wafers

We want:

- Each machine to behave the same way today as it did two months ago

How to achieve:

- Continuous monitoring/data collection
- Resources for preventive maintenance
- Quality framework (ISO9000?)

Method: Eliminate surprises

Goal #2:

SNF pre-pandemic

Goal #2: Knowledge Capture

SNF In 2023

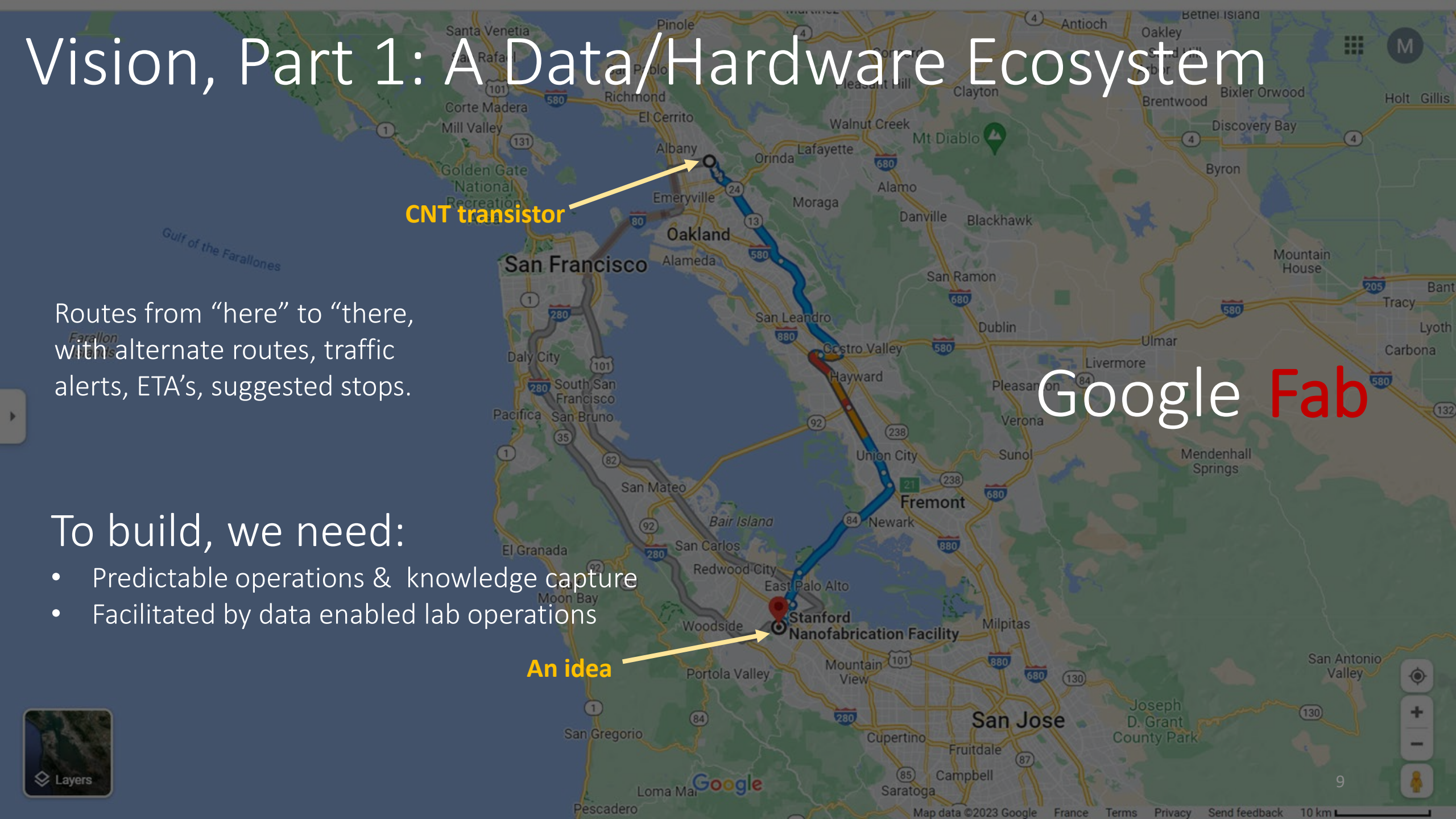
1/3 staff turnover since the pandemic hit.

Capture ops & experimental info = FAIR library

Goal #3: Community

- Low barriers to entry
- Cultivate active engagement
- Provide social, as well a technical, value

Vision, Part 1: A Data/Hardware Ecosystem



Vision: Part 2

Convergence – Remove barriers to bridge

- Research and education
- Education and work
- Research and commercialization
- Software and hardware
- Researchers, disciplines, organizations

A new nanofacilities ecosystem will:

Improve researchers' experience

- Lower the entry barrier
- Provide supportive community

Accelerate high quality research

- Sharing what didn't work
- Reduce experimental turnaround time
- Provide framework for data integrity/custody

Streamline nanofacilities operations

- Reduce operating costs
- Reduce our environmental footprint

Stanford Institute for Economic Research Policy (SIEPR)
https://siepr.stanford.edu/publications/policy-brief/race-bottom-how-competition-publish-first-can-hurt-scientific-quality

POLICY BRIEF | DECEMBER, 2021

Stanford | Institute for Economic Policy Research (SIEPR)

Race to the bottom: How competition to publish first can hurt scientific quality

By Carolyn Stein and Ryan Hill

KEY TAKEAWAYS

- Scientific research is a critical piece of R&D. Understanding what motivates scientists has important economic implications.
- A primary motivator in science is the credit associated with publishing first. But the race for a scoop leads to lower-quality work, which may threaten true scientific progress.
- Government subsidies of collaborative research can improve research quality by blunting the incentive to cut corners.
- Several scientific journals have recently instituted "scoop protection policies" aimed at curbing unhealthy competition.

Credit for new ideas is critical for research scientists. It is the currency of scientific careers that builds reputations and leads to funding, promotions, and prizes (Stephan, 1996). And where do
the sociol
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and others

Given the imp
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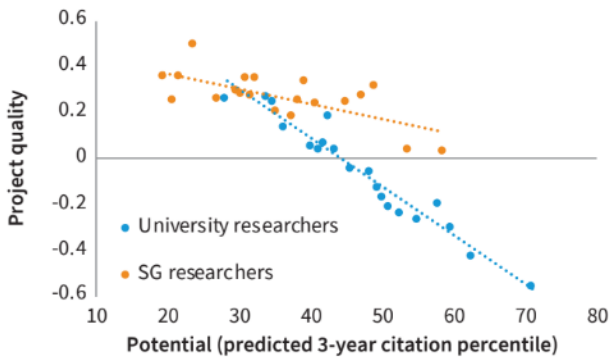
credit for inv
a manuscript
to Darwin's (
More recently
public conflic
so acrimonio
governments

While priority
science is be
scientific progress. As grants become increasingly selective, scientists must spend more time writing proposals, leading to "crippling demands" that subtract time from thinking, reading, and conducting research (Alberts et

Figure 4.
The Effect of Project Potential on Project Quality: University Researchers versus Structural Genomics Researchers



How can an NSF-funded nanotechnology program help lead and nucleate the broader national nanotechnology infrastructure ecosystem?

- Build a national nanotechnology infrastructure around information and people.
- Take data sharing and experiential education on a national level.
- Make it open-source.
- Make it community-based.
- Make it an ecosystem that is inclusive, welcoming all nanofacilities to participate.
- Engage experts to advise on infrastructure organization and management.