

Research and Economic Development Committee Agenda  
November 17, 2021  
Time: 3:00 PM – 5:00 PM

1. Welcome – Trustee Fall/Diana Hulme
2. Faculty Research/Business (Resono) presentation - Dr. Jonathan Naughton
3. WIP ARP Funding update – Steve Farkas
4. Carnegie Classification discussion – Provost Kevin Carman



# Small Business Development at the University of Wyoming

**Jonathan W. Naughton**

**Professor, Mechanical Engineering**

**Director, Wind Energy Research Center**

**CEO, Resono Pressure Systems**

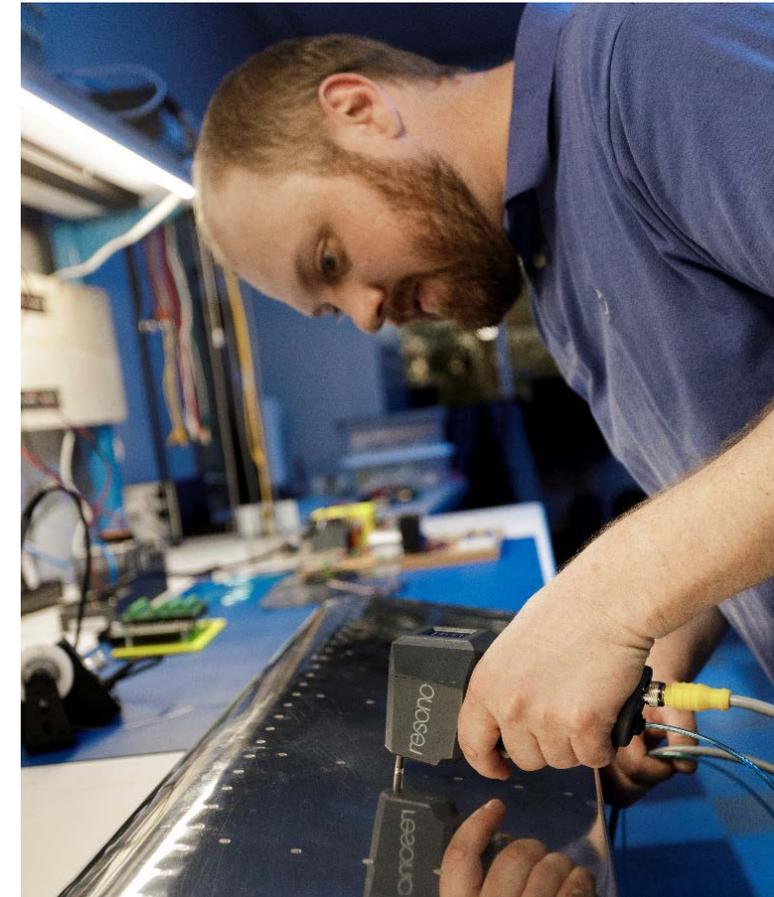
**Pourya Nikoueeyan**

**CTO, Resono Pressure Systems**

## Outline

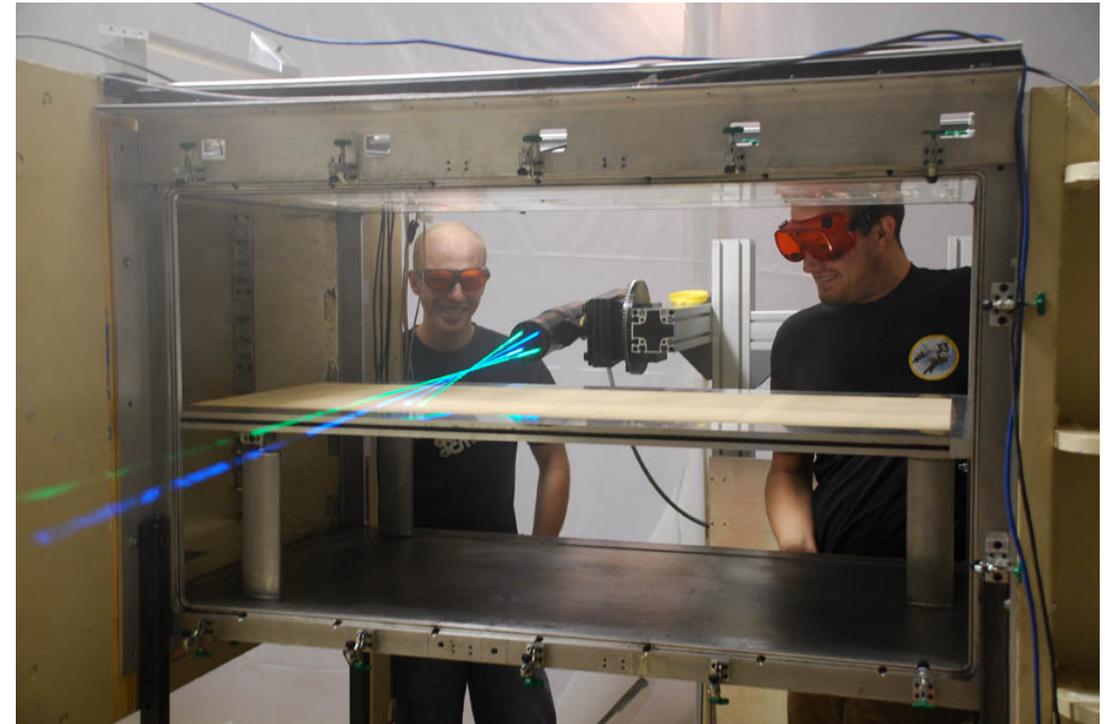
- **Origins of Tech Companies at a University**
- **The University of Wyoming Aeronautical Laboratories**
- **Product Origin - Challenge and the Solution**
- **Resono's Product History**
- **The Product**
- **Resono Today**
- **Support from UW and the State of Wyoming**
- **Ideas to Further Encourage Economic Development**

The ideas discussed in this presentation are our personal opinions and should not be considered to represent the official positions of the ME Department, CEAS, or UW



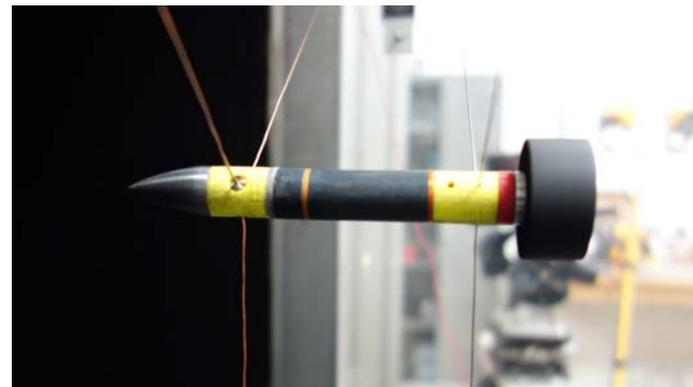
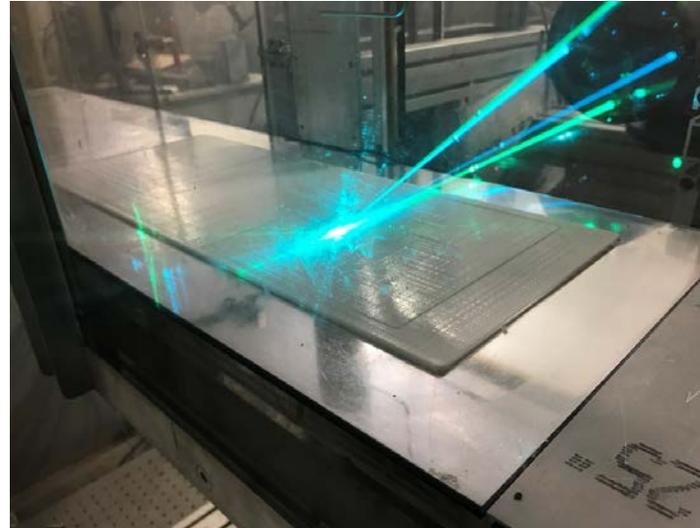
# Origins of Technology Companies at Universities

- **Technology companies come from ideas generated primarily in the Sciences and Engineering**
  - There are other examples, but they are small in number
- **The ideas result from a vigorous Research Enterprise**
  - Although not all research generates the ideas that will be the foundation of a company, a subset of the research can generate those ideas



# The University of Wyoming Aeronautical Laboratories

- **Established 1997**
- **Areas of Research**
  - Experimental Aerodynamics
  - Instrumentation
  - Analysis Methods
- **Applications**
  - Drag Reduction
  - Helicopter Blade Flows
  - Wind Turbine Blade Flows
  - Instrumentation Development



# The University of Wyoming Aeronautical Laboratories

- **Funding**

- Primary sources
  - Department of Energy
  - Department of Defense
    - Air Force
    - Army
  - NASA
- Amount (Past 3 years)
  - Total ~\$2 million, Naughton ~\$700k
- Funding has come from traditional grants, and more recently SBIR and STTR contracts awarded to companies



- **Students/Visitors/Employees**

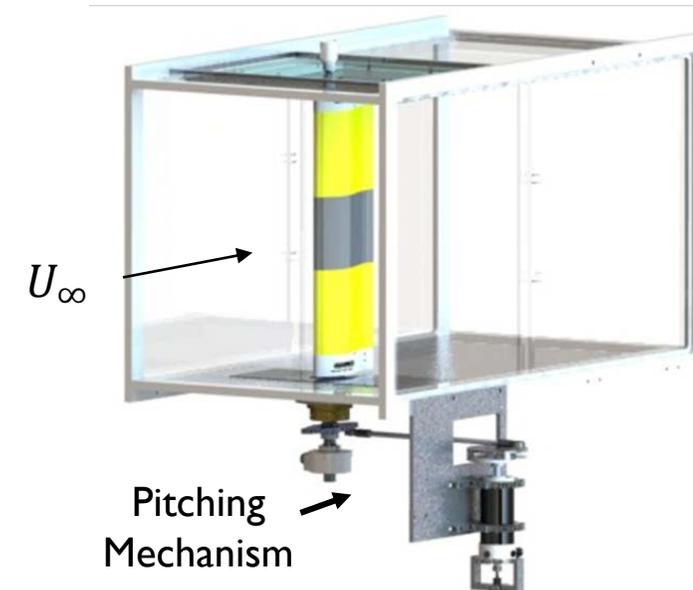
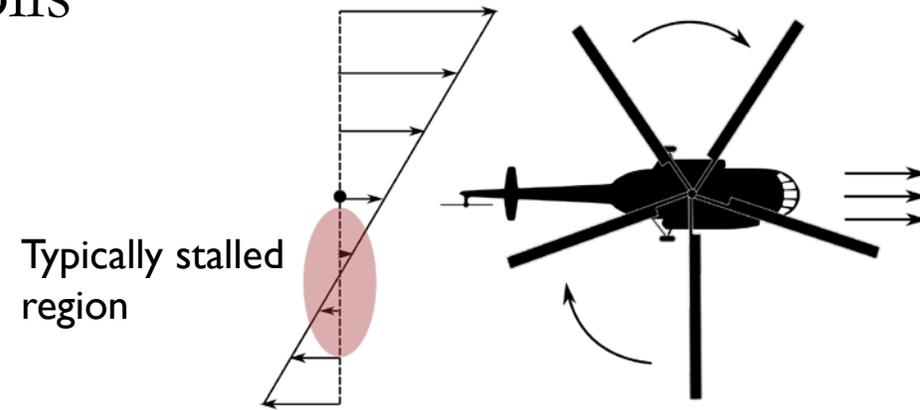
- PhDs – 7 (3)
- MS (thesis) – 20 (3)
- Undergrad Researchers - 20
- Engineers - 3
- Visiting Researchers – 3 (All International)
- Post-Doctoral Researchers – 3 (1)



# The University of Wyoming Aeronautical Laboratories

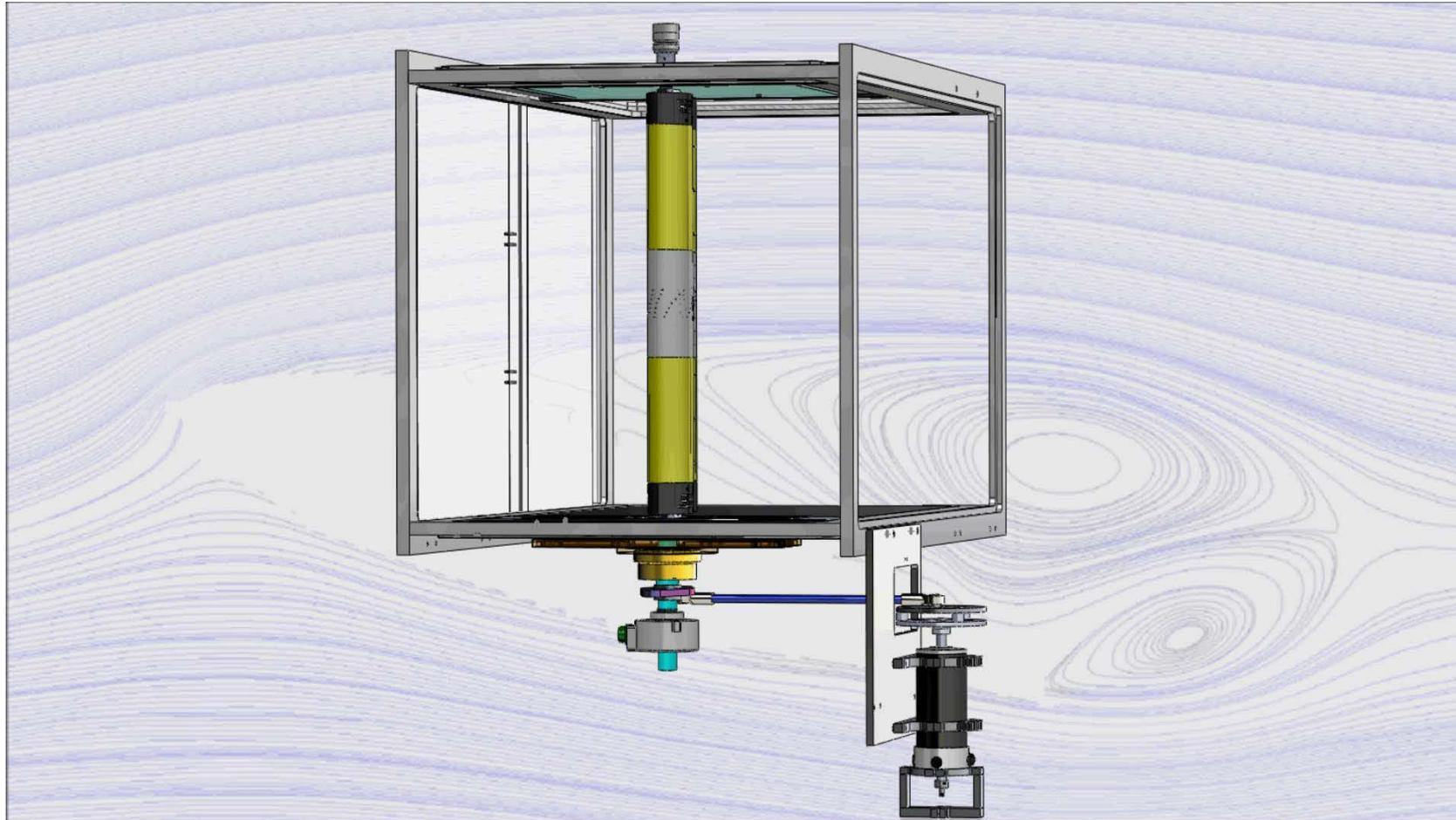
## Example Research – Oscillating Airfoils

- **Oscillating airfoils have been used as an “ideal case” for unsteady airfoil research**
  - Dynamic stall
- **Application Areas**
  - Helicopters in forward flight
  - Wind turbines at off-design conditions
- **Importance**
  - Increased lift followed by stall
  - Repeated load changes lead to fatigue



# The University of Wyoming Aeronautical Laboratories

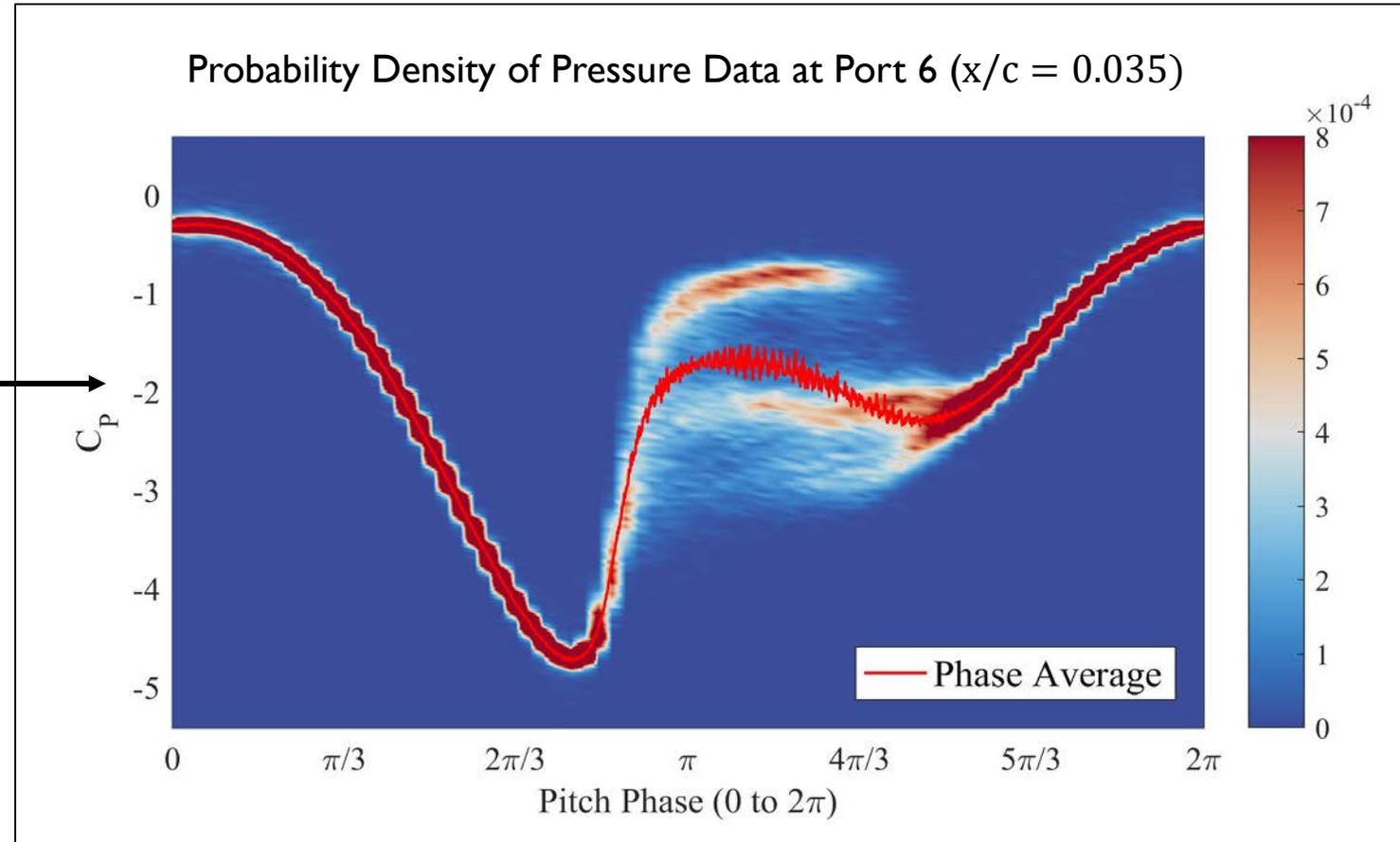
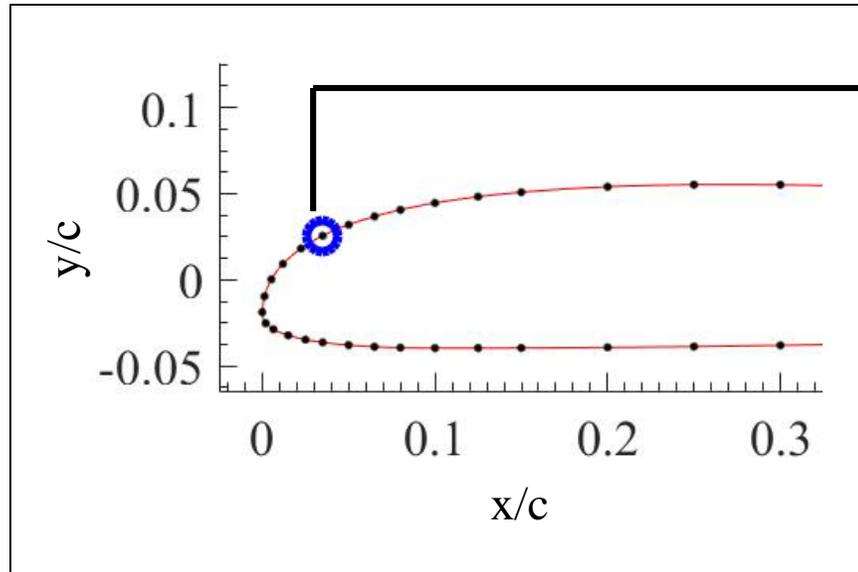
## Example Research – Oscillating Airfoils



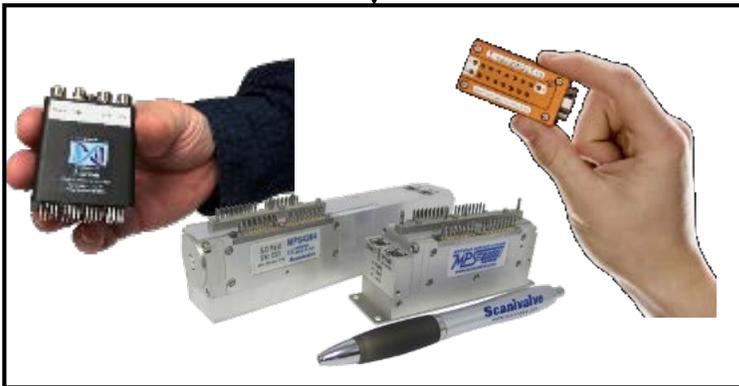
# The University of Wyoming Aeronautical Laboratories

## Example Research – Oscillating Airfoils

- **First documented discovery of “preferred paths” in cycle-to-cycle variations**



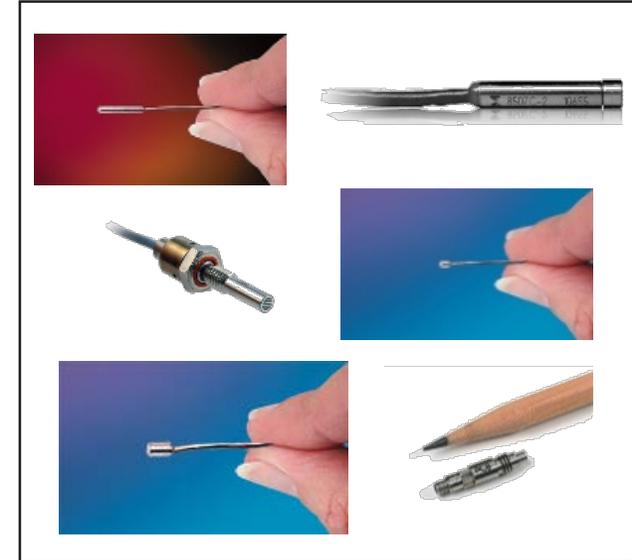
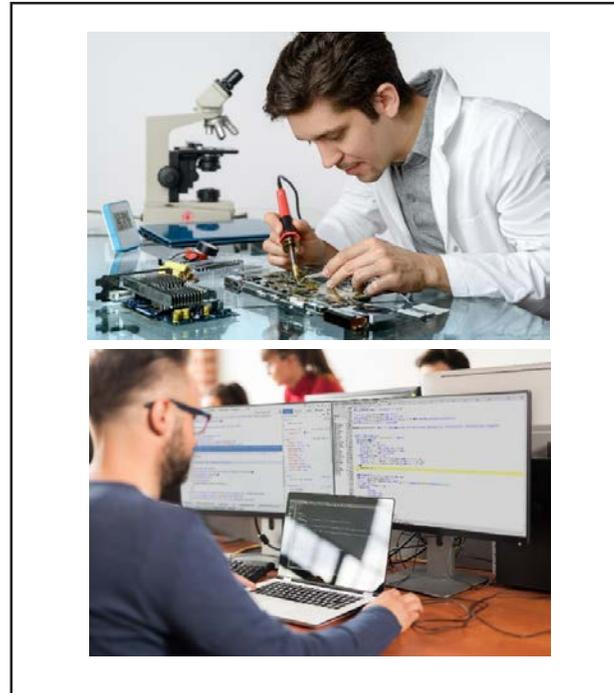
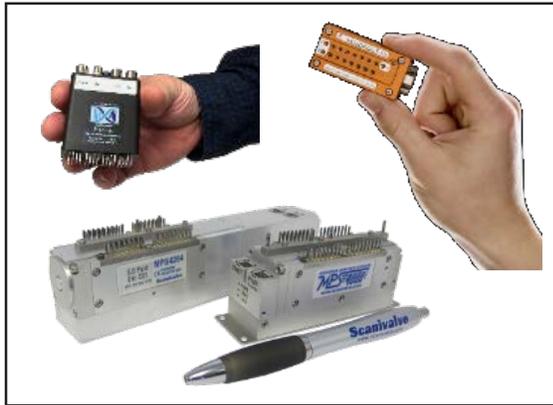
# Product Origin - The Challenge – Unsteady Pressure Measurement



- Convenient
- Robust
- Reusable
- Cost Effective (\$300/ch)

- Inconvenient
- Fragile
- Single-use
- Expensive (\$1000/ch)

# Product Origin - The Solution – Unsteady Pressure Measurement



Jonathan Naughton  
11/17/2021

# Resono's Product History

University of Wyoming

- **Motivated by unsteady airfoil research in the mid 2000's (airplane application - flutter)**
  - Needed a way to practically measure unsteady pressure at many points on an airfoil
  - Broke available sensors due to moving airfoil tested in the wind tunnel
- **Airfoil research resumed in the late 2000s (wind turbine aerodynamics)**
  - Developed method for measuring unsteady pressure using pressure scanners using approach of Whitmore and Wilson

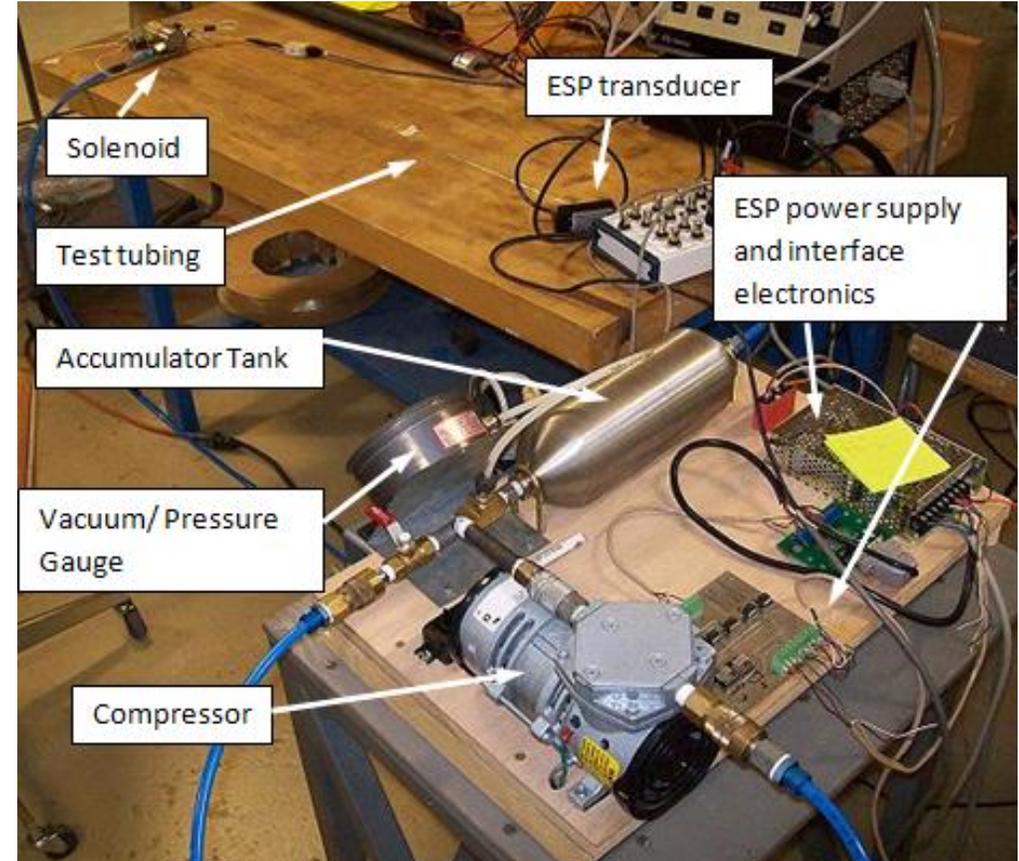


# Resono's Product History

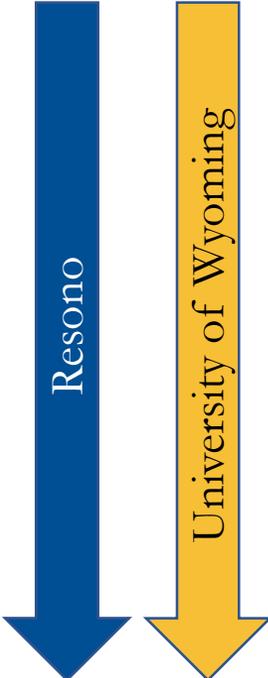
- Throughout the 2010s, the approach was refined
  - Contracts from DOE and Army provided sustained funding
- We started getting questions about how we were making the unsteady pressure measurements
- First considered commercializing in early 2010s
- Real work toward developing commercial application when Pourya Nikoueeayan indicated interest

University of Wyoming

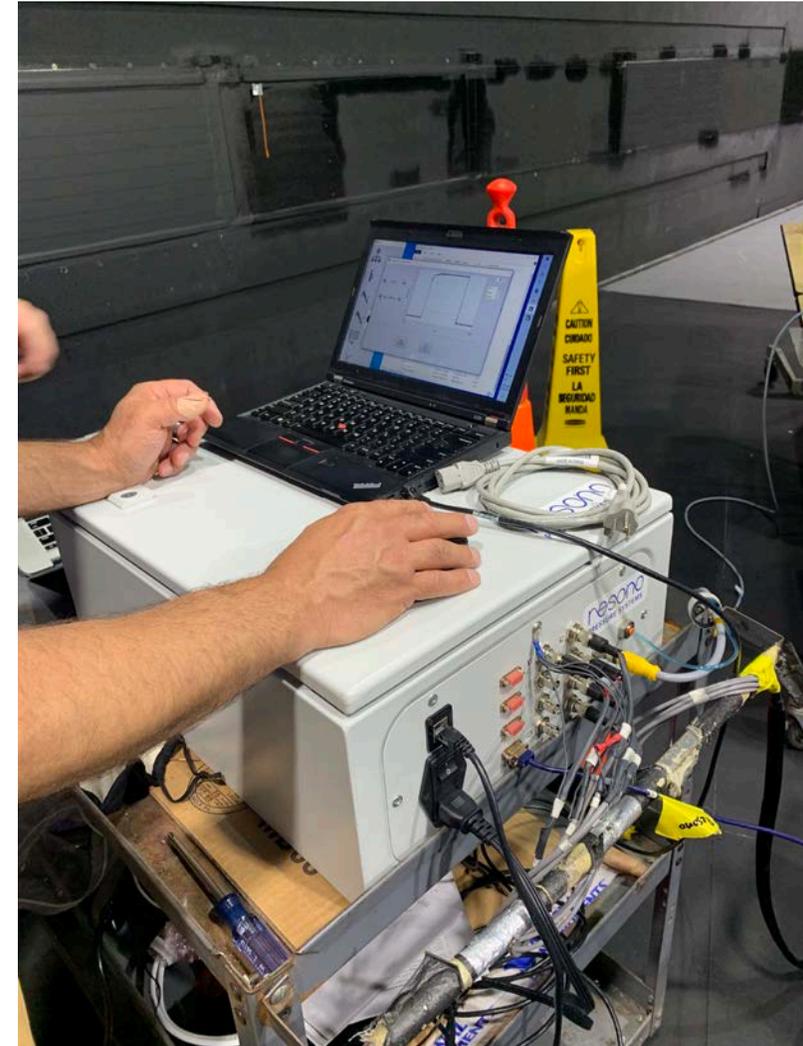
Resono



# Resono's Product History

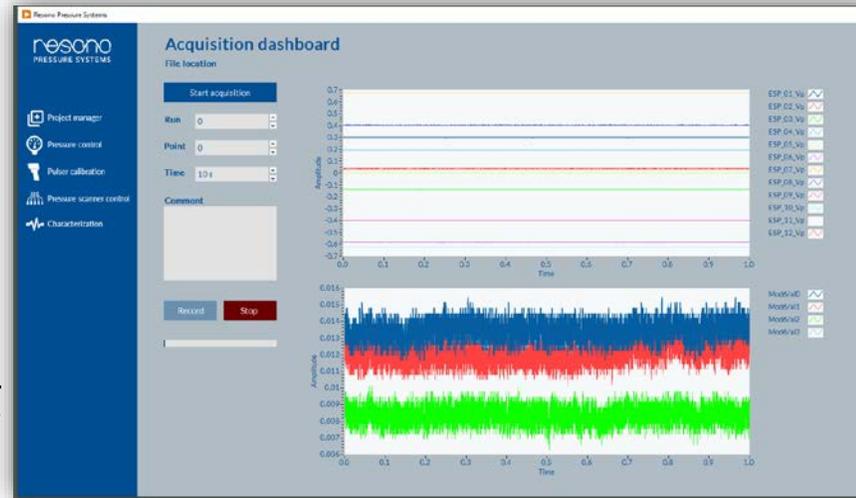


- **Resono Pressure Systems Founded in 2016**
  - Fisher Innovation Challenge 2016
  - DOE Phase I STTR
  - Air Force Research Labs STTR
    - Phase I
    - Phase II
  - WBC Match through ENDOW
  - NASA- Langley Demonstration



# The Product

- **Resono is a Software Company**
  - Software provides means to determine unsteady pressures using conventional hardware
- **Software Requires Hardware**
  - Hand-Held Pressure Characterization Device
  - Data-Acquisition System
- **Price Point is ~\$200K depending on the configuration**



# Resono Today - The Team



**Jonathan Naughton**

**PhD, Mechanical Eng., Penn State**  
**Chief Executive Officer**



**Pourya Nikoueeayan**

**PhD, Mechanical Eng., U. Wyoming**  
**Chief Technology Officer**



**John Strike**

**MSc, Mechanical Eng., U. Wyoming**  
**Hardware Design**



**Michael Hind**

**MSc, Mechanical Eng., U. Wyoming**  
**Algorithms**



**Stephen Whitmore**

**PhD, Aerospace Eng., UCLA**  
**Technology Adviser**



**Marvin Perry**

**MSc, Mechanical Eng., U. Wyoming**  
**System Integration**



**Leann Naughton**

**MSc, Biochemistry, Colorado State U.**  
**Business Manager**



**Benjamin Wimpenny**

**BS, Mechanical Eng., U. Wyoming**  
**System Development**

# Resono Today - Facilities

Our office and laboratory located in  
IMPACT 307 building in Laramie, Wyoming



We have expanded and improved our in-house system design and development capabilities.

## Resono Today – Current Activities

- **Phase II Small Business Innovative Research (SBIR) with Air Force**
  - Delivering 2 systems in December
- **Demonstration Test at NASA-Langley on the Space Launch System**
  - Carried out in July '21
  - Presenting results at a conference in June '22
    - 2 joint publications with NASA
- **Working on Next Projects**
  - First sales of a Beta commercial system
  - Additional grant-supported research for new applications
    - NASA- Langley, NASA-Armstrong
    - Arnold Engineering Development Center
  - Exploring Service-Based Product
    - System design
    - Fee-based testing



# Support from University of Wyoming and the State of Wyoming

- **Engineering Tier I Initiative**
  - Supported Pourya Nikoueeeyan during PhD studies
    - Part of his time was used to start Resono
- **Entrepreneurship Competitions**
  - Fisher Innovation Challenge 2016
    - Among 6 teams selected for development
  - Ellbogen \$50k Competition 2020
    - First Place Winner (\$30k)
- **Impact 307 Office Space and Support**
  - Small office in 2017
  - Moved into larger space in Summer 2020
  - Coaching from Impact 307 Personnel
- **Wyoming Business Council Support**
  - Phase I STTR Matching Grant
    - \$100k
  - Phase II STTR Matching Grant
    - \$200k

**This Support has Directly Impacted  
Resono's Ability to Develop**



# Ideas to Further Encourage Economic Development

- **Support the Research Enterprise**
  - This is contracting due to reduced budgets
    - Less research, fewer ideas
- **Provide Faculty the Incentives and Support to Develop Their Ideas**
  - Faculty are busy already
  - Little credit is given to faculty for this work (this is something the academic side needs to address)
  - Assisting faculty in the process can be the difference between an idea being pursued or not
- **Make Economic Development Support a 1-Stop Shop**
  - Over the time Resono has existed, have seen the organization of these activities vary
  - The support structure is scattered
    - Business College
    - Engineering and Applied Science
    - Impact 307
- **Encourage Faculty/Student Collaboration**
  - It is rare that a student has the background or experience necessary
  - Faculty typically lack time
  - Most economic development will grow out of the graduate programs
    - More emphasis is needed here

# Questions



# Carnegie R1 Classification

Kevin Carman

July 17, 2021

# Why does a “R1” designation matter?

- Recruitment of outstanding graduate and undergraduate students
- Recruitment and retention of outstanding faculty
- Reputation among peer universities
- Credibility with funding agencies
- Enhanced opportunities to contribute to state economic development
- Prestige with employers and alumni

# Who determines Carnegie research classification?

- Carnegie Foundation for the Advancement of Teaching
  - Indiana University
- Last reclassification in 2018
  - 130 R1
  - 131 R2
- Next assessment in December of 2021

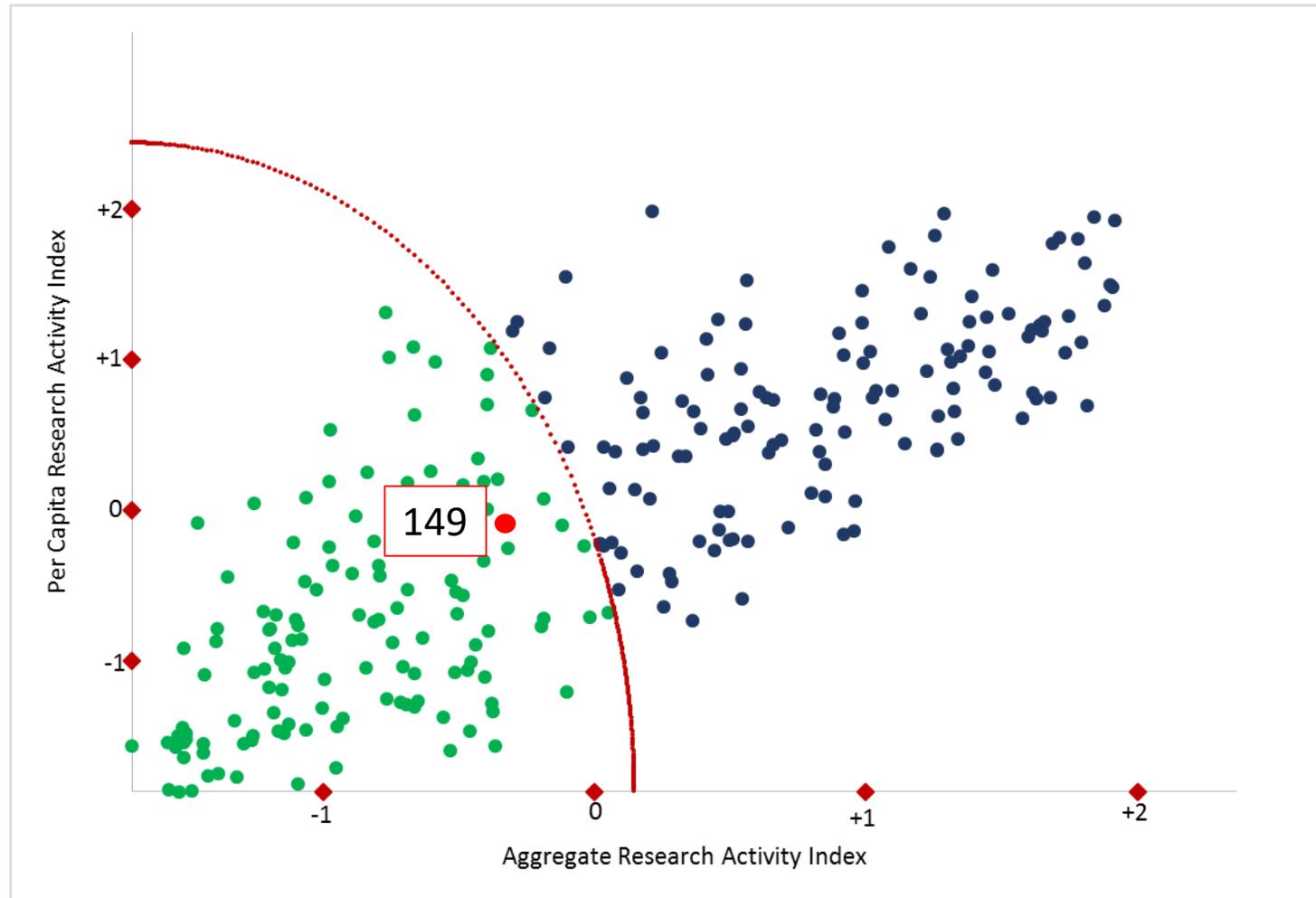
# Carnegie Metrics

- Doctoral degrees
  - Humanities
  - Social Sciences
  - STEM
  - Other Professional
- Non-Faculty PhD Research Staff (e.g., postdocs)
- Research Expenditures
  - Science & Engineering (S&E)
  - Non-S&E
- Each metric ranked (261-1)

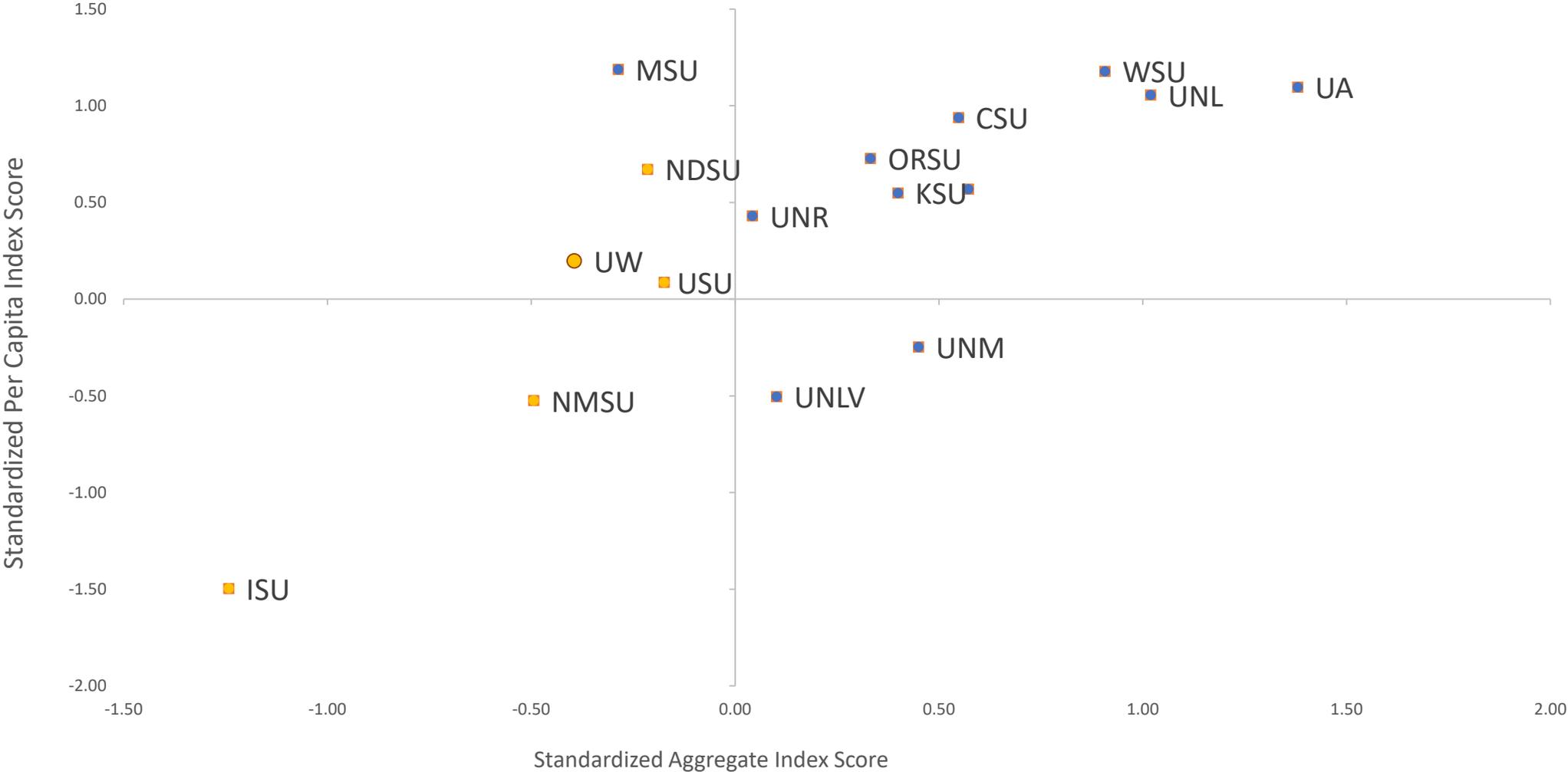
# Aggregate vs. Per Capita Indexes

Aggregate Research	Weight	Per Capita Research	Weight
STEM Doctorates	.909	STEM Expenditures	.935
STEM Expenditures	.899	Research Staff	.930
Research Staff	.894	Non-STEM Expenditures	.619
Doctorates: Social Sciences	.864		
Doctorates Humanities	.839		
Non-STEM Expenditures	.817		
Doctorates: Other Fields	.621		

# Combined weighted ranks are converted to standardized scores



# Standardized Per Capita Index Score and Standardized Aggregate Index Score



# How do we compare to R1 and R2 universities?

	STEM Expenditures (1000s)	Non-STEM Expenditures (1000s)	S&E Research Staff	Doctorates: Humanities	Doctorates: Social Sciences	Doctorates: STEM	Doctorates: Other Fields
R1 Median	295,776	18,986	346	36	37	160	65
R2 Median	25,644	2,191	23	0	4	23	24
UW	121,927	3,105	83	0	7	70	29

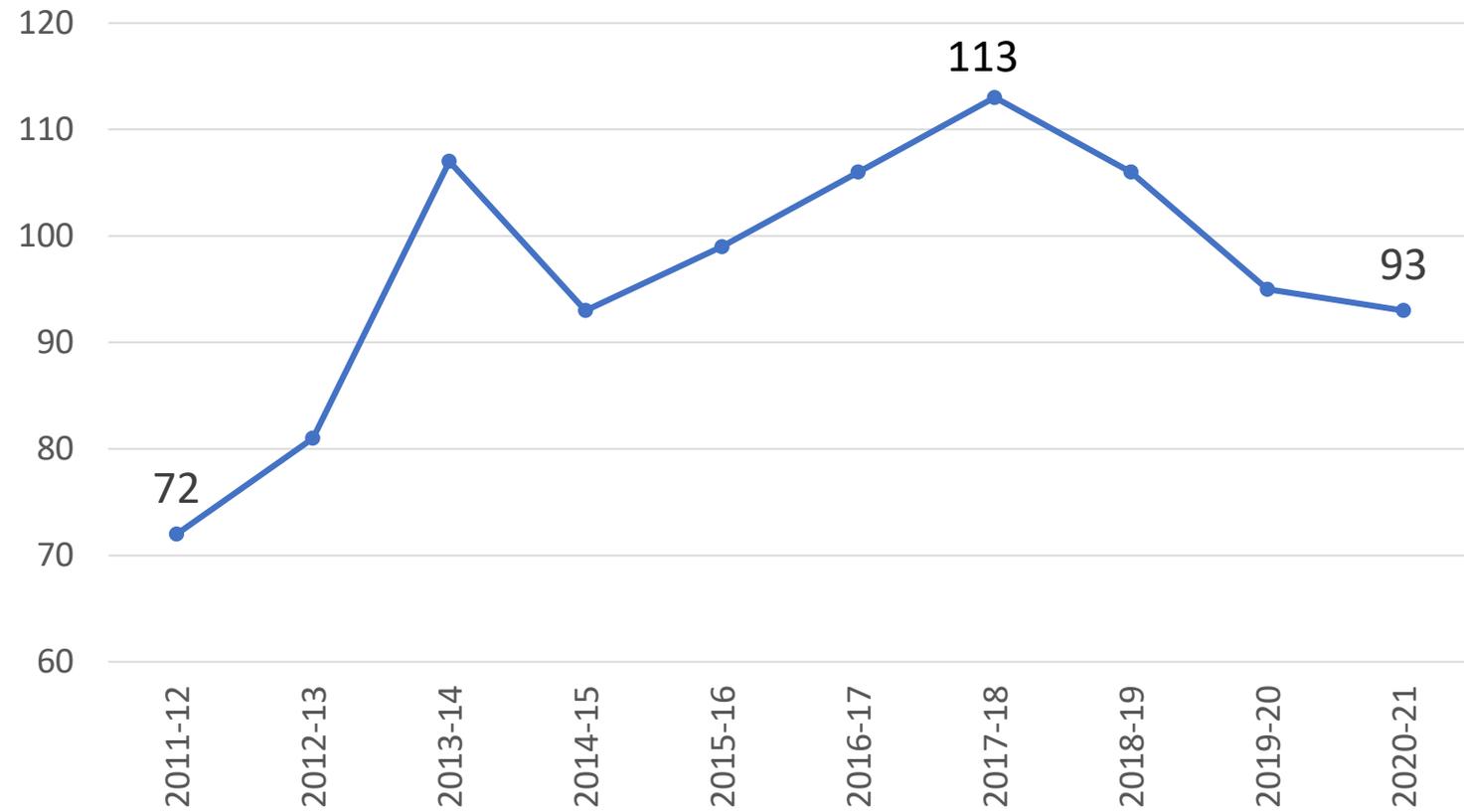
# How do we compare to R1 and R2 universities?

	Per-capita STEM Expenditures (1000s)	Per-capita Non- STEM Expenditures (1000s)	Per-capita S&E Research Staff	Number of Faculty
R1 Median	232	15.0	0.27	1263
R2 Median	63	4.7	0.05	469
UW	229	5.8	0.16	530

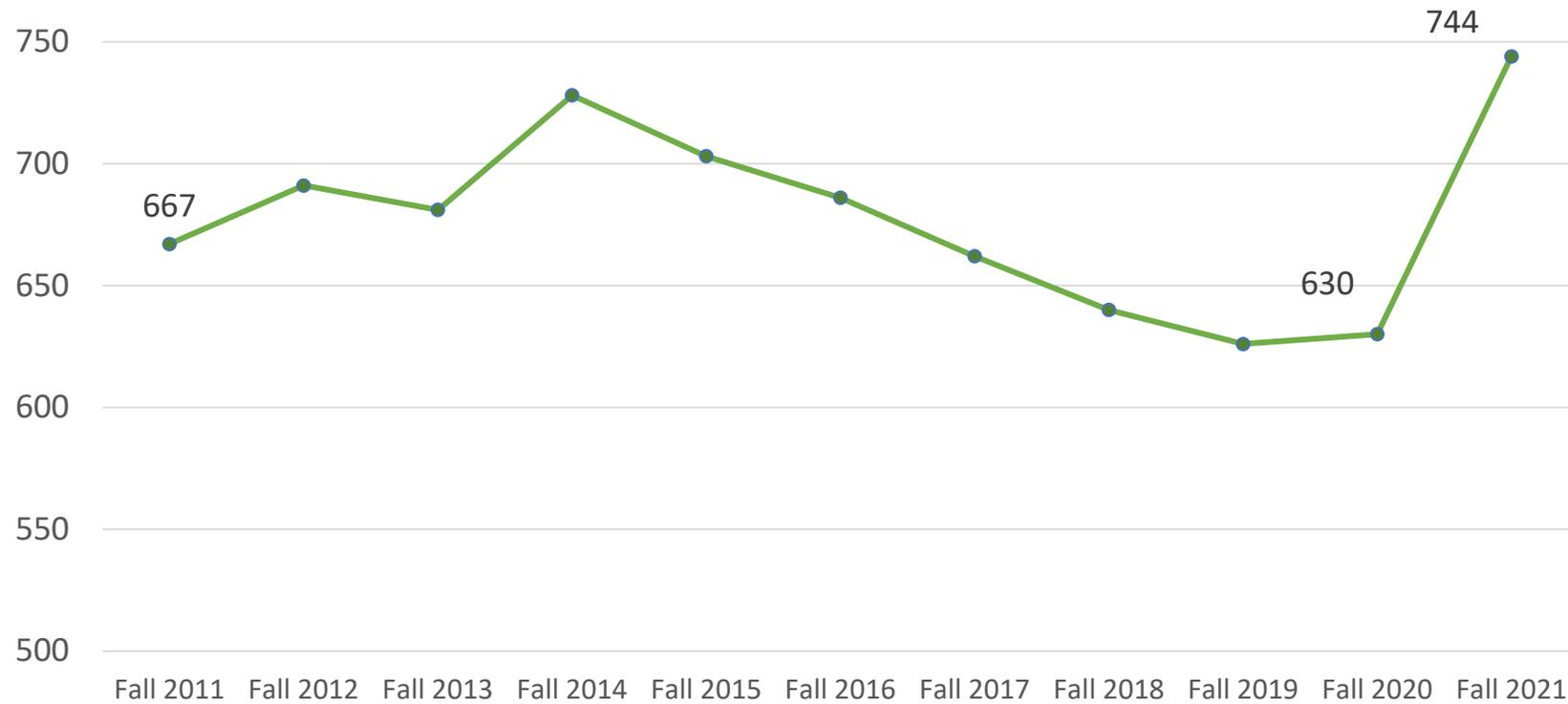
# The Need for Faculty in PhD programs

	Utah	New Mexico	UW
Total faculty	992	894	530
Faculty in PhD Programs	853	737	347
% in PhD Programs	86%	82%	65%

# Doctoral Graduates

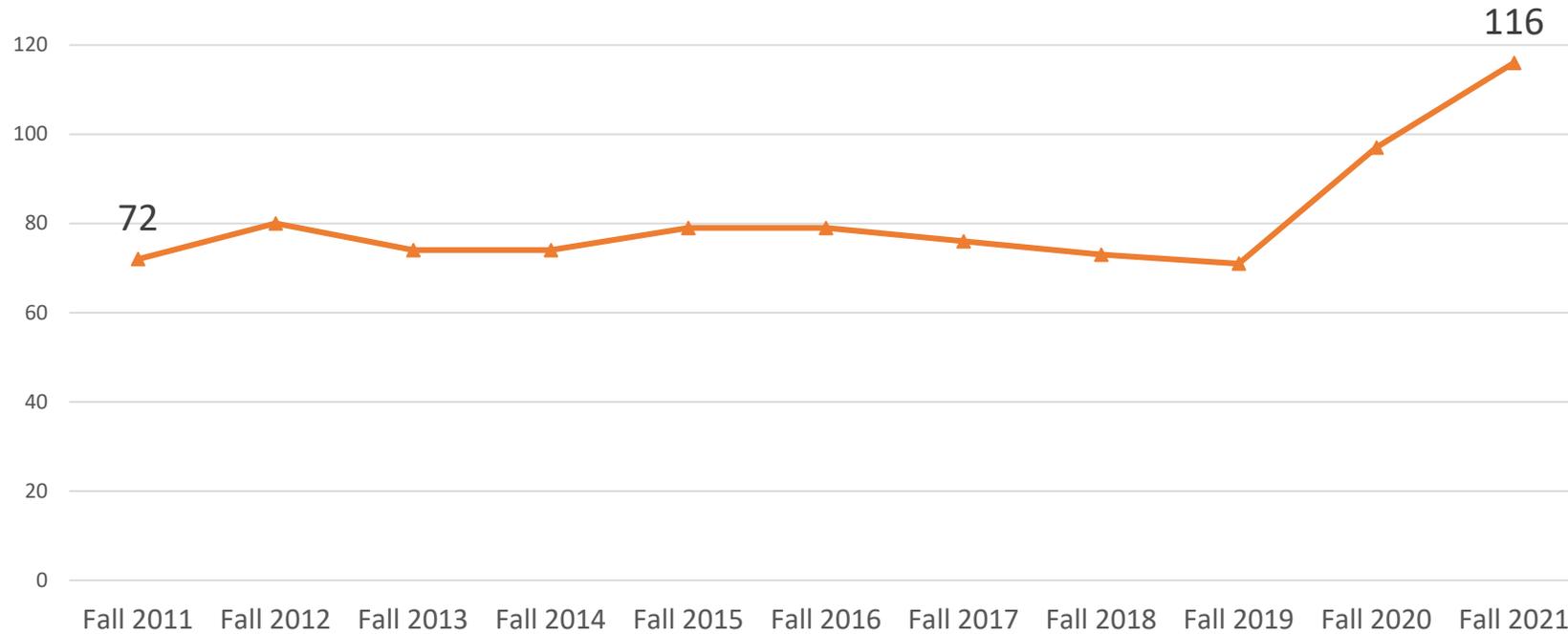


# Doctorate Enrollment

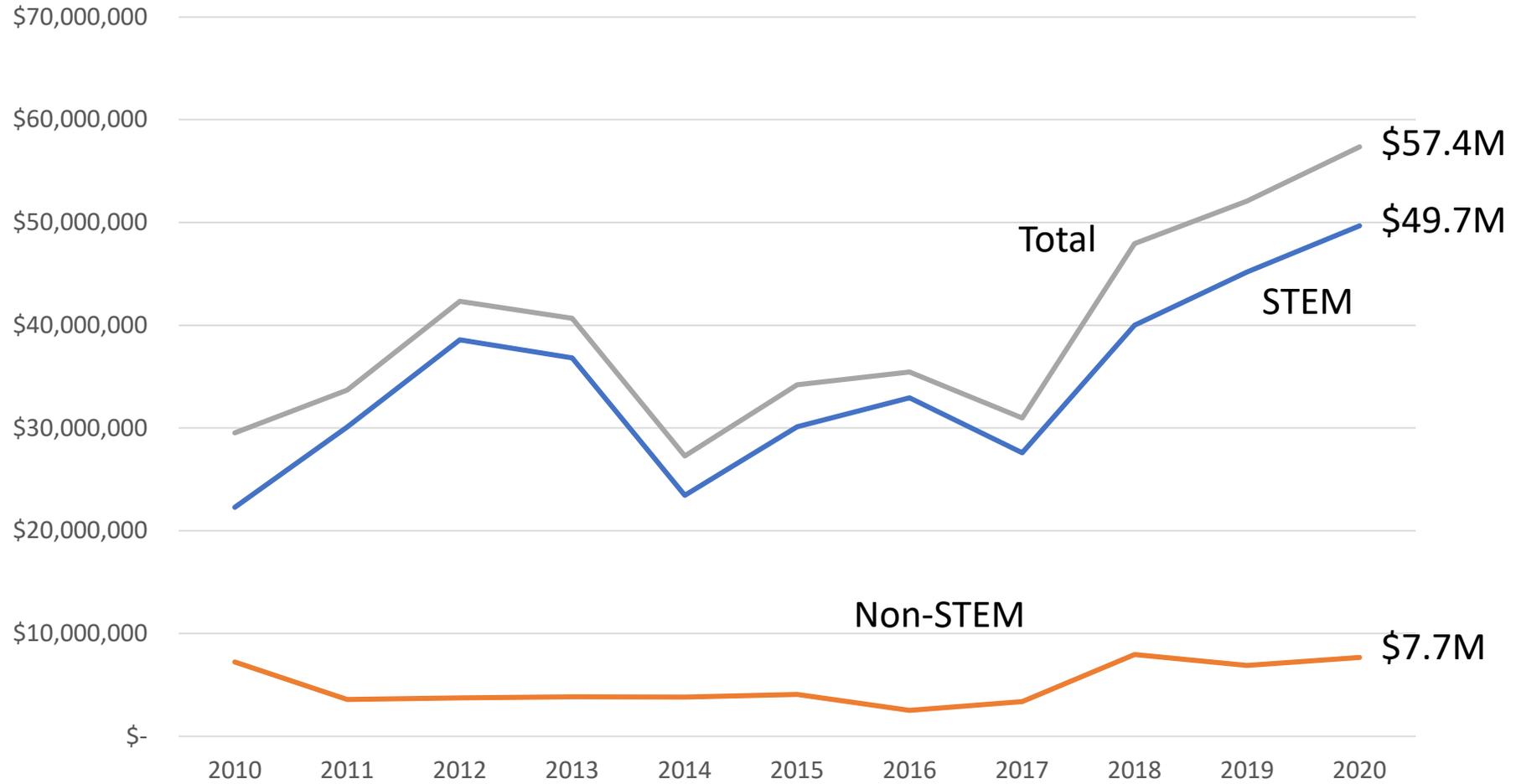


# Research Personnel

Post Doc, Research Prof, & Research Scientists with PhD



# Federal Research Expenditures



# Strategic next steps

- Assure we are getting full credit
  - Postdocs and research faculty
  - Faculty salaries/HERD reporting
- Strategic investments
  - ORED
  - Faculty in doctoral programs
  - Doctoral programs in humanities/social sciences
  - Graduate assistantships
  - Graduate stipends