



ATM | TEXAS A&M
UNIVERSITY



TURBOMACHINERY LABORATORY
TEXAS A&M ENGINEERING EXPERIMENT STATION



51ST TURBOMACHINERY & 38TH PUMP SYMPOSIA

SEPTEMBER 13-15, 2022 | HOUSTON, TX | GEORGE R. BROWN CONVENTION CENTER

WELCOME ADDRESS



MUSTER AREAS

PROCEEDINGS ACCESS

Look for the flyer in your delegate bag for instructions

- Two options
 - **TPS Website**
 - **Mobile App**



DOWNLOAD THE MOBILE APP

- Visit the app store on your smart device.
- Search for and download **Turbomachinery & Pump Symposia**.
- Login: **Your email address**
- Password: **Your registration confirmation number**



LUNCHES

Tuesday & Wednesday

Noon – 2 p.m.

Back of Exhibit Hall D



DINNERS

Tuesday – Tex-Mex

7:30 – 9 p.m.

Level 2, Hilton Ballroom A

Wednesday – Banquet

7:30 – 9 p.m.

Level 2, Hilton Ballroom A

Badges required; not open to Free Pass

TPS 2023 – Call for Papers open

Short Courses: **September 25, 2023** | Symposia: **September 26 – 28, 2023**

PUMP & TURBO 2023 PUBLICATIONS CALENDAR

- October 21, 2022: Abstract Deadline
- March 6, 2023: Full manuscripts, short course titles, authors and outlines due
- June 1, 2023: Final, monitor-approved manuscripts and author forms due

Welcome Dr. Guillermo Aguilar



- Professor, Mechanical Engineering at Texas A&M University
- James and Ada Forsyth Professor
- Department Head, Mechanical Engineering at Texas A&M University



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J. Mike Walker '66 Department of
Mechanical Engineering

Welcome Remarks – TPS 2022

Guillermo Aguilar, Ph.D.

September 13, 2022

Outline



TEXAS A&M UNIVERSITY

J. Mike Walker '66 Department of
Mechanical Engineering

- Education and Career
- Representative Research Topics
- J. Mike Walker '66 Department of Mechanical Engineering
 - Vision
 - By the numbers
- Our product: Students
- Turbomachinery Laboratory
- Industry Advisory Council

Education



- 1988-1993
 - UNAM (National Autonomous University of Mexico)
 - B.Sc. Mechanical and Electrical Engineering (Honors)
- 1993-1999
 - UCSB (University of California Santa Barbara)
 - M.S. Mechanical Engineering (1995)
 - Ph.D. Mechanical Engineering (1999)
- 1999-2003
 - UCI (University of California Irvine)
 - Whitaker Postdoctoral Fellow (1999-2000)
 - Researcher (2000-2001)
 - Beckman Laser Institute
 - Adjunct Assistant Professor (2001-2003)
 - Center for Biomedical Engineering



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UNIVERSIDAD
NACIONAL
AUTONOMA DE
MEXICO



Career

- 2003-2021
 - UCR (University of California Riverside)
 - Assistant Professor of Mechanical Engineering (2003-2007)
 - Associate Professor of Mechanical Engineering (2007-2011)
 - Professor of Mechanical Engineering (2011)
 - Graduate Advisor (2005-2010; 2011-2013)
 - Department Chair (2013-2021)
- 2021 -
 - Texas A&M University (TAMU)
 - Department Head, J. Mike Walker '66 Department of Mechanical Engineering



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Representative Topics of Past/Current Research

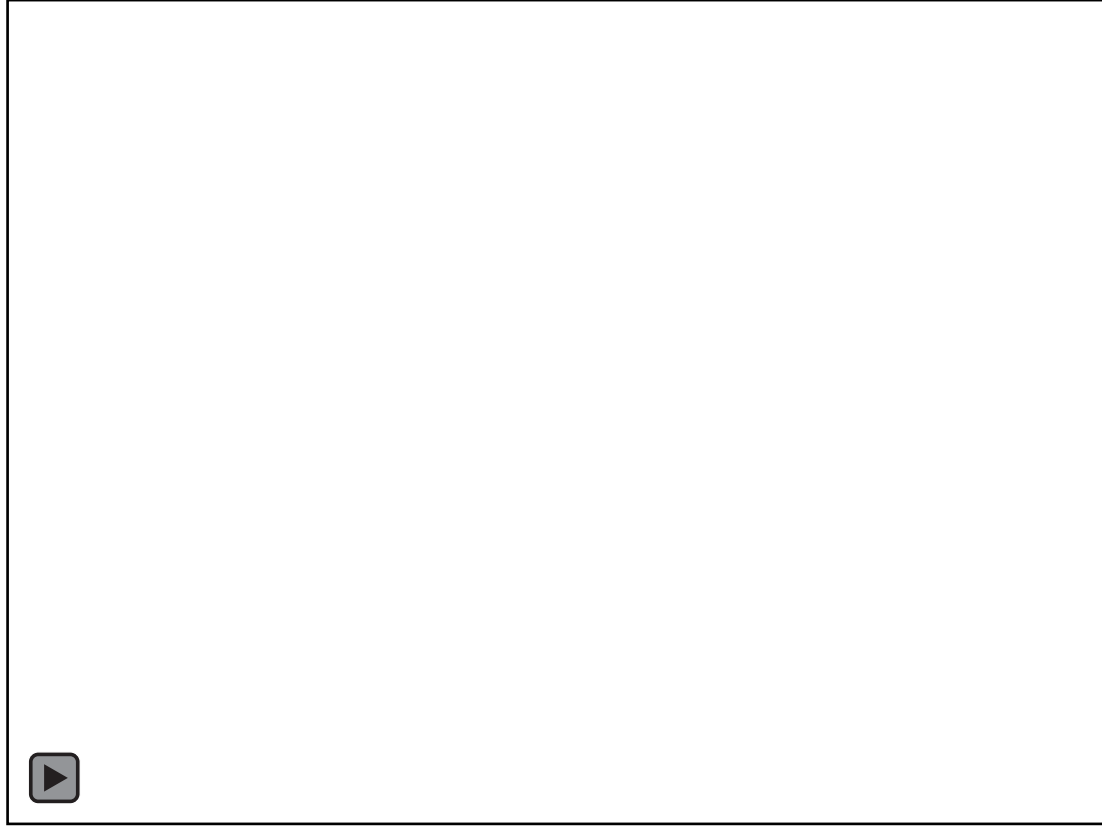


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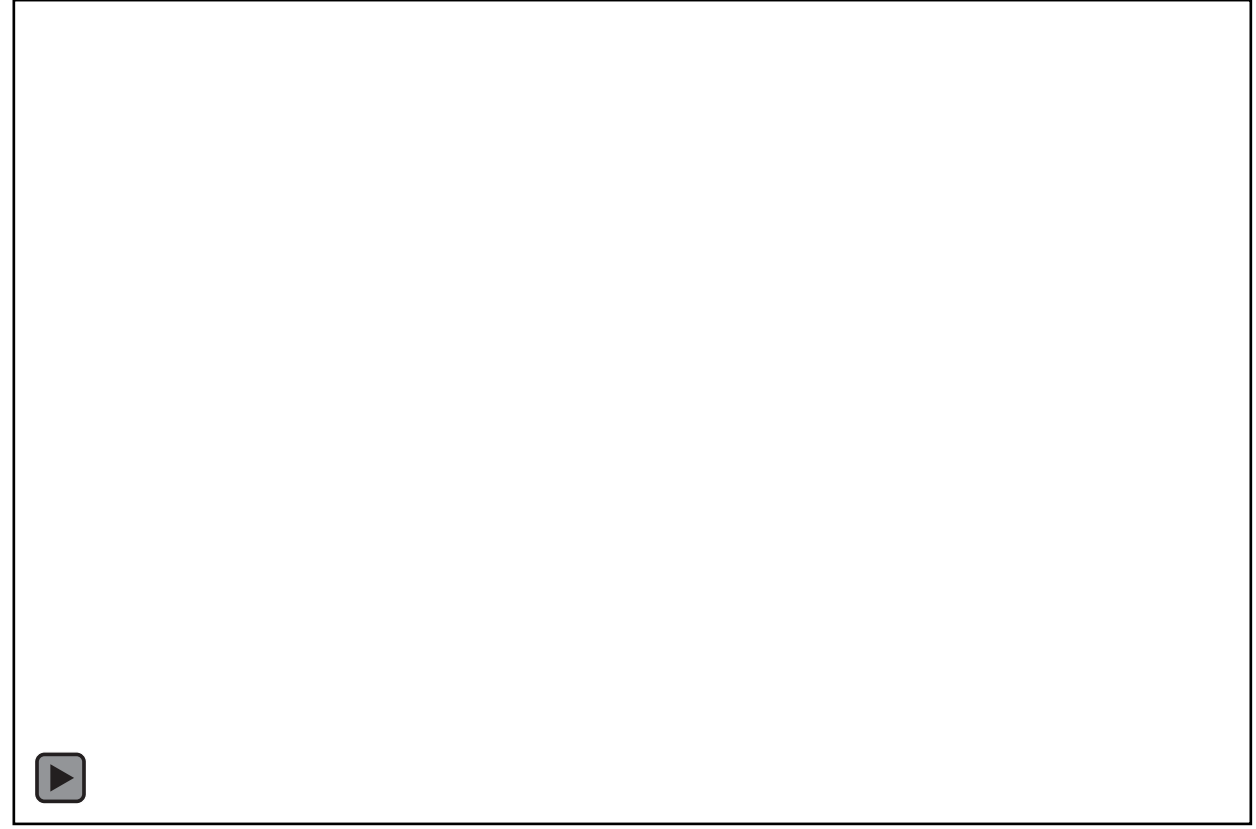
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- Cryogenic spray cooling/droplet impact
- Laser-tissue interactions
- Materials processing
- Window to the Brain (WttB)
 - Diagnostic
 - Therapeutics
- Laser rewarming of cryogenically preserved biological tissues (TA3: ATP-Bio – ERC)

Funded by multiple contracts with Sandia
National Laboratories (2006-2011)



Sandia



Laboratory, UCR

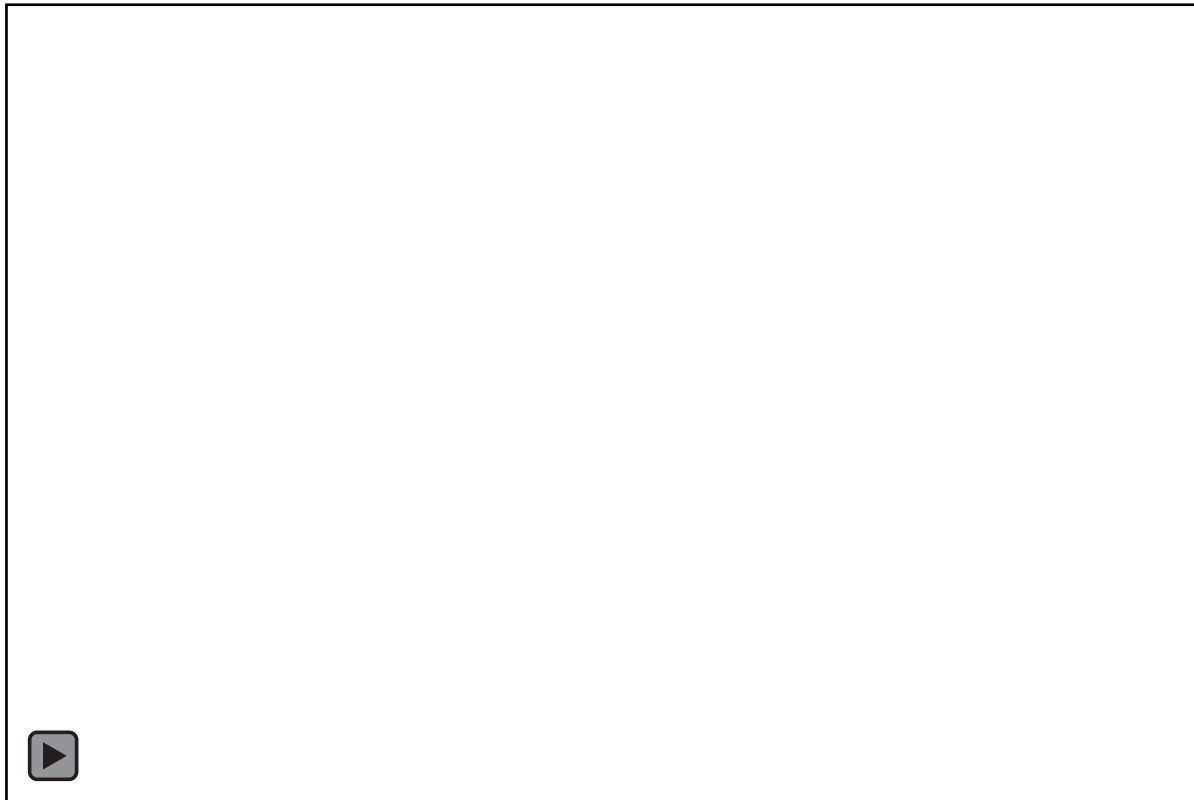


Pressure effect on impact dynamics

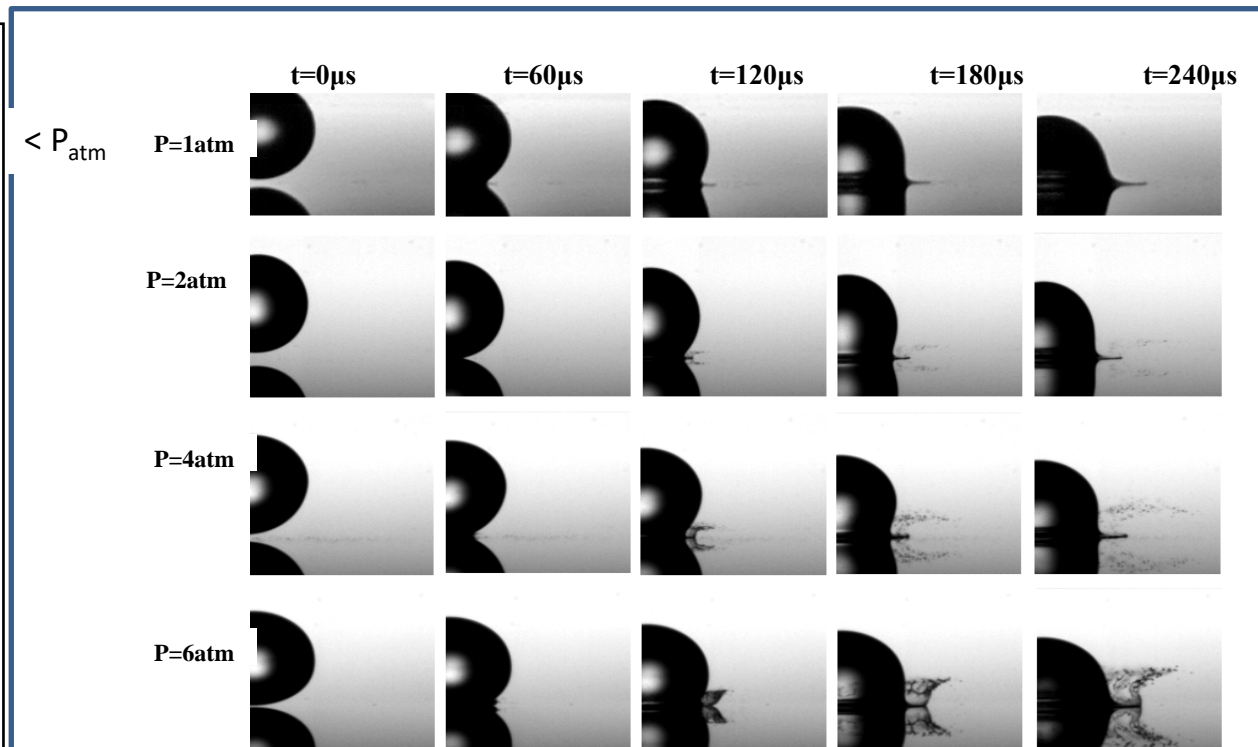
Weak splash occurs from
 $0.4 \leq P \leq 1$ atm.

As pressure increases, “crown” splash becomes evident.

(FC- 72, $D = 1.68$ mm, $V = 2.08$ m/s and $We = 1000$)



Schliering Imaging



J. Liu et al., *Splashing Phenomena During Liquid Droplet Impact*, 2010, *Atomization and Sprays* 20(4).

Representative Topics of Past/Current Research



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Materials Processing



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Waveguide-like structures written in transparent polycrystalline ceramics with an ultra-low fluence femtosecond laser

Gabriel R. Castillo-Vega,¹ Elías H. Penilla,^{2,3} Santiago Camacho-López,¹
Guillermo Aguilar,² and J. E. Garay^{2,3,*}

¹Departamento de Óptica, División de Física Aplicada, Centro de Investigación Científica y de Educación Superior de Ensenada, Ensenada, B.C., México

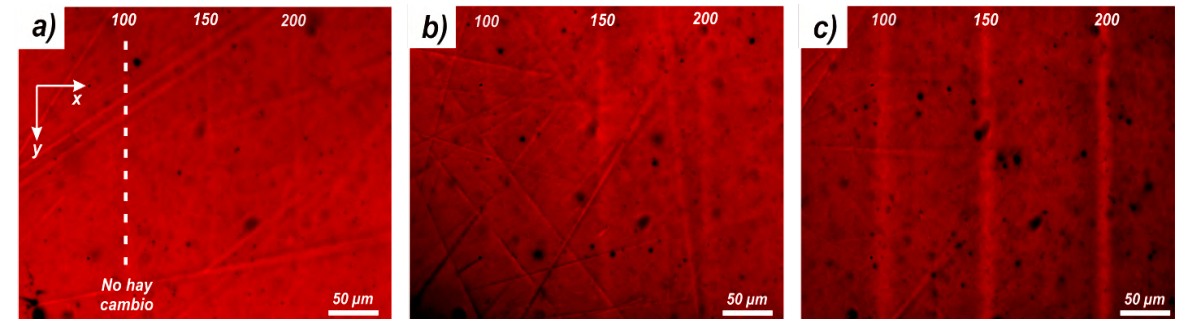
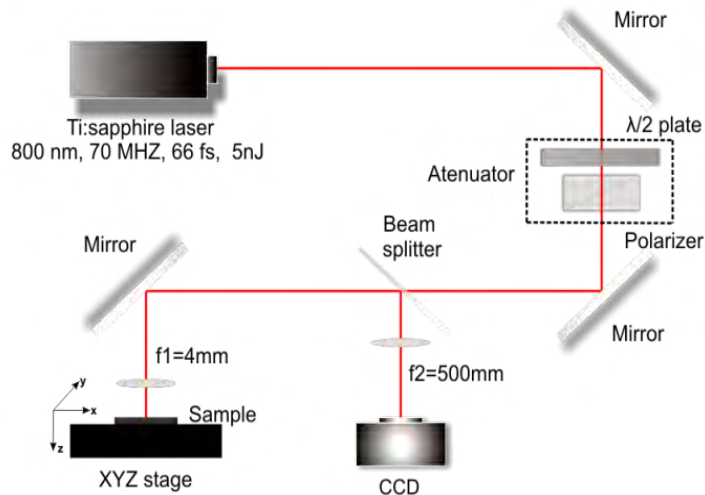
²Department of Mechanical Engineering, University of California, Riverside, CA 92521, USA

³Materials Science and Engineering Program, University of California, Riverside, CA 92521, USA

*jegaray@engr.ucr.edu

Received 7 Aug 2012; accepted 28 Aug 2012; published 20 Sep 2012

1 October 2012 / Vol. 2, No. 10 / OPTICAL MATERIALS EXPRESS 1416

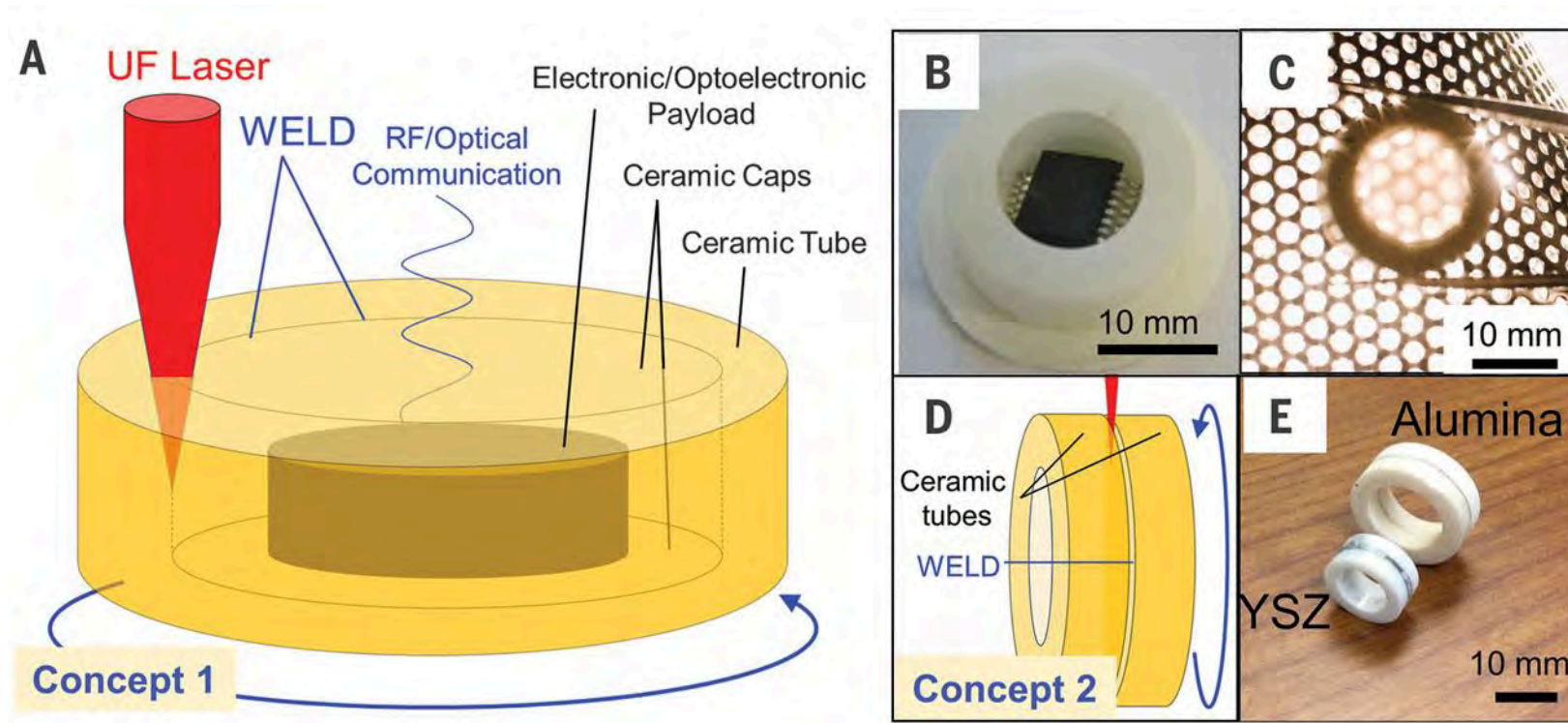


Laser Welding of Ceramics



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Fig. 1 Two concepts for UF laser welding of ceramics.



E. H. Penilla et al. *Science* 2019;365:803-808

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Science
AAAS

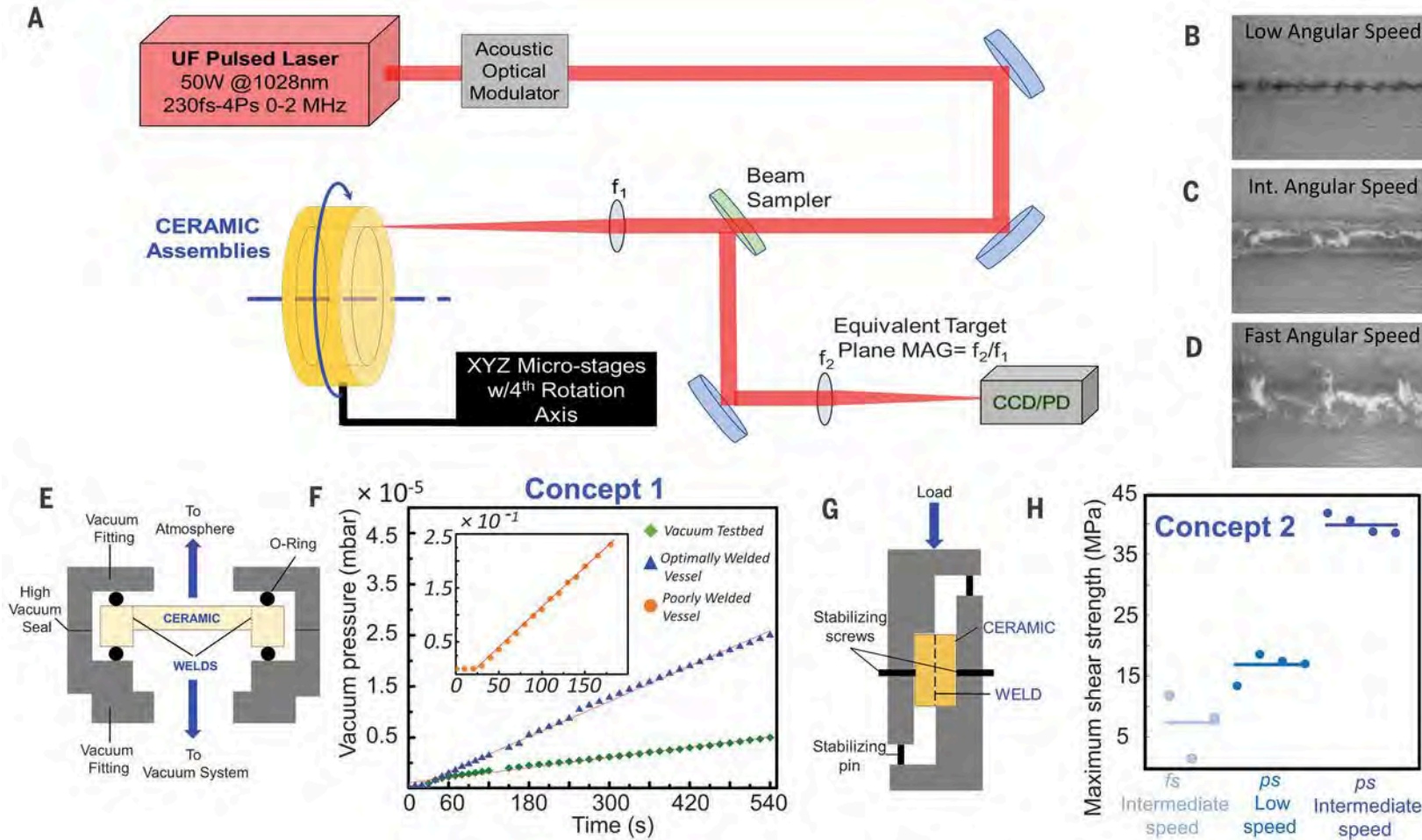
Laser Welding of Ceramics

Fig. 4 Laser welding of YSZ ceramic assemblies.



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E. H. Penilla et al. Science 2019;365:803-808

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Representative Topics of Past/Current Research



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Gen 4: NSF – ERC Center: ATP-BioSM



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TA 3: Laser Rapid Warming of Droplet Systems

Ideal Warming



Overheating



Kangas unpub. 2019

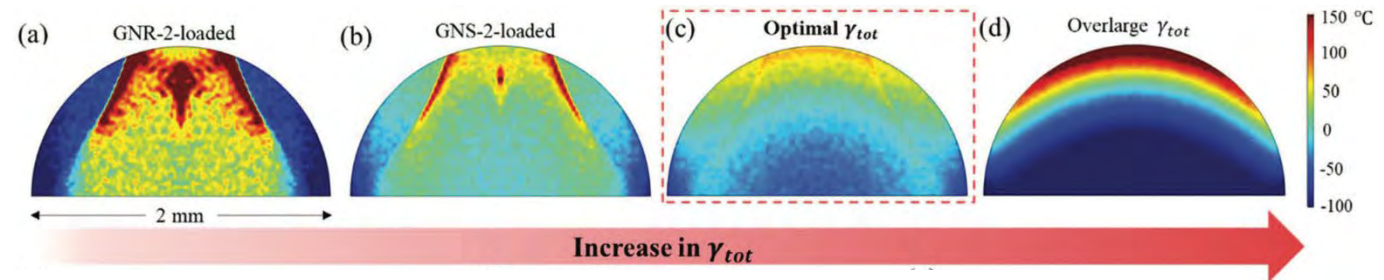
Uniformity:

Designing nanoparticles (Gamma = absorption/scattering)

Achievable rates:

Heating:

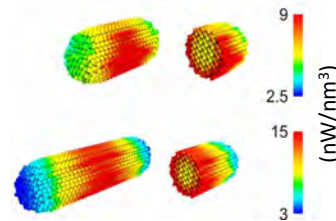
$10^5 - 10^8$ °C/min



Liu Nanoscale 2020

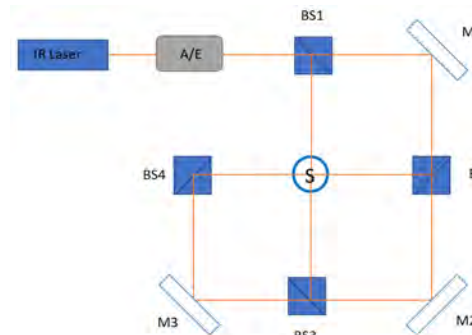
Nanoparticle Design:

Yin and Mangolini (UCR), Stadler (UMN)

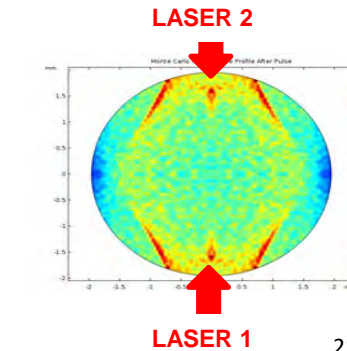


Baffou APL 2009

Beam Splitting Multiple Mirrors



Aguilar UCR



Administrative Leadership Team



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Guillermo Aguilar
Department Head



Sharli Nucker
Senior Director of Operations



Carlos Corleto
Undergraduate Program Director



Bryan Rasmussen
Associate Department Head,
Graduate Program



Waruna Kulatilaka
Associate Department Head,
Undergraduate Programs



Pablo Tarazaga
Associate Department Head,
Research and Strategic Initiatives



Anastasia Muliana
Faculty Mentoring and Success
Committee Representative



Lesley Wright
ABET Representative

Develop the profile of a top-5 MEEN department

- Capitalize on previous investments in infrastructure
 - State of the Art Academic Facilities: e.g., common labs: FEDC, Zachry Building
 - **State of the Art Research Facilities: Turbolab**
 - Potential for large-scale capital growth: RELLIS
- Personnel
 - Excellent mix of junior (13 assistant); midcareer (24 associate)—Recipients or prospects of CAREER, YIA, etc; and senior (37 professors)—accomplished (e.g., highly decorated, chaired, NAE members)
- Initiatives
 - Pursuit of new and large initiatives (DoD & National Lab Centers, ERCs, EFRC, etc.)
- Faculty growth
 - Student/faculty manageable; teaching load commensurate with other responsibilities (e.g., research, industry engagement)
 - Proper mix of faculty: regular lines (T/TT) and academic professional tracks (APT)
 - Diversity in hiring (ACES, ACES-Plus)

Vision



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MECHANICAL ENGINEERING
TEXAS A&M UNIVERSITY

- Retain faculty through mentorship and professional development
 - Mentoring and Success Program – ongoing and model for the CoE
 - Paths toward promotion
- Development
 - Endowed faculty positions (Fellowships, Career Developmental Professorships, Professorships, Chairs)
→ 43 named positions,
 - IAC endowed faculty fellowship for PoP – *new* professorship
 - Provide more scholarships and fellowships to better support our students
- Tell more of our story, better, and often
 - Have presence in all social media channels targeting different audiences
 - LinkedIn, Facebook, Instagram (TAMUMEEN)– *new*
 - Recognize our faculty, staff and students: high level awards and continuously

Department by the Numbers



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75
T/TT
Faculty

31
Staff

1,500
Undergrad
Students

23
APT Faculty

530
Grad
Students

Qatar Program
11 faculty
~160 students

USNWR vs Shanghai Rankings



U.S. News and World Report ranking of engineering departments/programs is based solely on the judgements of department heads/chairs

Shanghai Rankings are only metrics-based; looking at 1) high-impact publications, 2) citations, 3) international collaborations, 4) publications in top journals, and 5) awards

MEEN (Publics)	Shanghai	USNWR-UG*	USNWR-GR*
TAMU	4	7	7
UT- Austin	20	6	6
Univ. of Michigan	23	3	4
Purdue University	26	5	5
UI-UC	27	4	3
UC - Berkeley	31	2	1
Georgia Tech	33	1	2
Penn State	51-75	9	7
UCLA	151-200	8	8

* USNWR are public institution rankings

2022 Shanghai Global Ranking of Academic Subjects: Mechanical Engineering



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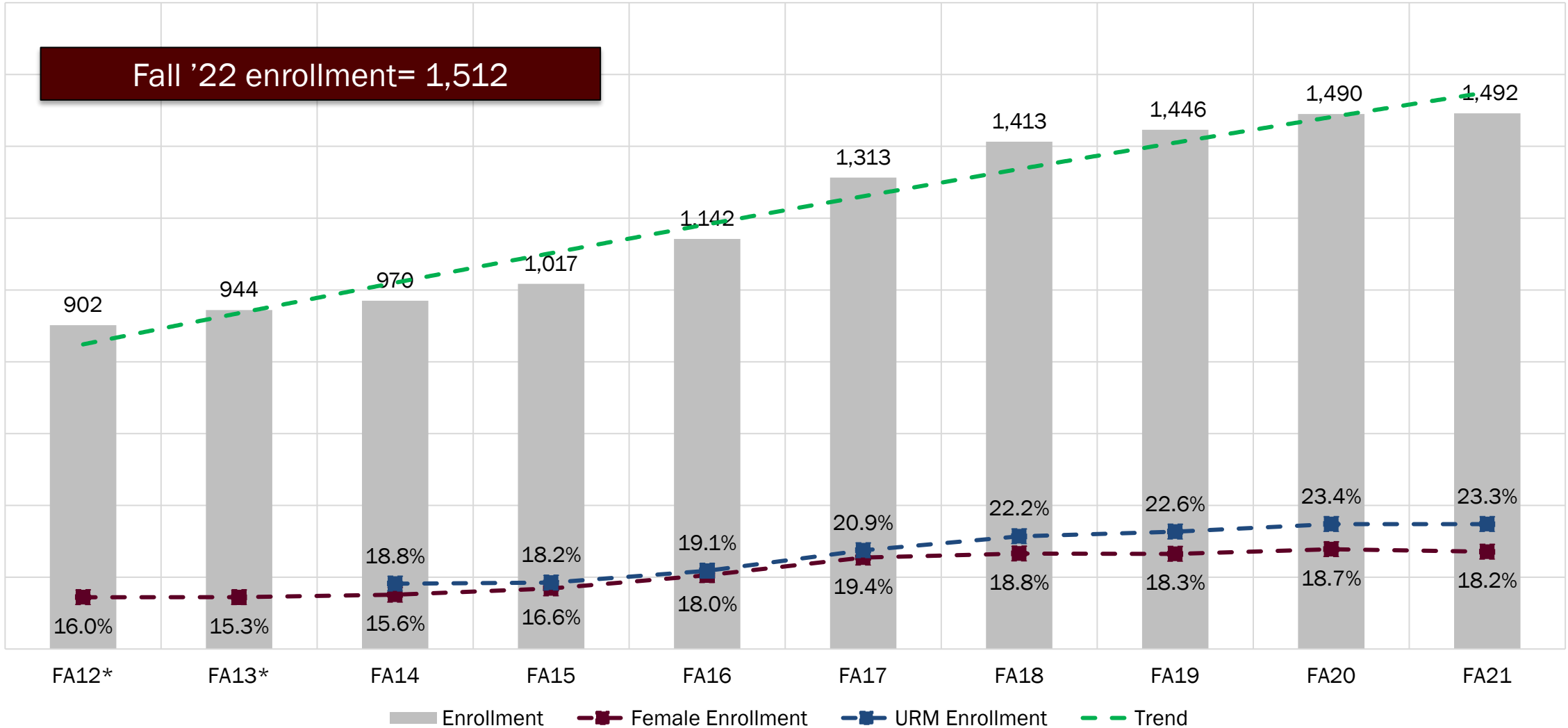
World Rank	Institution	Country/Region	Total Score
1	Xi'an Jiaotong University		285.0
2	University of Cambridge		271.3
3	Shanghai Jiao Tong University		267.2
4	Texas A&M University		266.7
5	Tsinghua University		265.9
6	Stanford University		251.4
7	Nanyang Technological University		248.2
8	University of California, San Diego		245.7
9	Northwestern University		244.1
10	California Institute of Technology		242.6

- **#4 Internationally**
- **#1 Nationally**
- Rankings based on metrics only:
 - High-impact publications (research output) (100)
 - Citations (100)
 - International collaborations (20)
 - Publications in top journals (research quality) (100)
 - Awards (100)

Undergraduate Enrollment Trends



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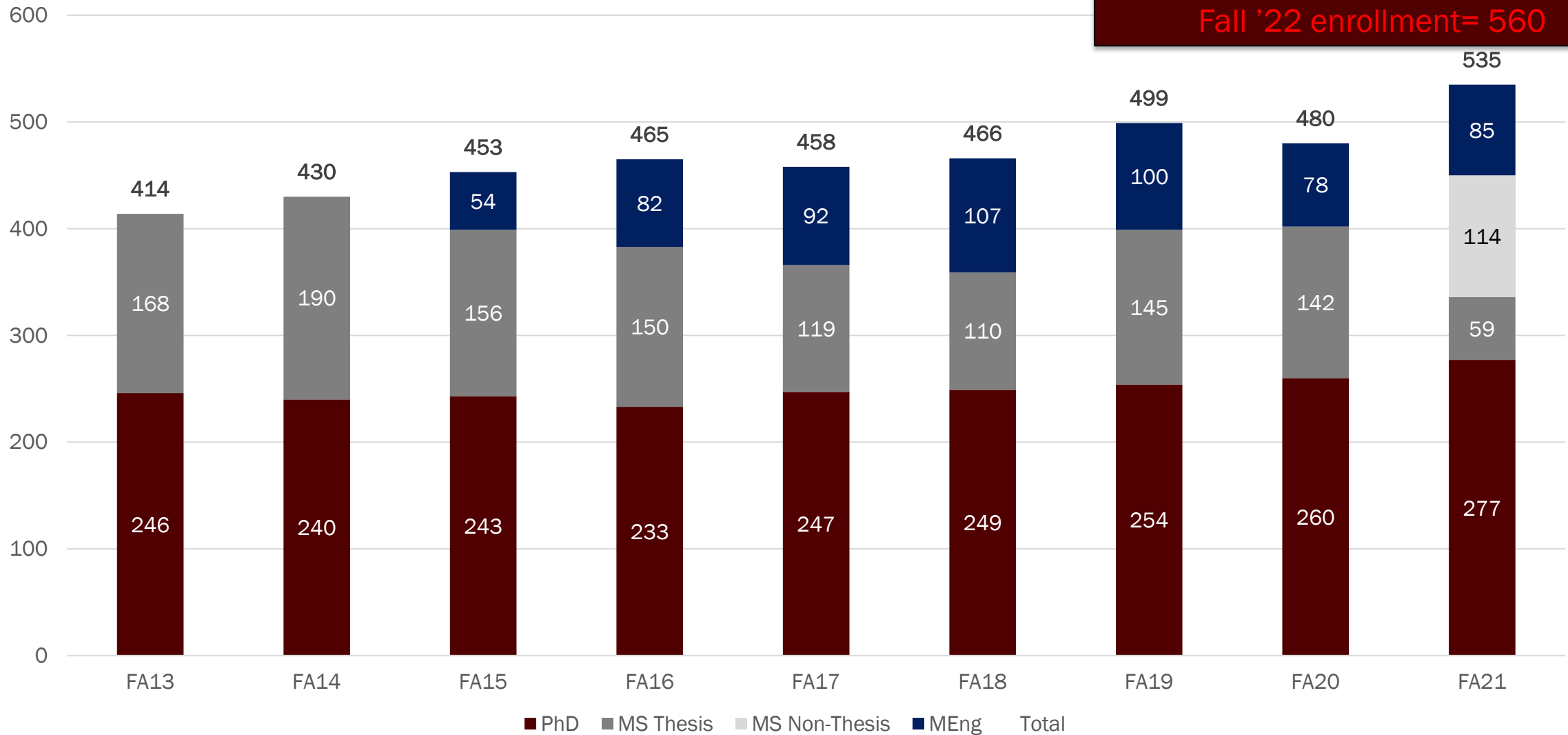
* U1 students excluded for consistency

Graduate Enrollment Trends



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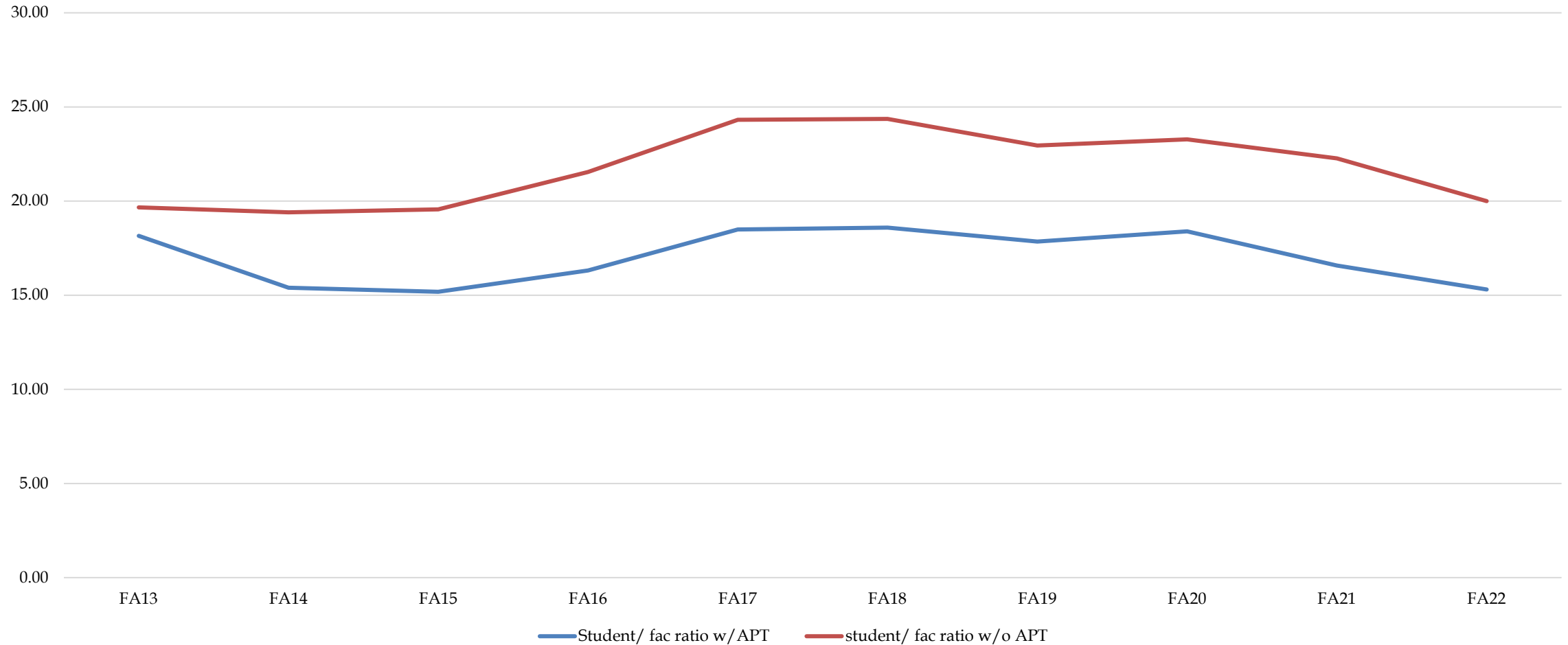
Fall '22 enrollment= 560



Student to faculty ratios



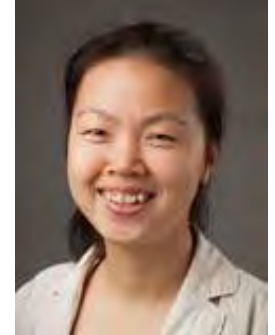
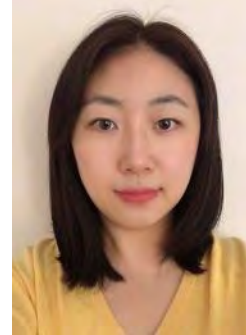
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New Faculty – Fall 2022



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**Aravind
Krishnamoorthy**
Assistant Professor

**Matthew Powell-
Palm**
Assistant Professor

Yuxiao Zhou
Assistant Professor

Wei Gao
Associate Professor

Jenny Qiu
Associate Professor



Matthew Elliot
Instructional
Associate Professor

Naveen Thomas
Instructional
Assistant Professor

Ravi Thyagarajan
Professor of Practice

Hai Tran
Instructional
Assistant Professor

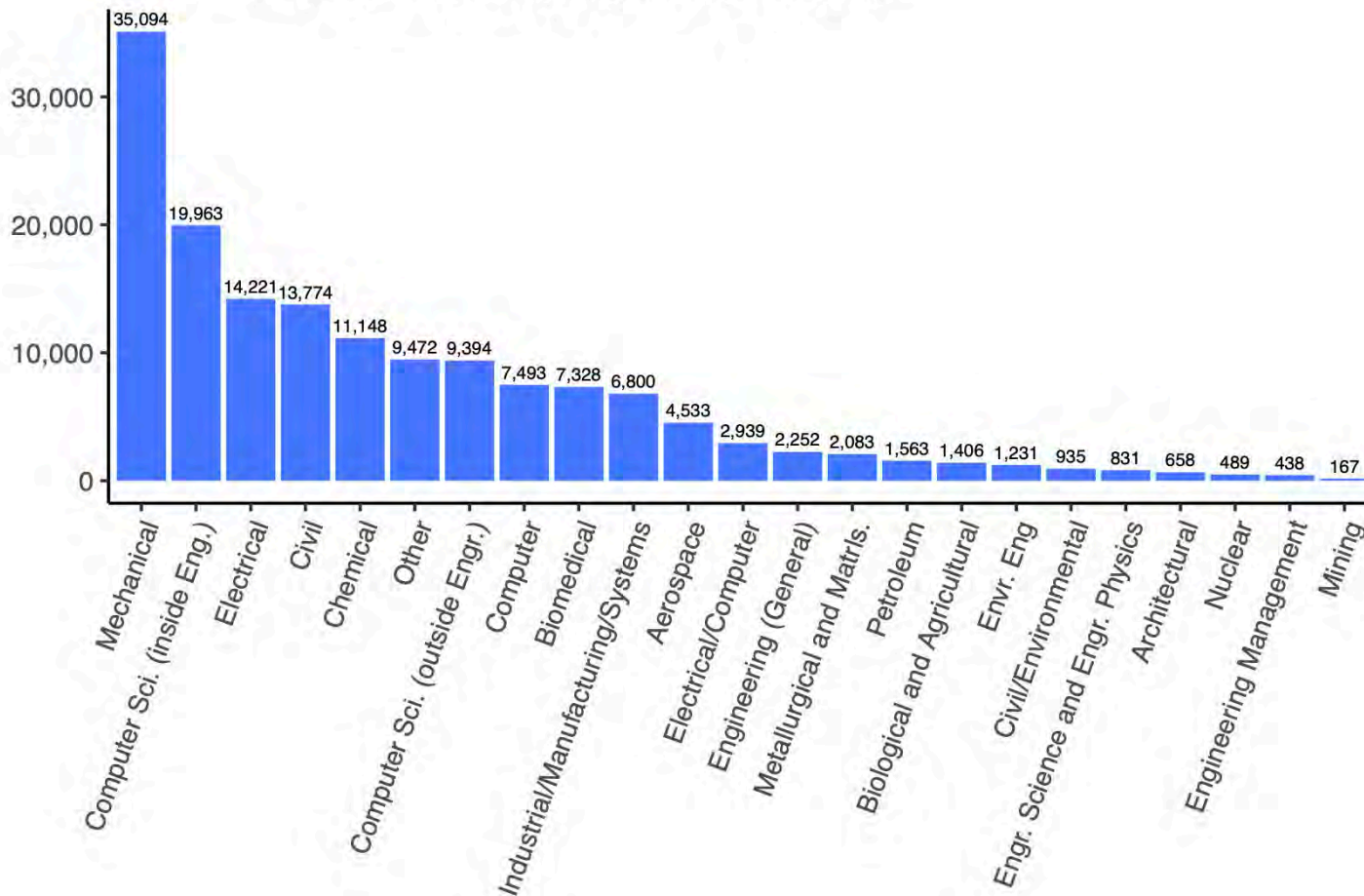
Mohsen Andani
Assistant Professor
Starting Fall 2023

National Engineering Trends



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Bachelor's Degrees Awarded by Engineering Discipline

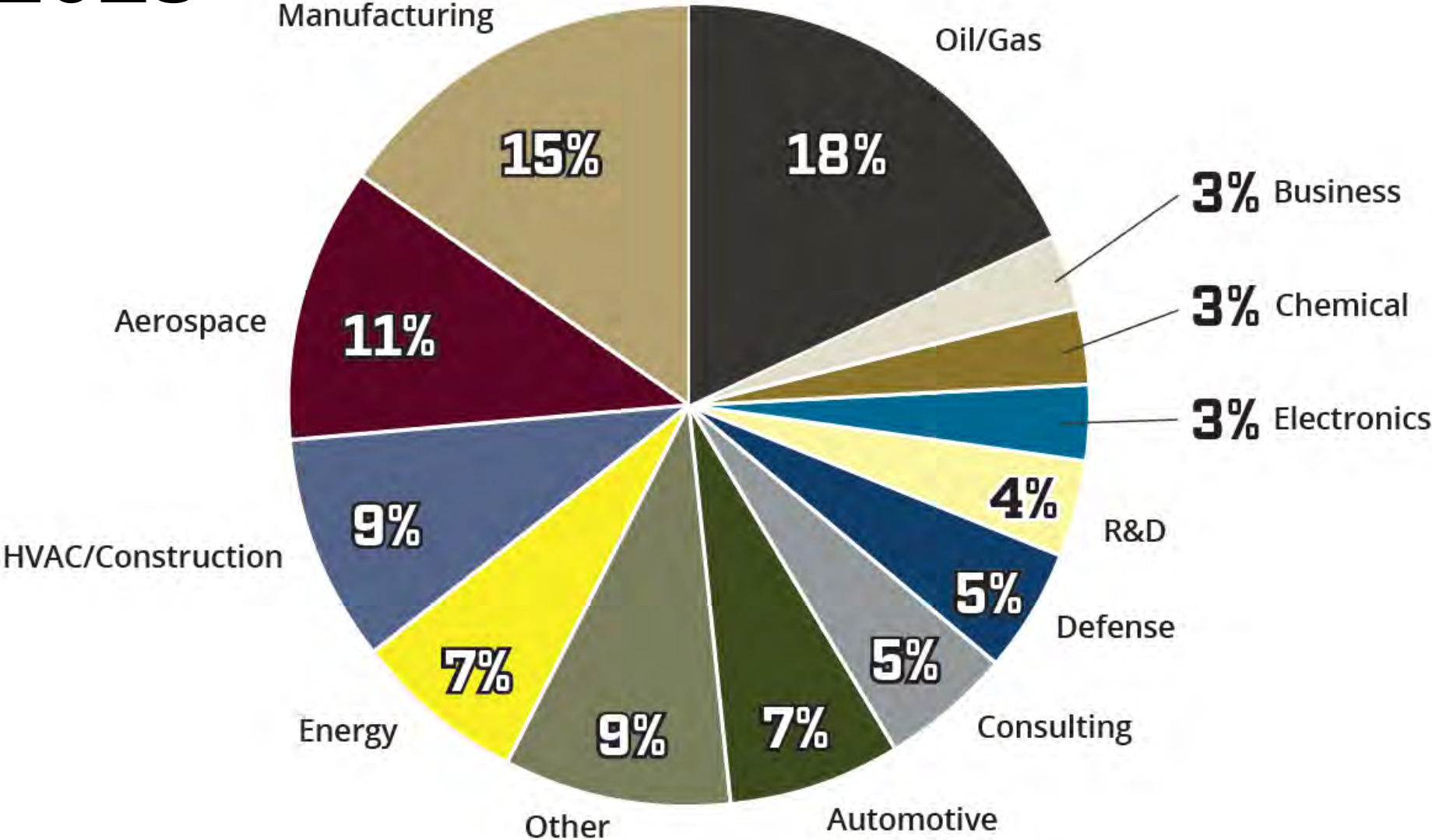


- **Degrees awarded: 136,233**
- **21.9% Women (14.8% ME)**
- **63.4% ME (31,936)+CS/ CE (37,386)+ECE (17,111)**
- **ENGR increased:**
 - **68% since 2008**
- **ME increased:**
 - **73% since 2008**
 - **38% since 2012**
- **ME at Texas A&M: 60% increase since 2012**

Industries Hiring ME Aggies, 2016-2018



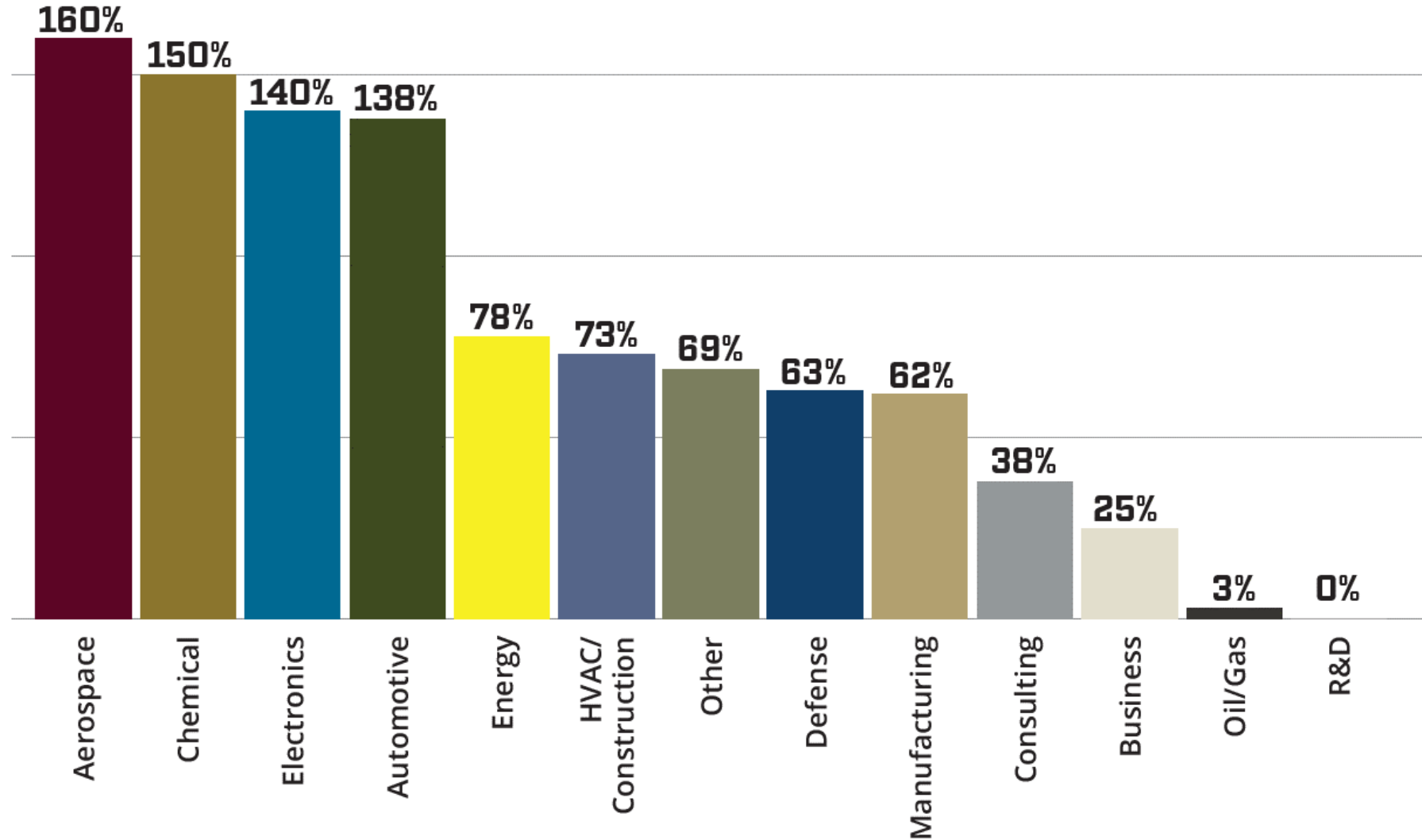
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Growth Rate for Industries Hiring ME Aggies, 2016-2018



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Turbomachinery Laboratory



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Turbomachinery Distinguished Lecture Series



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Established in 2014 to invite prominent speakers in the area of Turbomachinery to speak to Texas A&M students and faculty.



Fall 2022 – Dr. Reza Abhari
Director, Laboratory for Energy
Conversion at ETH Zurich

October 12, 2022

Previous Lecturers:

2014 – David C. Wisler

2015 – Frederic F. Ehrich

2016 – Kenneth C. Hall

2017 – Cyrus Meher-Homji

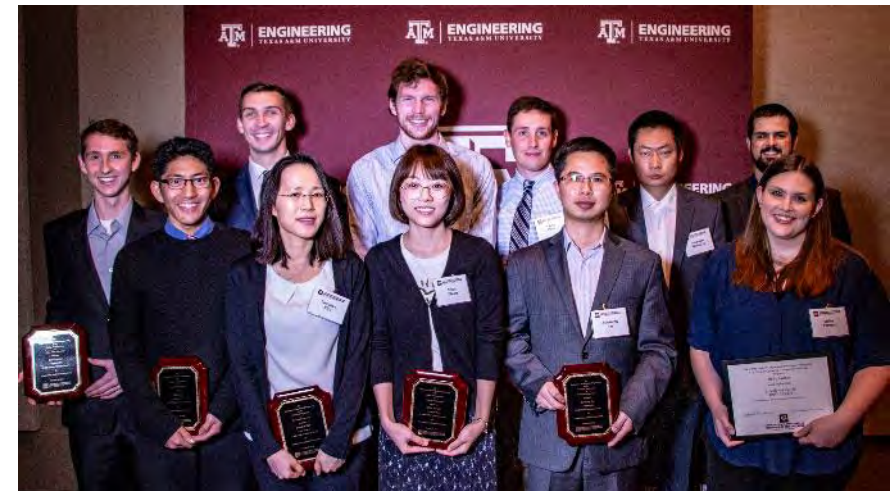
2018 – Timothy Lieuwen

2021 – Ann Karagozian

Supporting our Students

Annually, we're able to award \$1M in undergraduate scholarships and graduate fellowships to our students.

- **Turbomachinery Symposium Founders Committee Scholarship**, a need-based scholarship for undergraduate students
- Several graduate fellowships that support students working in the Turbomachinery Laboratory

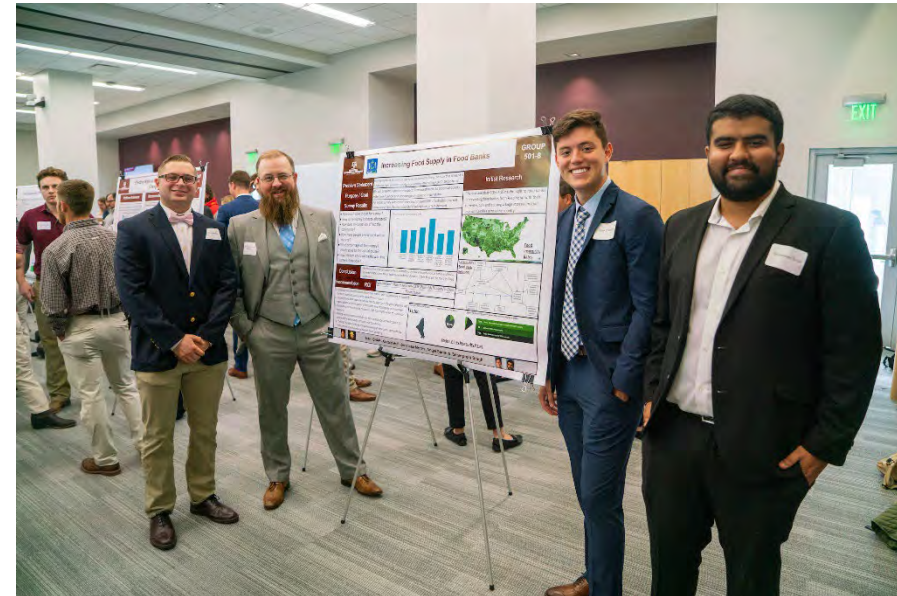
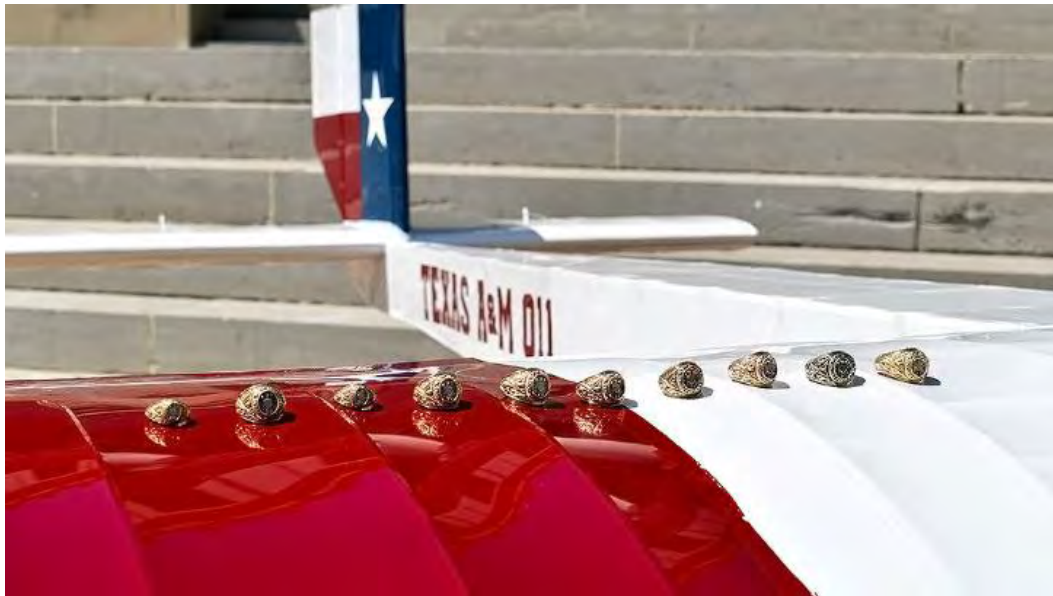


Former Student Engagement



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- Connecting with student organizations
- Sponsoring Senior Design Capstone Courses
- **Serving on departmental Industry Advisory Council**



Industry Advisory Council (IAC)



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- Mission:
 - Foster mutually beneficial relationship with industry, the engineering and scientific communities, state and federal governments, and former students
 - Advise the department with regard to the ongoing development of the undergraduate and graduate academic programs
 - Advise the department with regard to long range planning in research and assist in networking the department to research opportunities
 - Assist the department in resource development
- Currently 55 members
- Actively looking to diversify membership in all ways (race and ethnicity, gender, time since graduation, industry and company, etc.)

Industry Advisory Council (IAC)



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TEXAS A&M UNIVERSITY

Interested in serving on our Industry Advisory Council or connecting with our students?

Please reach out at tamu-me-head@tamu.edu.

Have a successful symposium!