Fort Worth Post of Society of American Military Engineers

UTA College of Engineering Trends and Updates

Peter E. Crouch

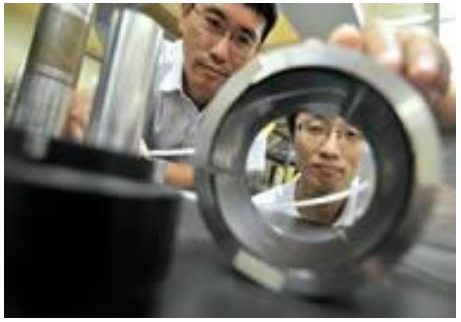
Dean of Engineering

College of Engineering

University of Texas at Arlington

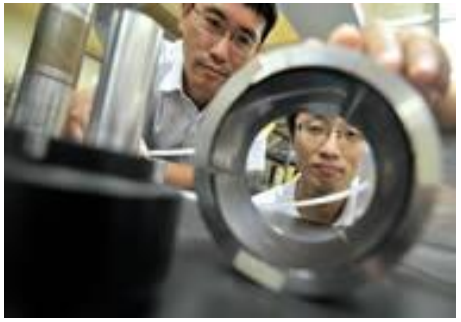
September 2017

The University of Texas at Arlington



- R-1: Doctoral Universities - Highest Research Activity by the Carnegie Classification of Institutions of Higher Education
- Global enrollment of >58,000 in AY 2016-2017
- Projected Campus enrollment > 44,000 in AY 2017-2018
- Second Largest University in UT System
- Sixth in Nationwide Universities named as “Next Generation University”

The University of Texas at Arlington



- UTA was cited by *U.S. News & World Report* as having the second lowest average student debt among U.S. universities.
- *U.S. News & World Report* also ranks UTA fifth in the nation for undergraduate diversity.
- Major Hispanic Serving Institute (HSI)
- Ranked as the top four-year college in Texas for veterans on *Military Times'* 2017 Best for Vets list.

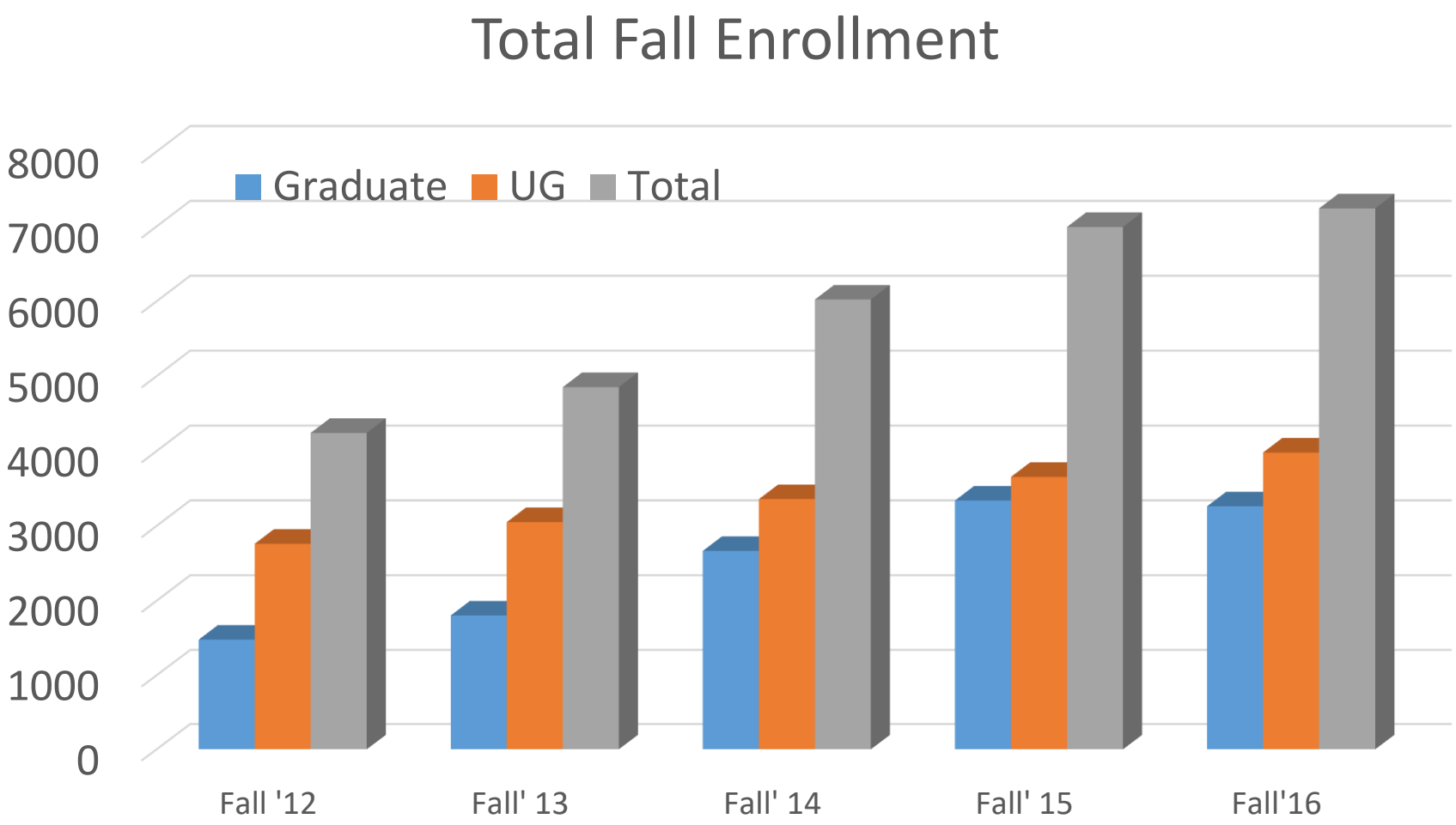
UTA College of Engineering

- Third Largest Engineering College in Texas as of Fall 2016
- Comprehensive College of Engineering with Seven Engineering Departments and offering 11 baccalaureate, 14 master's, and 9 doctoral degree programs
- Moved from 82nd to 73rd position in *US News* Graduate School Rankings in 2017
- 3,979 Enrolled Students in Fall 2016
- ~ 4,305 Enrolled undergraduates and ~2,772 Graduate students in Fall 2017
- Begins offering a BS program in Construction Management in Fall 2017

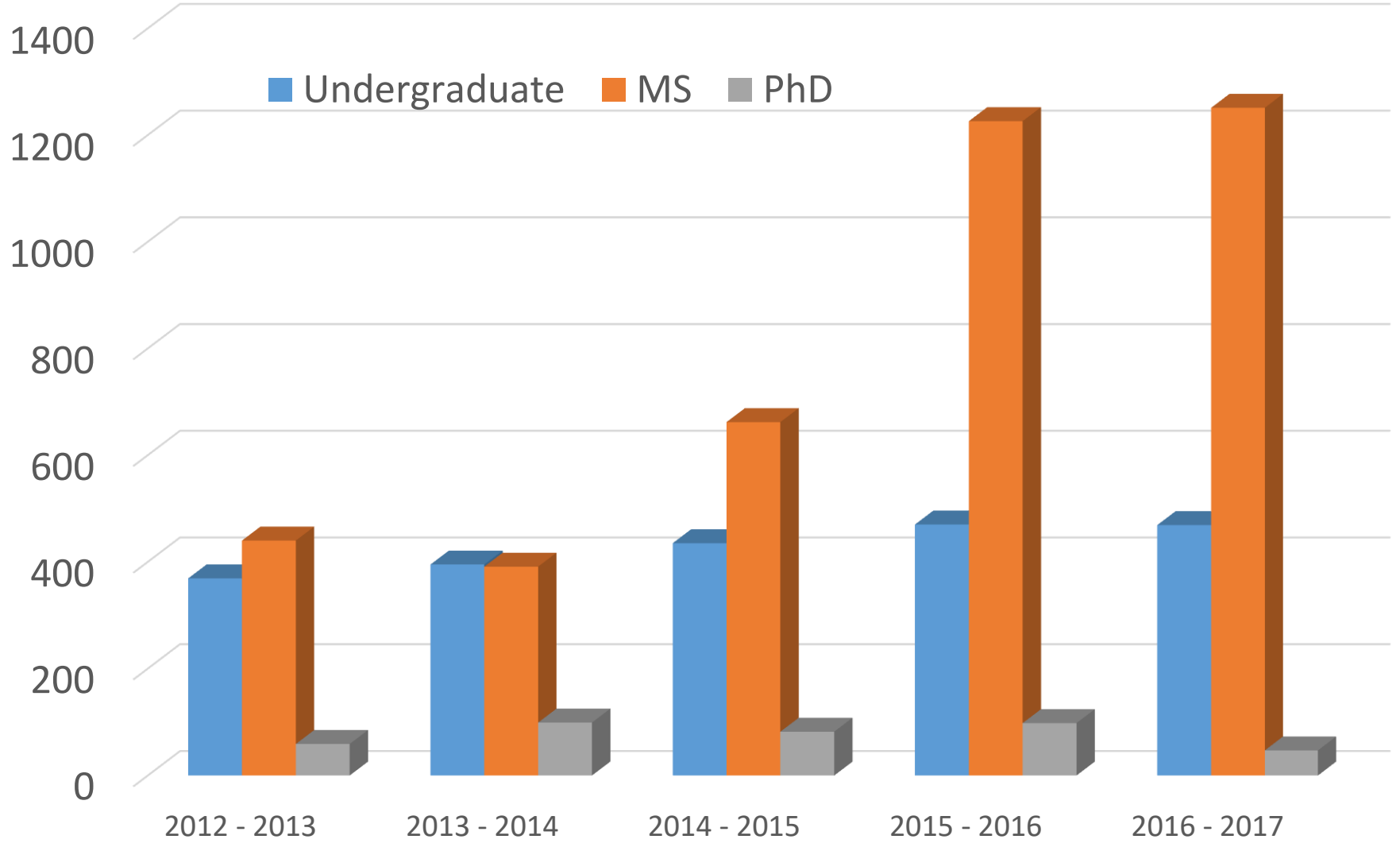
UTA College of Engineering

- Engineering related annual expenditures from external sources - $45,265,615 (2016) – significant increase expected
- In 2016-2017 graduated: 469 BS students; 1251 MS Students & 47 PhD Students – and on average over the last 3 years graduated: 458 BS students; 1046 MS Students & 76 PhD Students
- Offers 8 MS programs on-line, and is offering more undergraduate courses on line
- Begins offering curriculum in Construction Management, and “Introduction to Engineering” at the UTA Fort Worth Center Fall 2017 – hope to add offerings – what will “sell”?

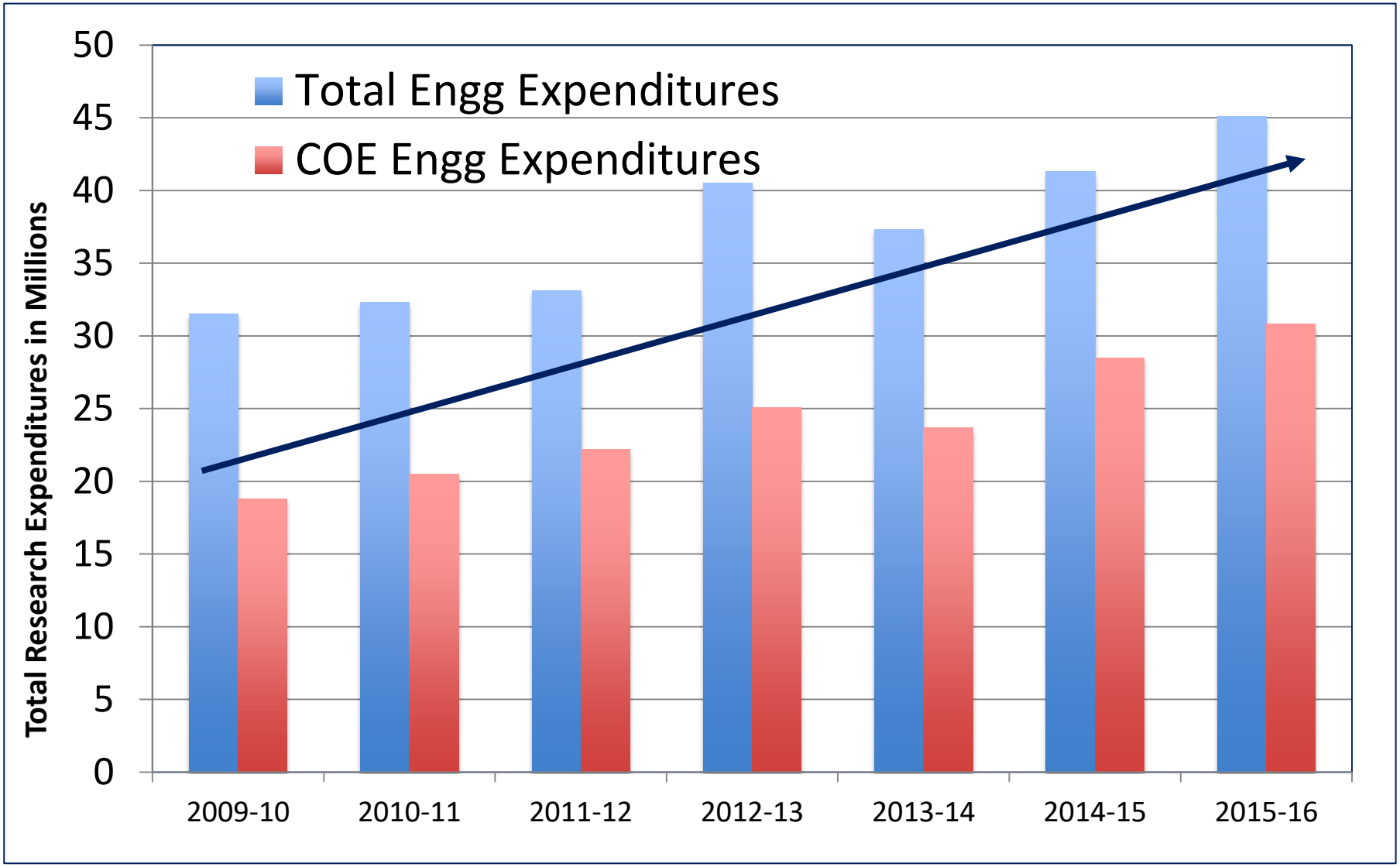
College Enrollment



Degrees Granted



College Research



UTA-SAME-Crouch

- PhD Harvard University (1974-1977) – not relevant – but brought Crouch to the USA for the first time!
- Dean of Fulton Schools of Engineering, Arizona State University (13 years 1995-2006) – Metro Phoenix then in a construction boom
- Fulton Schools of Engineering encompass the

  Del E. Webb School of Construction
- Ira A. Fulton, named the College of Engineering at ASU and is a land developer, & founder of Fulton Homes & alumnus of ASU

UTA-SAME-Crouch

- Dean College of Engineering, University of Hawaii (10 years 2006-2016) – 1/3 of Hawaii's GDP is in construction and so a focus for the College
- Significant Military presence accounting for another ~1/3 of Hawaii's GDP and so a focus for the College
- Dean, College of Engineering, University of Texas at Arlington (1 year) – Construction is again important
- Crouch now looking to identify Military Related relationships for the College to complement UTA's relationship/reputation with Veterans

UTA-SAME-Crouch

Relationships established with many Military organizations in Hawaii including:

- Joint Base Pearl Harbor Hickam
- Pearl Harbor Naval Ship Yard & Intermediate Maintenance Facility – Major Employer of Engineers in Hawaii
- Command, Submarine Force, U. S. Pacific Fleet (COMSUBPAC)
- Naval Facilities Engineering Command NAVFAC Pacific & Hawaii
- Army Corps of Engineers – Honolulu District & Pacific Ocean Division
- Marine Corps Forces Pacific (MARFORPAC)
- Space and Naval Warfare Systems Center Pacific
- University of Hawaii – Applied Research Lab (Navy Lab.)

UTA-SAME-Crouch

Some Activities:

- Environmental remediation of Military Sites around Hawaii
- Enhance Waikiki drainage basin – with US Army Corps, Honolulu District (included Univ. Hawaii at Manoa!)
- Study corrosion mitigation – US Army (all but one climate in HI)
- Active Military representation on College of Engineering Board of Advisors – workforce and research
- Participation in Military training exercises in Asia – hosted by MARFORPAC – developing low tech alternates of high tech
- Participation in Military conferences – LANPAC (Army) Symposium, & Pacific Operational Science and Technology Conference (POST) – (Navy)
- SAME(Honolulu POST) hosts start of Engineers Week – annual banquet – provides scholarships

The Crowded Opportunity Space in Civil Engineering and Construction Today -

- Bridges, Dams, Walls…
- Structural Health Monitoring
- Highways
- Instrumented Highways
- Automated Highways
- Traffic simulation, modeling & regulation
- Alternative Transportation – Bullet Train, Hyperloop,….
- Prefabrication
- Residential
- Commercial
- High-rise technology
- Special Purpose Construction (clean rooms / aquariums…)
- Water
- Solid Waste
- Waste Water
- Utility pipelines
- Underground Infrastructure Replacement and Maintenance
- Trenchless Technology
- Smart Cities
- Urban reclamation and city planning
- Geotech - exploration
- Oil/Gas Extraction – Pipelines
- Sustainable Materials
- Renewable Energy Infrastructure
- Remote monitoring and UAVs

So many opportunities for technology to revolutionize!

Planning for the future of Civil Engineering at UTA

- UTA College of Engineering supplies raw recruits for the future of CE in North Texas
- We train these raw recruits ONLY in areas of expertize of the faculty!
- Which of these areas of opportunity in CE are more important than others for the future of North Texas? – Can you help us predict? - So that we can hire appropriate faculty to train and educate the next generation of Civil Engineers

But the Challenge is much Harder

We need to do this planning for all of the College of Engineering!

7 disciplines in all!

Engineering Degree Programs

Bioengineering:
B.S., Biomedical Engineering
M.S., Biomedical Engineering
Ph.D., Biomedical Engineering

Materials Science and Engineering:
M.S., Materials Science and Engineering
M.Eng., Materials Science and Engineering
Ph.D., Materials Science and Engineering

Civil Engineering:
B.S., Architectural Engineering
B.S., Civil Engineering
B.S., Construction Management (new Fall 2017)
M.S., Civil Engineering
M.Eng., Civil Engineering
Master of Construction Management
Ph.D., Civil Engineering

Computer Science and Engineering:
B.S., Computer Engineering
B.S., Computer Science
B.S., Software Engineering
M.S., Computer Engineering
M.S., Computer Science
M.S., Software Engineering
Ph.D., Computer Science and Engineering

Electrical Engineering:
B.S., Electrical Engineering
M.S., Electrical Engineering
M.Eng., Electrical Engineering
Ph.D., Electrical Engineering

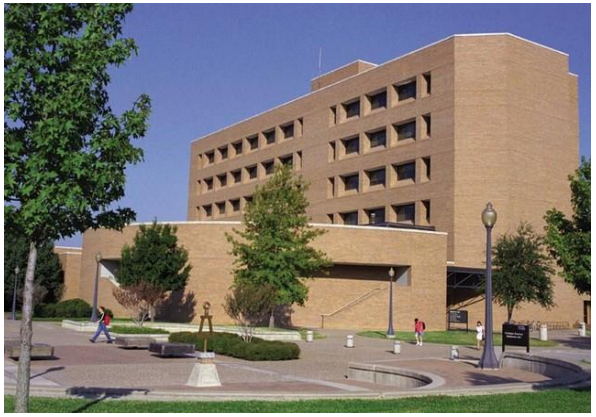
Mechanical and Aerospace Engineering:
B.S., Aerospace Engineering
B.S., Mechanical Engineering
M.S., Aerospace Engineering
M.Eng., Aerospace Engineering
M.S., Mechanical Engineering
M.Eng., Mechanical Engineering
Ph.D., Aerospace Engineering
Ph.D., Mechanical Engineering

Industrial, Manufacturing and Systems Engineering:
B.S., Industrial Engineering
M.S., Engineering Management
M.S., Industrial Engineering
M.S., Logistics
M.S., Systems Engineering
M.Eng., Industrial Engineering
Ph.D., Industrial Engineering

Facilities

Woolf Hall

Engineering Lab



Nedderman Hall

Aerodynamics Research Center

Civil Engineering Lab

Facilities

Iconic Engineering Research Building

SEIR - Science, Engineering, Innovation, and Research Building Ready Fall 2018

College Faculty Update

- 139 Tenure Track Faculty in FY 16-17 (does not count administrators – like me!)
- 145 Expected TT Faculty in FY 17-18 – adding 9 and 3 left
- 41 Full Time Non Tenure Track Faculty in FY 16 – 17
- 54 Expected Full Time NTT Faculty in FY 17 – 18 – adding 13
- Moving from ~ 178 full time faculty to ~ 200
- Overall Student /Faculty Ratio from 42:1 to 36:1

Student Growth

- Texas Needs Engineers for its growing economy!
- 4 years ago a general state plan for higher education engineering schools resulted in a target for UTA College of Engineering enrollment of 10,000 by 2020 – last fall it was 7,240
- Over the four year interval ‘13-’14 to ‘16-’17 the average increase in students in the College has been 750 students per year (BS – 305; MS- 445; PhD 21) for a total increase of 3,000.
- The same rate of increase till 2020 would meet the 10,000 goal
- Undergraduate recruitment is robust (in migration of people to North Texas)
- BUT: Graduate recruitment is fragile (US Administration change)

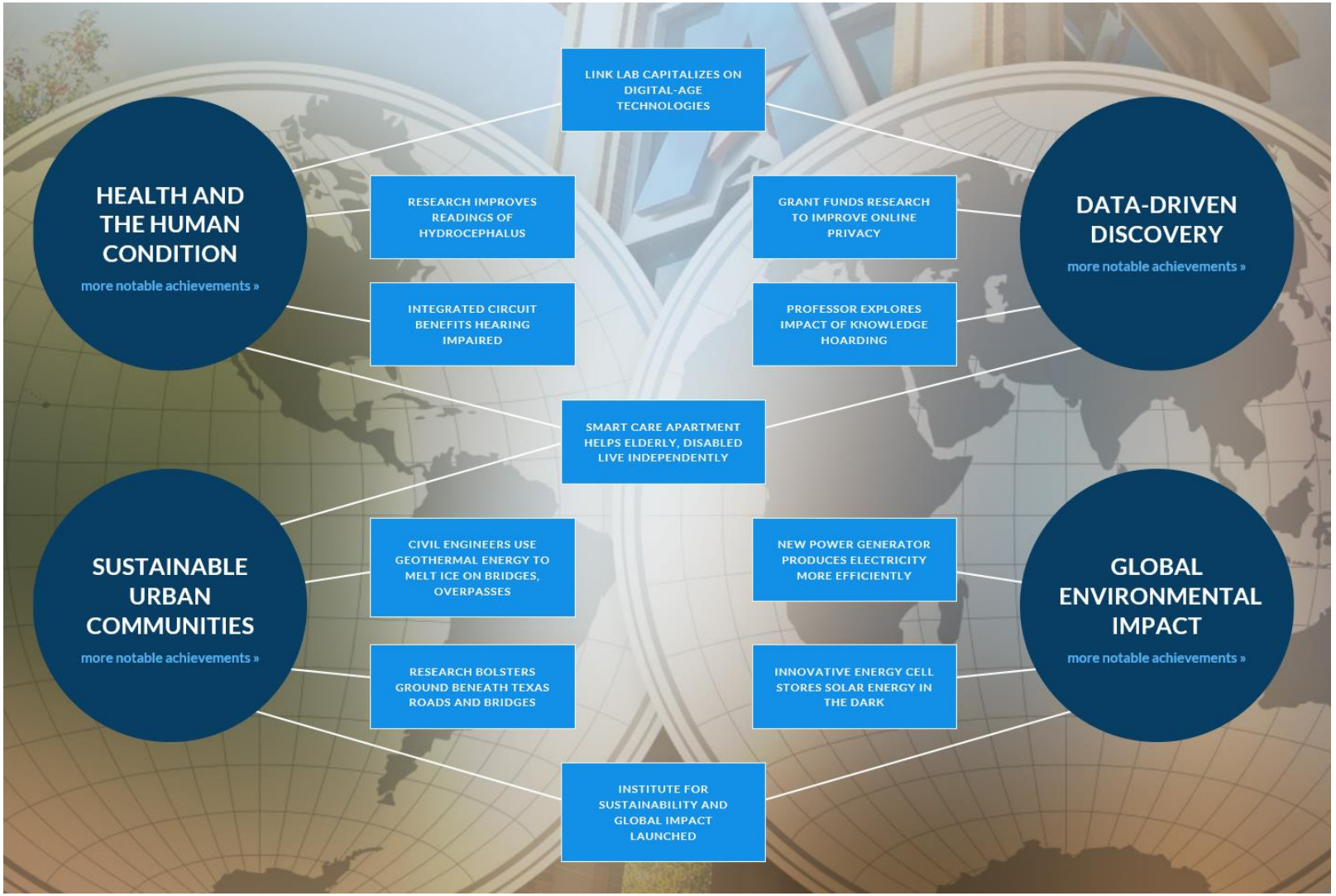
College Focus Areas

1. Aerodynamics/ Aero-propulsion
2. *Automation / Autonomous Systems
3. *Big Data/HPC
4. *Built Infrastructure
5. Communications and Networks
6. *Energy
7. Internet of Things
8. Logistics
9. *Manufacturing
10. *Materials
11. *Nano-Technology
12. Health Care
13. *Security
14. *Smart Cities
15. Engineering of Biomedical Systems
16. *Water

* Areas where Civil Engineering Contributes

University Strategic Areas

https://www.uta.edu/strategicplan/



University Themes v. College Focus Areas

College Focus Areas / University Themes	Health and the Human Condition	Sustainable Urban Communities	Global Environmental Impact	Data- Driven Discovery
Aerodynamics and Aeropropulsion				X
Automation/ Autonomous Systems	X	X		X
Big Data/HPC	X	X		X
Built Infrastructure		X	X	
Communications and Networks		X		X
Energy		X	X	X
Internet of Things	X	X		X
Logistics	X	X		X
Manufacturing		X	X	X
Materials	X	X	X	
Nano-Technology	X		X	X
Health Care	X			X
Security	X	X		X
Smart Cities	X	X	X	x
Engineering of Biomedical Systems	X			X
Water	X	X	X	

College Focus v. Industry Sectors

College Focus Areas / Supported Industries	Construction	Resource Engineering (not extraction)	Automotive	Aerospace / Defense	Electric Power	Non energy Utilities	Health Care	Electronics	Software
Aerodynamics/Aero propulsion				X					
Automation/ Artifical intelligence			X	X			X	X	X
Big Data/HPC					X		X	X	X
Built Infrastructure	X	X				X			
Communications and Networks			X		X			X	X
Energy	X	X	X	X	X				
Internet of Things			X				X	X	X
Logistics	X			X			X		X
Manufacturing	X		X	X					X
Materials	X	X		X	X			X	
NanoTechnology				X			X	X	
Health Care							X		X
Security				X	X		X		X
Smart Cities	X	X	X		X	X		X	X
Engineering of Biomedical Systems							X		
Water	X	X				X			

Hurricane Harvey implications

Some professors who are involved in assessment:

- Nick Fang – hydrology - prediction
- Ali Abolmaali – Pipes – Integrity assessment
- Anand Puppala – geo tech – drones/ damage assessment to infrastructure, dams/ coasts, bridges etc.
- Stefan Romanoschi – pavement assessment

Going after funding from TxDOT, FHWA, NSF….to do assessment studies on aftermath of Harvey

- Have not yet seen engagement with US Army Corps of Engineers involvement with UTA as of 9/1/17

Hurricane Harvey implications

"UT-Arlington flood expert helped keep Houston hospitals safe during Harvey's onslaught" – *Dallas Morning News*

Together with professor Phil Bedient of Rice University, Professor Nick Fang helped Texas Medical Center (TMC) in Houston remain dry and operating throughout. Their system predicts flooding conditions ahead of time allowing TMC in particular to "shut their floodgates and evacuate basement garages before the flood hit — but not so early as to make access unnecessarily difficult for patients and staff."

How can SAME help/get involved?

- Members join UTA alumni – College building an engineering chapter – get involved
- Provide Internships (College and UTA)
- Participate in Mentor Program (College and UTA)
- Participate in UTA Engineering Career Day
- Help connect the College to Military sponsored opportunities in TX & US
- Community leadership involvement with College Board of Advisors

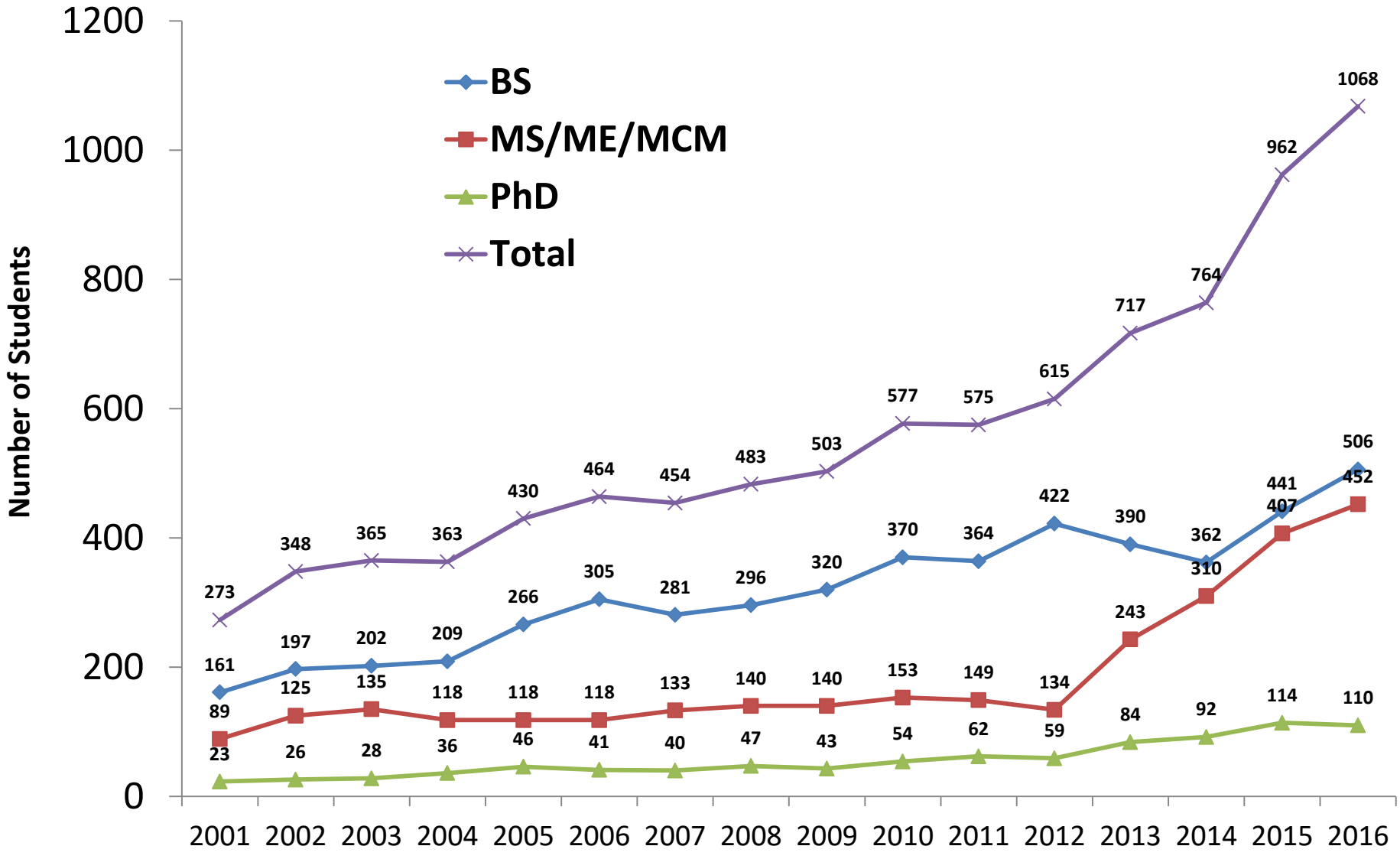
How can SAME help/get involved?

- Engineers Week, and similar activities
- Support K-12 STEM Outreach Activities
- Promotion of UTA College of Engineering – Its not all about semiconductors/telecoms and UTD – we do that as well…
- Identification of professional education needs and partner on delivery of these
- Partner on putting together topical conferences and meetings – e.g. *What did we learn from Hurricane Harvey and planning for the 1,000 year flood every 10 years?*

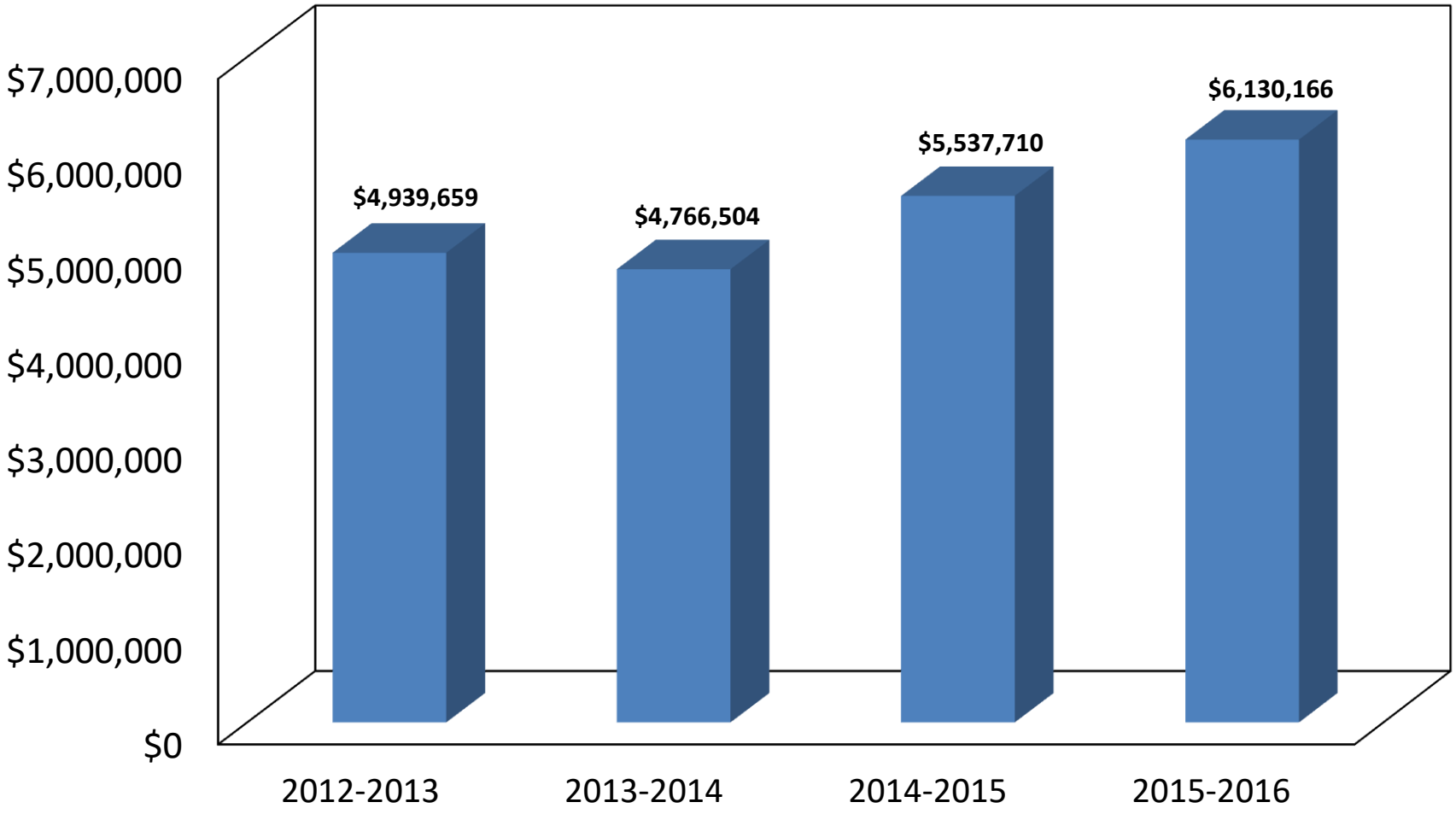
Civil Engineering Areas of Concentration

- Construction Engineering and Management
- Environmental Engineering
- Geotechnical Engineering
- Infrastructure Engineering
- Structural Engineering and Applied Mechanics
- Transportation Engineering
- Water Resources Engineering

Civil Engineering Enrollment



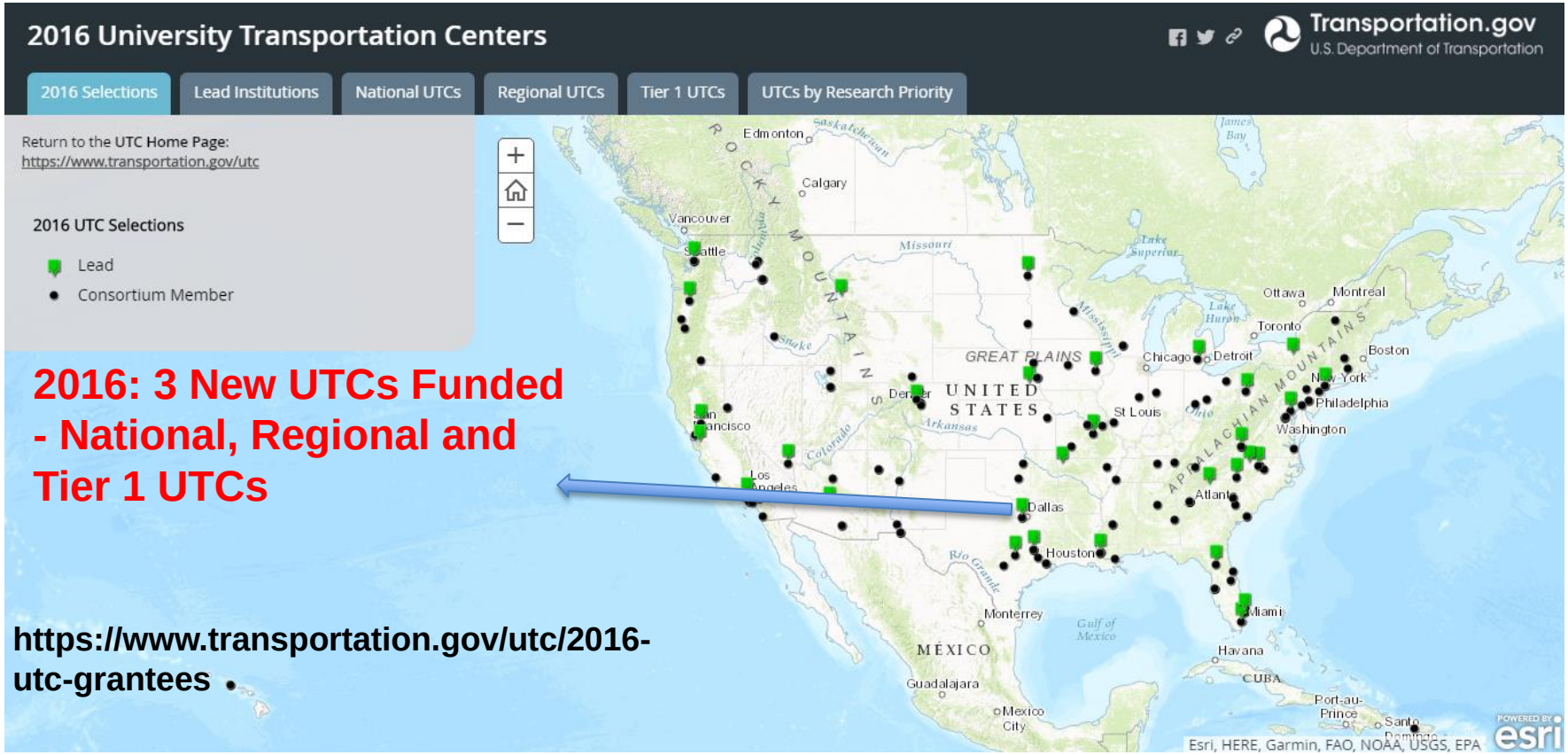
Civil Engineering Research Expenditures



Civil Engineering Research Centers

- ORCE - Solid Waste Institute for Sustainability (SWIS)
- ORCE - Sustainable and Resilient Civil Infrastructure (SARCI)
- Construction Research Center (CRC)
- Center for Structural Engineering Research (CSER)
- Center for Underground Infrastructure Research and Education (CUIRE)
- Geotech Extreme Events Reconnaissance (GEER)
- Urban Water Institute

University Transportation Centers (UTCs)



UTA University Transportation Centers

National Institute for Transportation & Communities: **Improving Mobility of People and Goods** (NATIONAL UTC) Portland State University – Lead
Consortium Members: Oregon Institute of Technology, University of Arizona, University of Oregon, University of Texas at Arlington, University of Utah

Transportation Consortium of South Central States: **Improving the Durability and Extending the Life of Transportation Infrastructure** – Region 6 (REGIONAL UTC) Louisiana State University – Lead
Consortium Members:, Arkansas State University, Baton Rouge Community College, Navajo Technical University, New Mexico State University, Oklahoma State University, Prairie View A&M University, Texas A&M University, University of New Mexico, University of Texas at Arlington, University of Texas at San Antonio

Center for Transportation Equity, Decisions and Dollar: **Preserving the Existing Transportation System** (**TIER 1 UTC**) University of Texas at Arlington – Lead
Consortium Members: California Polytechnic State University, San Louis Obispo, Georgia Institute of Technology, University of South Florida, University of Wisconsin – Madison

Civil Engineering Laboratory Building

- 26,000-square-foot building
- State of the art structural testing laboratories
- Accommodates a unique Geo-mechanics Research Lab for advanced testing of unsaturated & expansive soils under simulated foundation, traffic, & earthquake loads

UTA Structural Laboratories
Full-Scale Structural Experiments

Civil Engineering Laboratories

Accelerated Pavement Testing Facility

- Pavement Materials

Civil Engineering Laboratory Building

- Construction
- Geotechnical
- Structure
- Materials

Nedderman Hall Laboratories

- Environmental
- Geotechnical
- Water Resources

Field Investigation Studies

UAV & LIDAR Studies

Horizontal inclinometer

MEMS Instrumentation

Sensor Installation

Data logger with laptop

Inclinometer Casing

Accelerated Pavement Testing and Materials - Dr. Romanoschi

Validation of Maximum Allowable Amounts of Recycled Binder, RAP & RAS using Accelerated Pavement Testing

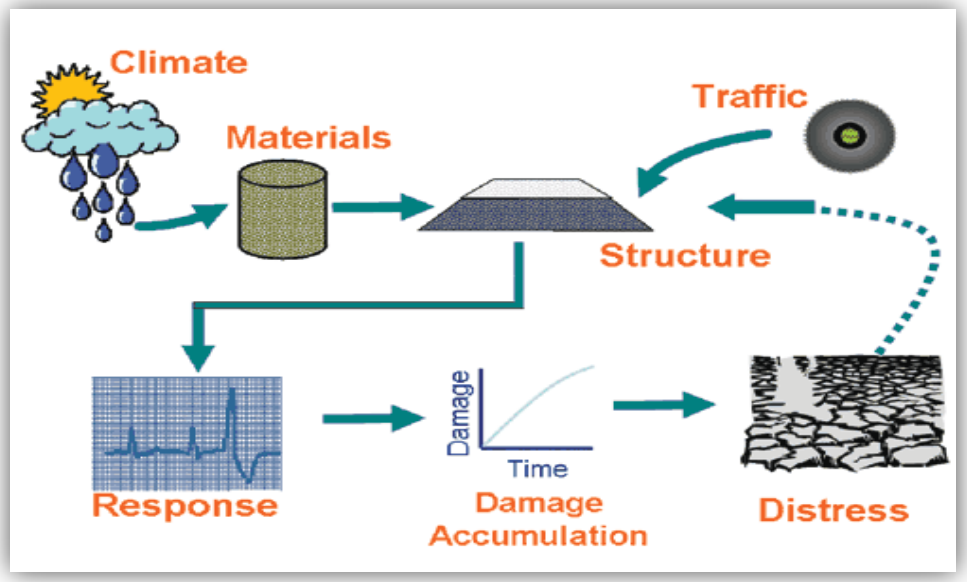
(Texas DOT)

Testing of the RAP&RAS Experimental Pavement Sections

(Texas DOT)

Local Calibration of the AASHTO Pavement M-E for the Design of New Flexible Pavement Structures Pavement Design Guide

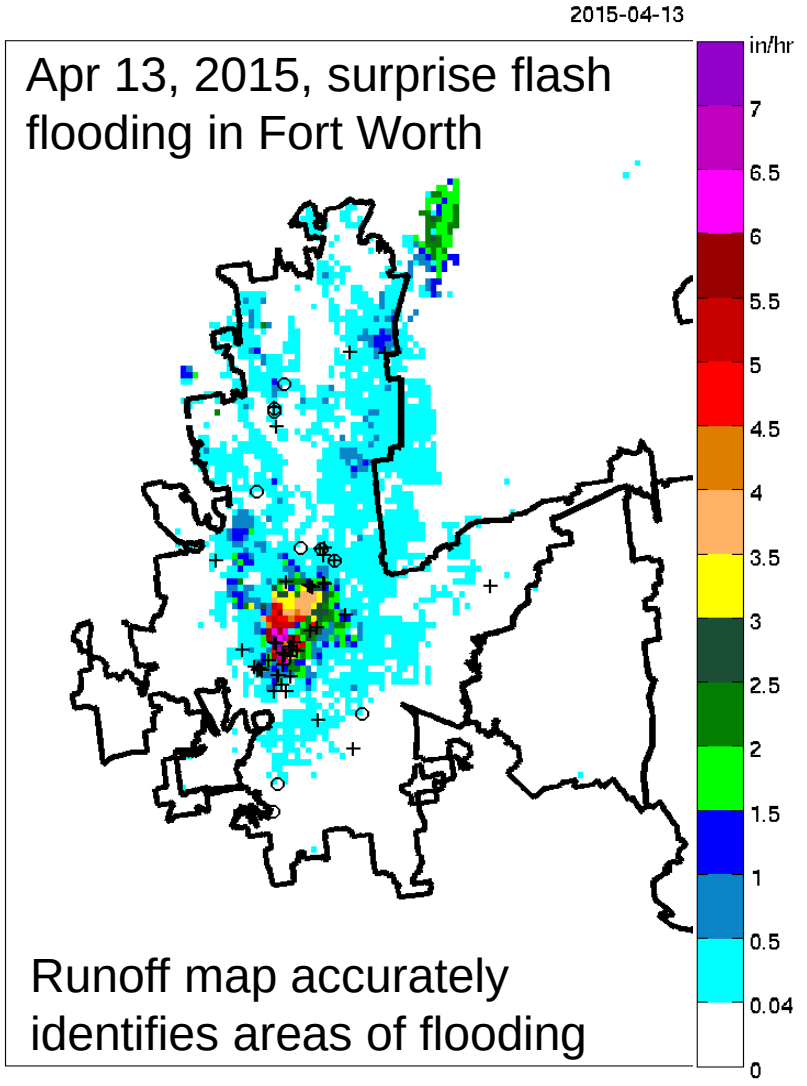
(New York State DOT)



Flash Flood Warning System - Dr. DJ Seo's Group

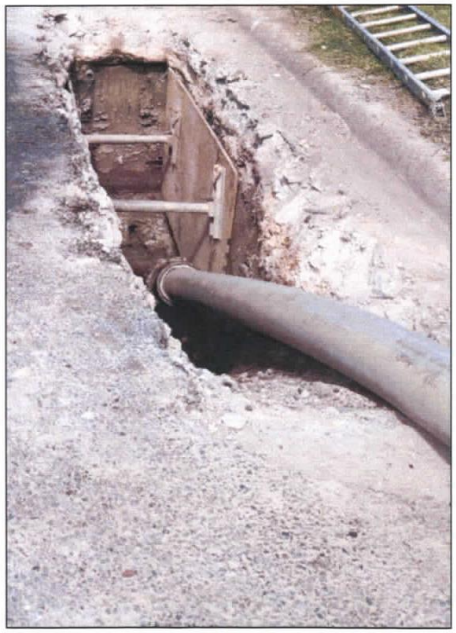
Potential Regional Solution for Location- and Time-Specific Warnings

- Uses High-Resolution (1 min, 500 m) Rainfall Data from CASAWX
- Runs the NWS Hydrologic Model
- Produces Runoff, Discharge and Flood Frequency Maps
- Integration of All Available Data Under Way
  - ✓ City-Owned HWWS
  - ✓ UTA-Deployed Sensors
  - ✓ Cellphone App



INFRASTRUCTURE REHAB & REPLACEMENT

- Have you developed a Capital Improvement Plan (CIP)?
- Are you aware of existing infrastructure needs?
- Are you replacing infrastructure pro-actively rather than re-actively?



Assessment of Pipeline Systems in the City of Arlington

A collaboration between the City of Arlington – and UTA College of Engineering Department of Civil Engineering - Dr. Ali Abolmaali and Mr. Buzz Pishkur Director of Water Utilities, City of Arlington (COA)

- Condition Assessment of City of Arlington's Sewer by Using Modern Techniques
- Service Life Prediction
- Replacement and Retrofit of Damaged Areas Only
- Avoiding Costly Replacement of Entire Segments or Regions
- Implementation for Small Communities in Texas

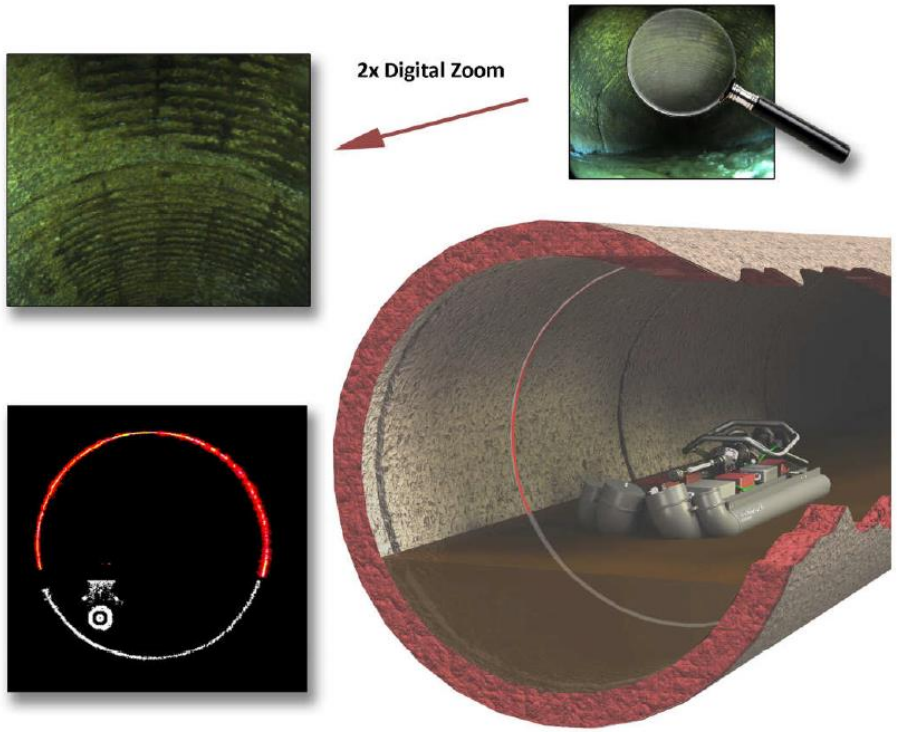
Background

- Sewer systems account for approximately 50% of the underground infrastructure in the United States (Shook and Bell 1998)
- ASCE Assigns a Grade D to Nation's Infrastructure (Limited Information on Condition of Sewer Pipelines)
- Without a condition assessment for the pipe, a collapse is imminent
- A portion of a West Side road collapsed in San Antonio after a sewer main ruptured underground and a Deputy was killed (San Antonio Express-News)

By San Antonio Express-News Updated 6:32 pm, Tuesday, December 13, 2016 http://www.mysanantonio.com/news/local/article/West-Side-road-collapses-week-after-massive-10793869.php#photo-11939555

Inspection Method - CCTV

HD Profiler Module

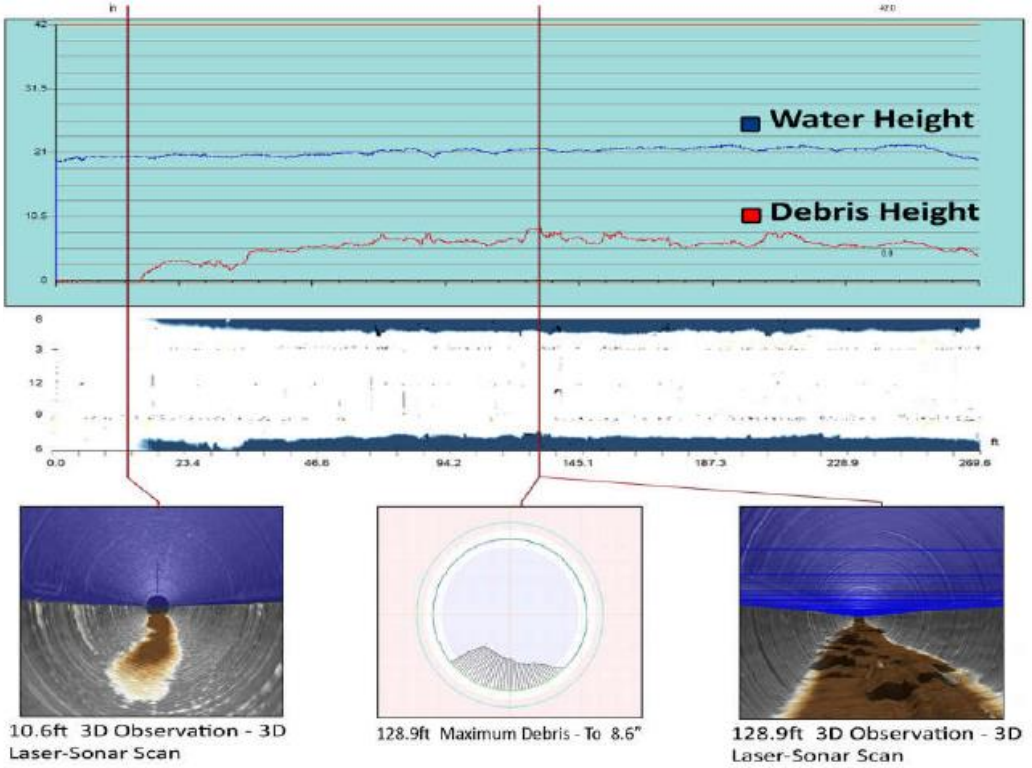


- Assessment Method
  - HD-CCTV
  - SONAR
  - A E
- Identification of Defected Regions
- Core Sampling
- Corrosion Study
- Propose Indicators - Pipe Condition Assessment Between the Physical Conditions and Assessment Results

Inspection Method-Sonar

Sonar Profiler Module

Debris Graphs



Field Measurement