



# x88 Engineering Education at University of Michigan

NAS Aeronautics & Space Engineering  
Board (ASEB)

October 17, 2023

# OBJECTIVE + BRIEFING STRUCTURE

1

The  
**Need for Change**

2

The  
**Transformation**  
what is it, and what are  
the **benefits**?

3

How has the  
**student experience**  
**in talent development**  
been  
**transformed?**

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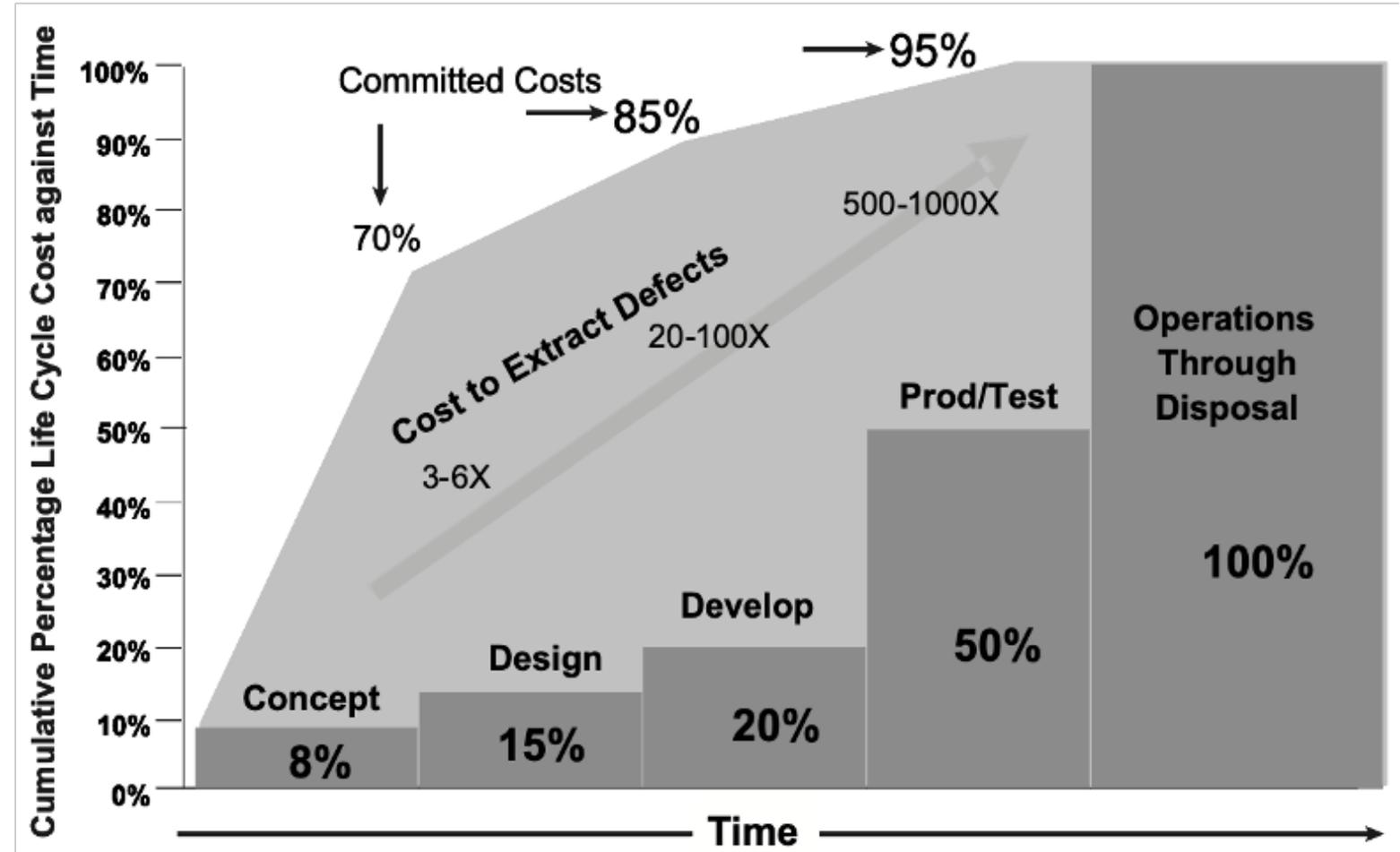
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NEED FOR CHANGE

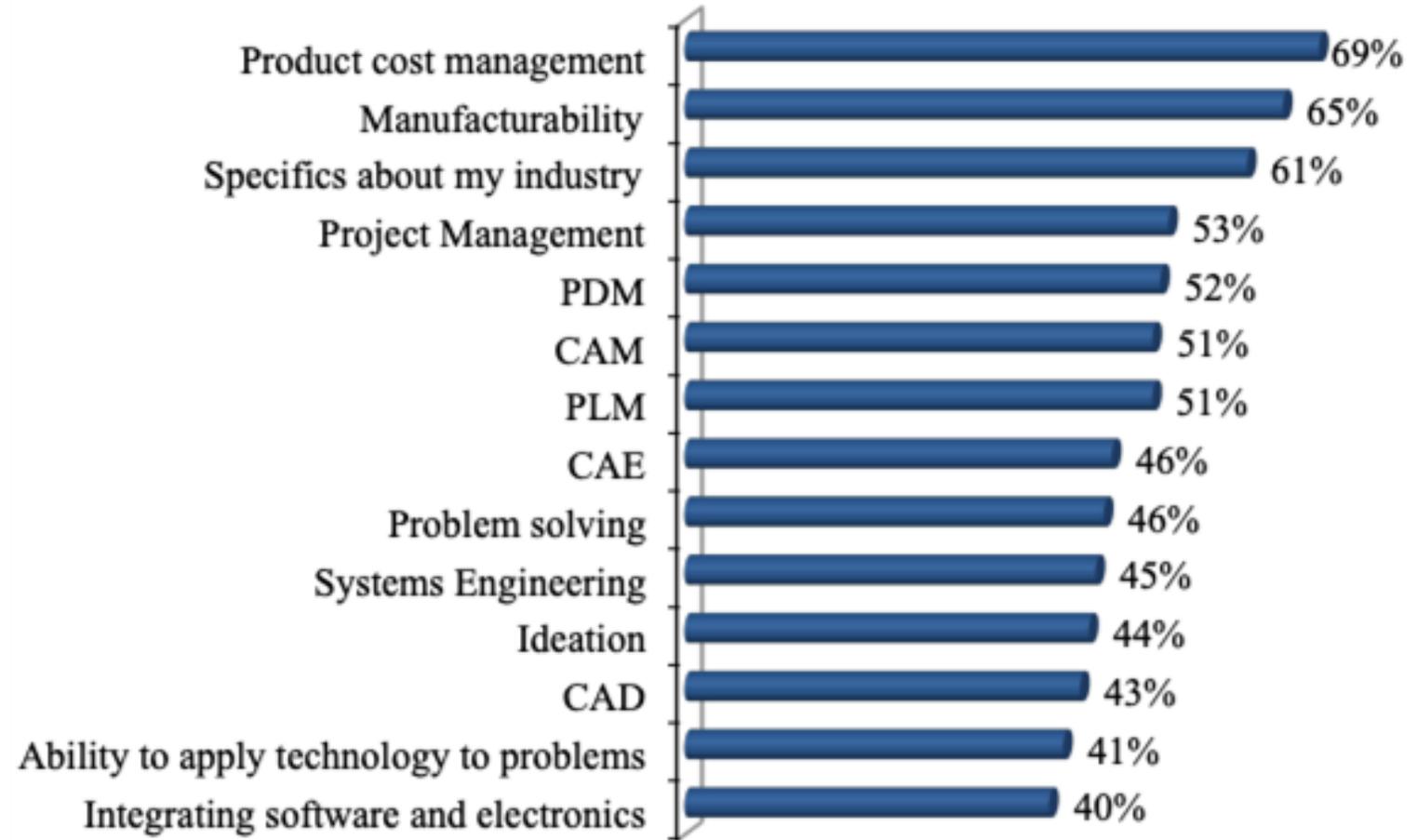
# The Systems Engineering Development Cost Opportunity



Source: INCOSE -TP-2003-002-03.01 INCOSE Systems Engineering Handbook, version 3.1 August, 2007

NEED FOR CHANGE

# Academia and Industry Are Not Connecting

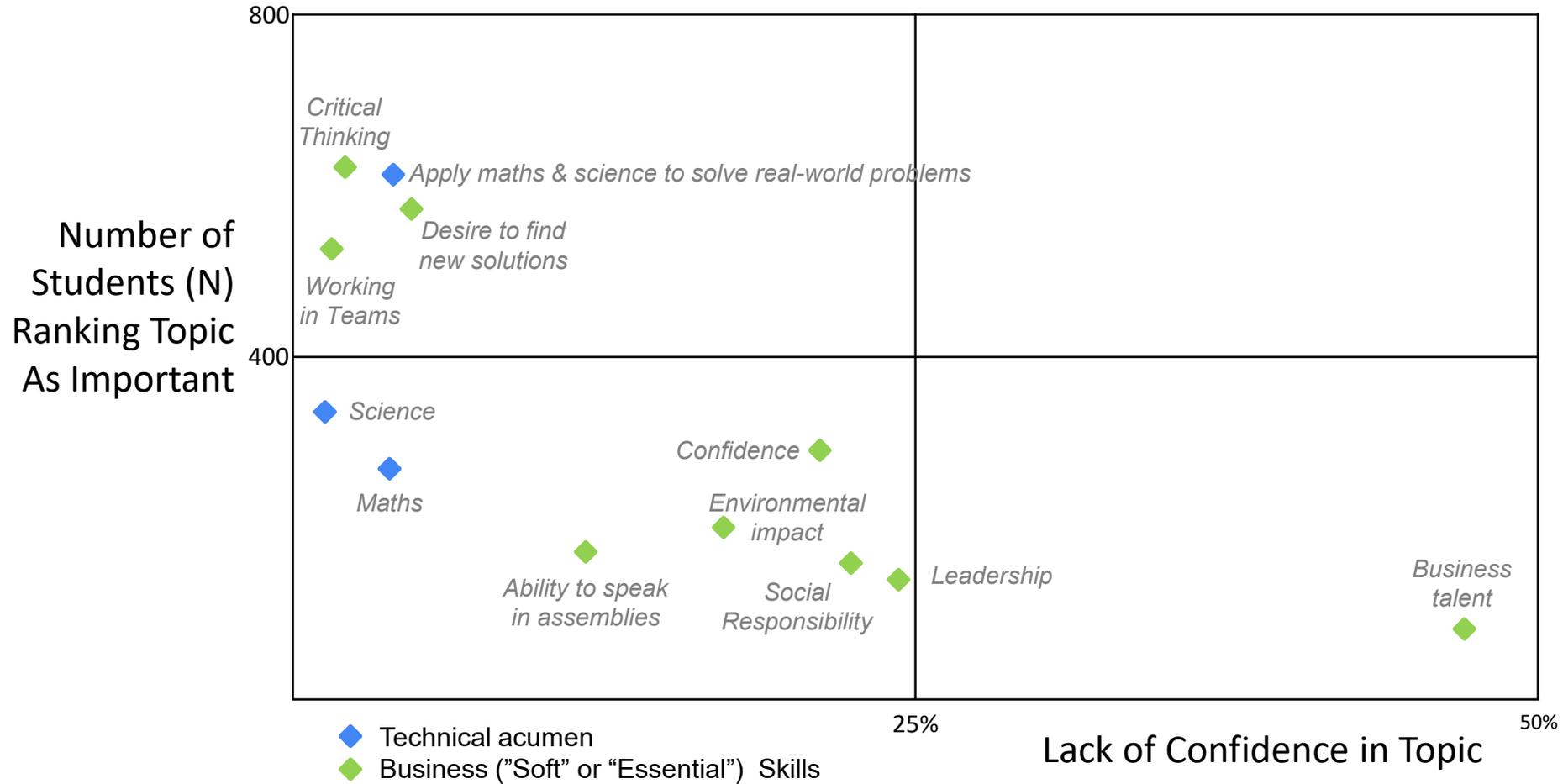


**Figure 6: Top Skills Schools Do NOT Prepare Students Well**

Source: M. Boucher, "Close the Engineering Skills Gap: Prepare New Graduates to be Real World Ready," Tech-Clarity, 2017.  
Available: <https://techclarity.com/enigneering-skills-gap/6423>

NEED FOR CHANGE

# Academia and Industry Are Not Connecting



Source: A. Kolmos, J. Egelund Holgaard. (Nov. 2018). "Employability in Engineering Education: Are Engineering Students Ready for Work?," *Philosophy of Engineering and Technology (POET)*, vol. 32.

NEED FOR CHANGE

x88  
Obsession  
with Process  
Discipline



*“If you can't describe what you're doing as a process, you don't know what you're doing.”*

- W. Edwards Deming, engineer, statistician, professor, author, consultant

*“We get brilliant results from average people managing brilliant processes - while our competitors get average or worse results from brilliant people managing broken processes.”*

- Fujio Cho, Honorary Chairman and retired senior executive, Toyota Motor Corporation

Imagine what one can get from *brilliant* educated and trained *people* students managing brilliant processes?

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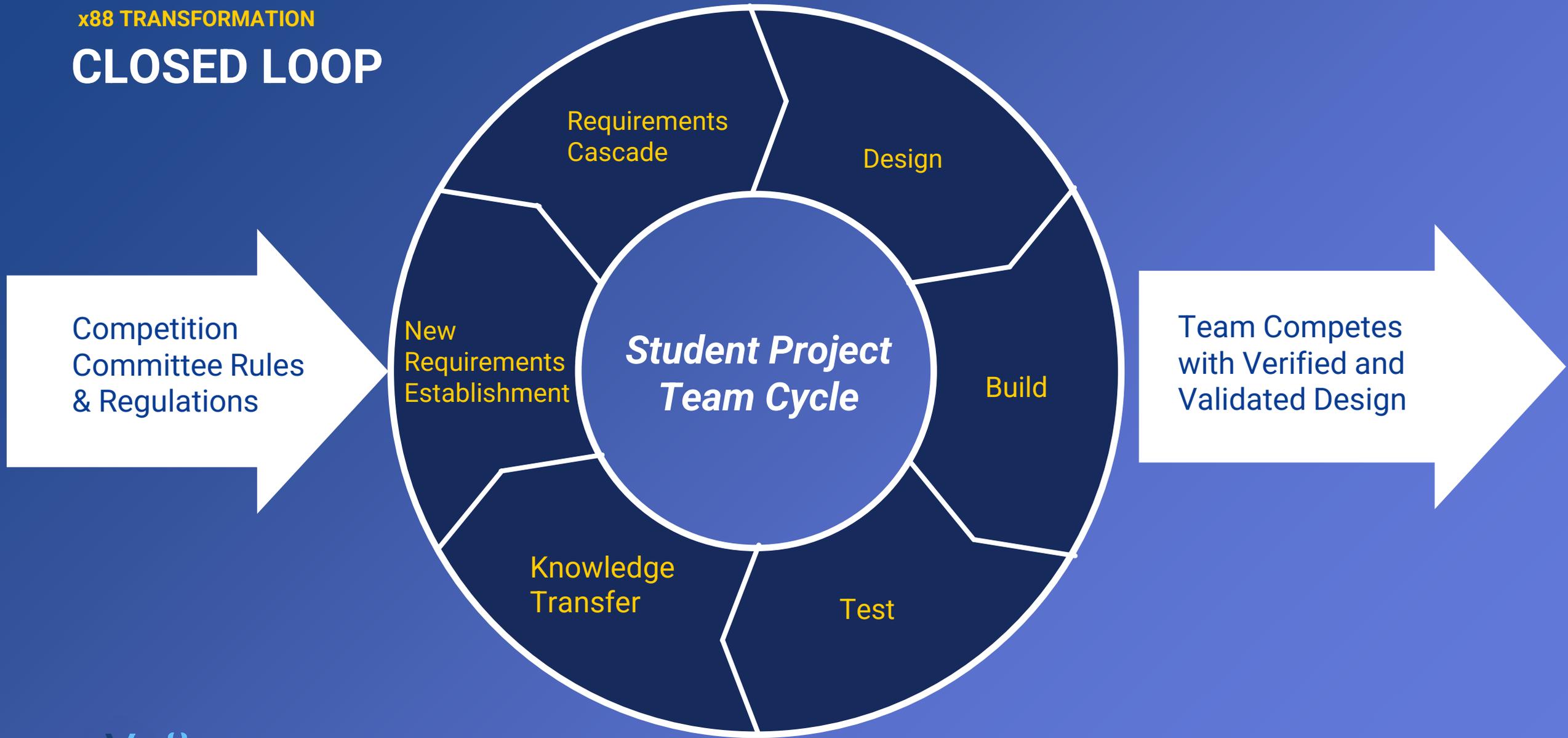
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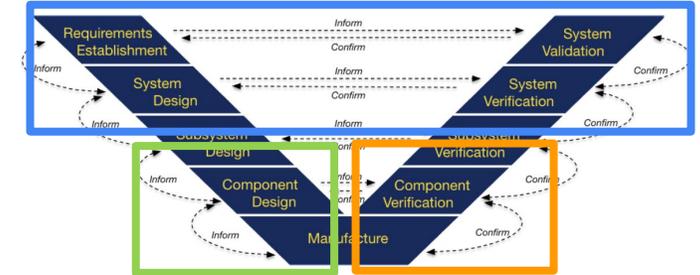
x88 TRANSFORMATION

# CLOSED LOOP



# x88 COURSE OUTLINE

488 students will mentor and coach 288 and 388 students



**AEROSP 488**  
(Jr/Sr) (4)  
Product Development Leadership

|   |  |                                       |                                     |
|---|--|---------------------------------------|-------------------------------------|
| Systems Requirements, Risk/FMEA, Stakeholders | Project Finances and Budgets                 | Ethics & Culture, DEI                 | Effective Executive Presentations   |
| Proj. Mgmt. Prime, Contingency, Critical Path | Systems Validation                           | Knowledge Capture                     | Decision Making Tools and Processes |
| Team Development Sustainment                  | Delivering Constructive Development Feedback | Selecting & Developing Future Leaders | Servant Leadership & Empathy        |

**AEROSP 288**  
(Soph/Jr) (3)  
Fundamentals of Product Development

|  |                                     |   |
|--|-------------------------------------|---|
| Model-Based Systems Engineering (MBSE) | Conducting Effective Design Reviews | Manufacturing Process/Material Selection    |
| Project Management                     | Technical Presentations             | Geometric Dimensioning & Tolerancing (GD&T) |
| FMEA/DVPR/Risk Management              | Team Dynamics, DEI                  | Technical & Cost Budgets                    |

|                                |                              |                                  |
|--------------------------------|------------------------------|----------------------------------|
| Intro to Quality Engineering   | Statistical Modeling         | 6σ Root Cause Analysis Deep Dive |
| Physical Testing Methodologies | Model/Testing Correlations   | Multi-Criteria Decision Making   |
| Design of Experiments          | Managing Product Variability | Field Validation/ Flight Testing |

**AEROSP 388**  
(Soph/Jr) (4)  
Aerospace Tools & Methods (MBSE)

September      October      November      December      January      February      March      April      May



# x88 MBSE Lab Thread

Digital

## 1. Requirements

Analyze drone example in Siemens SMW. Create project requirements and cascade to subsystems

## 2. CAD

Design propeller and shaft assembly in Siemens NX

## 3. Simulation (CFD, CAE)

Star-CCM+ and Ansys Discovery used to calculate aero pressures. Resultant forces into NASTRAN for structural analyses

## 4. Manufacturing

Tool cutter paths created in NX. Injection mold vs. 3D printing inflection point calculated

## 5. Statistical Modeling

Create design of experiments. Perform basic multivariate statistics, analysis of variance, and regressions

## 6. Multi-Domain Systems

Model propeller, shaft, battery, & microcontroller system and perform power simulations

## 7. Programming & Controls

Model controls for propeller system and program microcontroller to execute them

Physical

N/A

Generate G-Code and 3D print propeller model

Verify forces and loading on a thrust test stand. Perform wind tunnel corroborations of CFD calculations

Demo die-locked part and mold-tool best practices

N/A

Build and test microcontroller and propeller system in Matlab

Flash code through Simulink to microcontroller and test control system

← 288

388 →

Students learn MBSE in a controlled series of experiments on a relevant system for “just in time” hands-on application on their team projects.

# Student Projects in x88

*Unshaded cells denote 488 students*

| Belcan Cybersecurity Project |            |           |          |
|------------------------------|------------|-----------|----------|
| Team Member                  | First Name | Last Name | username |
|                              | Ken        | Weintraub | idken    |
| 1                            | Abraham    | Abouljoud | anaboulj |
| 2                            | Brett      | Bajema    | bbajema  |
| 3                            | Faiyaz     | Bhuiyan   | fbhuiyan |
| 4                            | Henry      | Csicsila  | hcsicsil |
| 5                            | Victoria   | Gasienica | wikibyte |
| 6                            | Jamie      | Greenwood | jamiemgr |
| 7                            | Ethan      | Landt     | elandt   |
| 8                            | Mason      | Melville  | mmelv    |
| 9                            | Miles      | Smith     | milesds  |
| 10                           | Jonathan   | Taylor    | jontaylr |
| 11                           | Noah       | Vogel     | noahv    |
| 12                           | Matthew    | Wang      | wangmd   |
| 13                           | Maxton     | Herst     | maxtonh  |

| Blue Origin Feather Frame Project |                 |           |          |
|-----------------------------------|-----------------|-----------|----------|
| Team Member                       | First Name      | Last Name | username |
|                                   | Elijah          | Simpson   | elijahgs |
|                                   | Peter           | Belkin    | pbelkin  |
| 1                                 | Nikhil          | Bajwa     | nikhilb  |
| 2                                 | Alina           | Bhagwakar | abhagw   |
| 3                                 | Michael         | Carlson   | mikecar  |
| 4                                 | Daniel          | Fairfax   | dfairfax |
| 5                                 | Isaac           | Faris     | lfaris   |
| 6                                 | Ashton          | Jaffar    | ajaffar  |
| 7                                 | Nathaniel       | Jennings  | nwjenn   |
| 8                                 | Marcello        | Lara      | marlara  |
| 9                                 | Jenna           | Pasetsky  | jpaset   |
| 10                                | Sarah           | Squadrito | sarahsq  |
| 11                                | Marie           | Taylor    | taymari  |
| 12                                | William (Billy) | Vogel     | wcvogel  |

| Blue Origin/MASA Rocket Project |            |               |          |
|---------------------------------|------------|---------------|----------|
| Team Member                     | First Name | Last Name     | username |
|                                 | Jakob      | Gorisek-Gazze | jgorisek |
|                                 | Devin      | Mroz          | devinmz  |
|                                 | Charles    | Weber         | cfweber  |
| 1                               | Gavin      | Campbell      | gavincam |
| 2                               | Boden      | Chell         | bchell   |
| 3                               | Rohan      | Desai         | radesai  |
| 4                               | Serabi     | Francis       | serabif  |
| 5                               | Matt       | Nurick        | mnurick  |
| 6                               | Sean       | Pasek         | Spasek   |
| 7                               | Devansh    | Patel         | devanshv |
| 8                               | Cody       | Rushton       | rushtonc |
| 9                               | Aaron      | Schwarz       | aarones  |
| 10                              | Lydia      | Steeby        | lydsteeb |
| 11                              | Andrew     | Zhao          | andzhao  |
| 12                              | Kelsey     | Smith         | kelseysr |

| Collins Aerospace VR/AR Space Systems Project |             |               |          |
|---|-------------|---------------|----------|
| Team Member                                   | First Name  | Last Name     | username |
|   | Owen        | Faulkner      | fowen    |
|   | Tobi        | Farbstein     | tfarbs   |
|   | Henry       | Poutasse      | poutasse |
| 1   | William     | Combs         | wacombs  |
| 2   | Emmanuel    | Hernandez     | hemmanue |
| 3   | Karis       | Hu            | karishu  |
| 4   | Rachel      | Justus        | rjustus  |
| 5   | Maxwell     | Kenny         | maxkenny |
| 6   | Samuel      | Lumbala       | samuelml |
| 7   | Jack        | Mikhail       | jackmik  |
| 8   | Jose Filipe | Pedroso Botas | jfbotas  |
| 9   | Isabella    | Scanlan       | iscanlan |
| 10  | Krishan     | Shah          | krishans |
| 11  | Makenzie    | Womack        | Womakenz |

| Collins Aerospace Wheelchair Accessibility Project |            |            |          |
|--|------------|------------|----------|
| Team Member  | First Name | Last Name  | username |
|  | Ashley     | Carman     | acarman  |
|  | Honor      | Robertson  | hsrobert |
| 1  | Martha     | Ainsworth  | Marthaai |
| 2  | Kai        | Babcock    | kbab     |
| 3  | William    | Hong       | willwh   |
| 4  | Collin     | Lightfoot  | lcollin  |
| 5  | Molly      | Meengs     | mmeengs  |
| 6  | Rishika    | Mukherjee  | rishikam |
| 7  | Samuel     | Opinsky    | sopinsky |
| 8  | Patel      | Rohan      | rohahdp  |
| 9  | Rachel     | Smith      | srach    |
| 10   | Sophia     | Troshynski | strosbyn |
| 11   | Javier     | Casella    | javc     |
| 12   | Mitchell   | Kort       | mhkort   |

| General Electric Sustainability Demonstrator |            |            |          |
|--|------------|------------|----------|
| Team Member                                  | First Name | Last Name  | username |
|  | Adam       | Jones      | adamjnes |
|  | Elizabeth  | Troia      | ertroia  |
| 1  | Jonathan   | Abraham    | jtabrah  |
| 2  | Rainer     | Becker     | rainerb  |
| 3  | Bradley    | Bialke     | bdbialke |
| 4  | Victoria   | Cobb       | vcobb    |
| 5  | Alexander  | Comai      | atcom    |
| 6  | Caleb      | Erickson   | ecaleb   |
| 7  | Haydon     | Herron     | herronha |
| 8  | Diego      | Karlin     | djkarlin |
| 9  | Joon Kyo   | Kim        | johnchun |
| 10   | Keith      | LaFriniere | Klaf     |
| 11   | Ethan      | McCartney  | ethanmcc |
| 12   | Andrew     | Painter    | anpaint  |
| 13   | Hrshita    | Shyamsukha | hrisha   |

| Leidos Machine-Learning Drone Project |            |            |          |
|---------------------------------------|------------|------------|----------|
| Team Member                           | First Name | Last Name  | username |
|                                       | Sam        | Hoffman    | hoffmsam |
| 1                                     | Atul       | Amanchi    | aamanchi |
| 2                                     | Nilay      | Dedhia     | ndedhia  |
| 3                                     | Kenneth    | Fuher      | kfuher   |
| 4                                     | Isaiah     | Learman    | ilearman |
| 5                                     | Kathleen   | Leighton   | Leightka |
| 6                                     | Robert     | Macpherson | rmoemac  |
| 7                                     | Blake      | Marlow     | btmarlow |
| 8                                     | Liam       | O'Driscoll | lodrisc  |
| 9                                     | John       | Pye        | jepye    |
| 10                                    | Ashley     | Ruder      | aruder   |
| 11                                    | Dennis     | Serbin     | dserbin  |
| 12                                    | Nolan      | Emerick    | nemerick |
| 13                                    | Brandon    | Fritz      | bnfritz  |
| 14                                    | Alexander  | Marlin     | ajmarlin |

| Pratt & Whitney Hybrid-Electric Propulsion System Project |            |                |          |
|---|------------|----------------|----------|
| Team Member   | First Name | Last Name      | username |
|   | Maria      | Reitz          | mreitz   |
|   | Lillian    | Croghan        | lcroghan |
|   | Marcus     | Gilkie         | mgilk    |
| 1   | Chris      | Broddie        | sbroddie |
| 2   | Harrison   | Chung          | chunghar |
| 3   | Martin     | Fuentes Quiñon | mafuqui  |
| 4   | Siddharth  | Gupta          | siddhag  |
| 5   | Charles    | Kindelt        | ckindelt |
| 6   | Will       | MacIntosh      | toshwill |
| 7   | Colin      | Powers         | cdpowers |
| 8   | Joel       | Sawyer         | djsawyer |
| 9   | Oliver     | Van Note       | ovannote |
| 10  | Arvin      | Yang           | arviny   |
| 11  | Timothy    | Zamarro        | tzamarro |



INSTRUCTIONAL TEAM AY2023-24

# Our Team



**Ashley Carman**  
Junior  
AEROSP 200 IA



**Lillian Croghan**  
Junior  
AEROSP  
288/388 IA



**Sophia Papp**  
Senior  
AEROSP  
288/388 IA



**Hunter Sagerer**  
Grad Student  
AEROSP  
288/388 GSI



**Rishika Mukherjee**  
Sophomore  
Business Operations  
Manager



**Morgan Serra**  
Grad Student  
AEROSP  
288/388 GSI  
*Aviation Week  
20 Twenties  
2022-23*



**Izzy Scanlan**  
Sophomore  
Lab Manager



**Elijah Simpson**  
Junior  
AEROSP 200 IA  
*Patty Grace  
Smith Fellow  
2022*



**Ashton Tucker**  
Senior  
AEROSP  
288/388 IA



**Ken Weintraub**  
Junior  
AEROSP  
288/388 IA



**Claudia Zimmerman**  
*Mech. &  
Systems Eng.*  
Grad Student  
AEROSP 488  
GSI

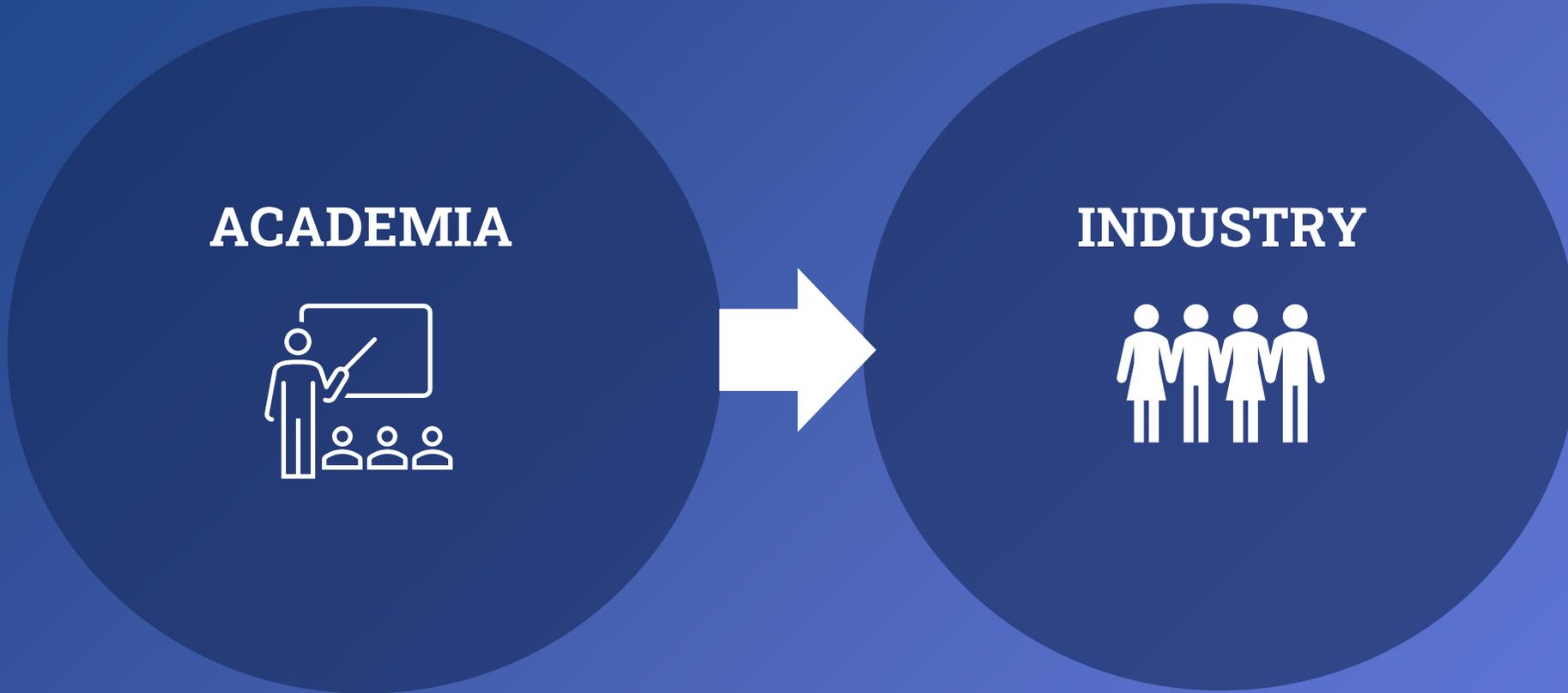
## x88 PHYSICAL MANIFESTATION

# MBSE Leadership Lab

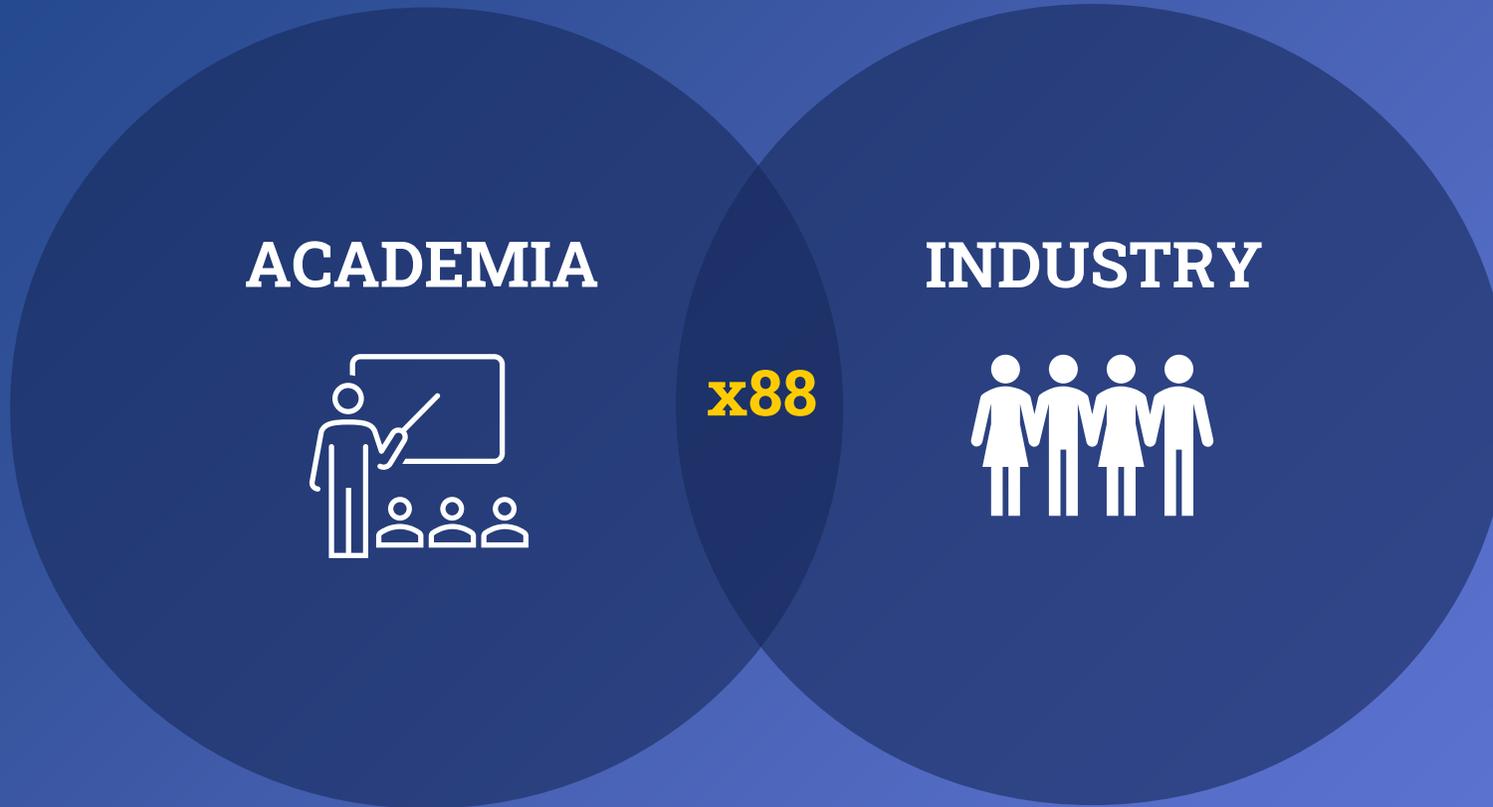
- Enables physical lab work and teaming space to supplement and validate MBSE modeling
- Corporate Sponsors (\$760,000): Belcan, Blue Origin, Collins Aerospace, GE Aerospace, Leidos, Pratt & Whitney, Raytheon, Siemens
- Expressed Interest: TBD
- Flexibility to accommodate multiple needs
- Key lab equipment
- Teaming space
- Expansion to more central space underway



# Traditional model



# Transformational model



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# AEROSPACE x88 PILOT RESULTS



Moon to Mars

Mar 28, 2022

## NASA Selects University Teams to Tackle Moon Exploration Challenges

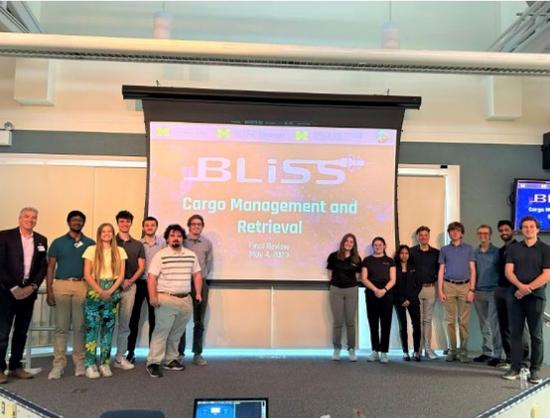
NASA has selected fifteen undergraduate and graduate finalist teams to advance to the next phase Concepts - Academic Linkage (RASC-AL) competition and present their concepts to NASA and the 2022 RASC-AL finalist teams are:

- Embry-Riddle Aeronautical University with Politecnico di Milano
  - Project Title: *SALVARE - Self-Acquisition of Liquid propellant Versatile Arsenal of Re*
  - Faculty Advisors: Dr. Davide Conte, Professor Claudia Ehringer Lucas, and Dr. Mich
- Massachusetts Institute of Technology
  - Project Title: *BART & MARGE (Bipropellant All-in-one In-situ Resource Utilization Th*
  - Faculty Advisors: Professor Jeffrey Hoffman and Dr. Olivier de Weck
- University of Central Florida
  - Project Title: *Project Vitality: Martian ISRU Architecture*
  - Faculty Advisors: Dr. Jeffrey Kauffman and Dr. Kawai Kwok
- University of Cincinnati
  - Project Title: *Resource Extraction and Propellant Architecture for Mars*
  - Faculty Advisor: Dr. Catharine McGhan
- University of Illinois at Urbana Champaign with Honeybee Robotics
  - Project Title: *Mars Ice Thermal Harvesting Rig and ISRU Laboratory (MITHRIL)*
  - Faculty Advisors: Dr. Michael Lembeck and Dr. Zachary Putnam
- University of Puerto Rico - Mayaguez with Venturi Astrolab and Thin Red Line Aerospace
  - Project Title: *MAPPER: Martian Architecture for Propellant Production and Explorati*
  - Faculty Advisors: Dr. Bárbara Calcagno, Dr. Gustavo Gutierrez, Dr. Julio Briano, and
- Virginia Polytechnic Institute and State University
  - Project Title: *Mission Khione: Martian Autonomous Propellant Harvesting Station*
  - Faculty Advisor: Dr. Kevin Shinozuka
- University of Michigan
  - Project Title: *LuVESS: Lunar Vacuum-Enabled Sample Solution*
  - Faculty Advisors: Professor George Halow, Professor Steve Battel, and Dr. Jonathan Van Noord
- University of Texas at Austin
  - Project Title: *Modular Universal Preservation System (MUPS)*
  - Faculty Advisor: Professor Adam Nokes
- University of Maryland
  - Project Title: *Design of a Suptport Logistics Carrier*
  - Faculty Advisor: Dr. David Akin
- University of Texas at Austin
  - Project Title: *Suptport Interface Logistics Carrier (SILC)*
  - Faculty Advisor: Professor Adam Nokes
- Tulane University



Michigan Aerospace  
2,271 followers  
3w · 🌐

The Cargo team of **Bioastronautics and Life Support Systems (BLISS)** presented their final design review to their primary sponsors--NASA's Deep Space Logistics Team--on Thursday, May 4, at the Kennedy Learning Institute (KLI) Buik ...see more



You and 67 others 4 comments · 1 repost

## Parker Trombley's student team wins 1st-place in the Vertical Flight Society's Design-Build-Vertical Flight student competition

| Order | University                                 | Penalty | Score |
|-------|--|---------|-------|
| 1     | University of Michigan - Ann Arbor         | 0       | 91.67 |
| 2     | University of Central Florida              | 0       | 90.33 |
| 3     | Dayananda Sagar College of Engineering     | 0       | 90.33 |
| 4     | University of Petroleum and Energy Studies | 0       | 88.88 |
| 5     | Georgia Institute of Technology            | 0       | 88.37 |

| Order | University   | Penalty | Score |
|-------|--|---------|-------|
| 1     | University of Michigan - Ann Arbor                 | 0       | 91.67 |
| 2     | University of Central Florida                      | 0       | 90.33 |
| 3     | Dayananda Sagar College of Engineering             | 0       | 90.33 |
| 4     | University of Petroleum and Energy Studies         | 0       | 88.88 |
| 5     | Georgia Institute of Technology                    | 0       | 88.37 |
| 6     | Wentworth Institute of Technology                  | 0       | 88.12 |
| 7     | University of Notre Dame                           | 0       | 87.90 |
| 8     | Clarkson University                                | 0       | 87.88 |
| 9     | The Ohio State University                          | 0       | 87.57 |
| 10    | University of Maryland - College Park              | 0       | 87.40 |
| 11    | Embry-Riddle Aeronautical University Daytona Beach | 0       | 87.15 |

|    |  |      |       |
|----|--|------|-------|
| 36 | Oregon State University                                | 0    | 81.42 |
| 37 | San Diego State University                             | 0    | 80.83 |
| 38 | University of California San Diego                     | 0    | 80.77 |
| 39 | University of Kansas                                   | 0    | 80.67 |
| 40 | The University of Oklahoma                             | 0    | 80.33 |
| 41 | Rensselaer Polytechnic Institute                       | 0    | 80.15 |
| 42 | Cairo University                                       | 0    | 80.00 |
| 43 | The University of Alabama Tuscaloosa                   | 0    | 79.67 |
| 44 | University of Florida                                  | 0    | 78.87 |
| 45 | University of Minnesota-Twin Cities                    | 0    | 77.93 |
| 46 | Arizona State University                               | 0    | 77.57 |
| 47 | University of Maryland, Baltimore County               | 0    | 77.10 |
| 48 | Texas A&M University                                   | 0    | 75.83 |
| 49 | Trine University                                       | 0    | 75.83 |
| 50 | Case Western Reserve University                        | 0    | 75.33 |
| 51 | University of Glasgow                                  | 0    | 75.02 |
| 52 | Technische Universiteit Delft                          | 0    | 73.78 |
| 53 | University of South Alabama                            | 0    | 73.25 |
| 54 | Brigham Young University                               | 0    | 71.00 |
| 55 | Purdue University                                      | 0    | 72.83 |
| 56 | University of Colorado at Boulder                      | 0    | 72.82 |
| 57 | Colorado School of Mines                               | 0    | 72.30 |
| 58 | New Mexico Institute of Mining and Technology          | 0    | 71.75 |
| 59 | Lafayette College                                      | 0    | 71.07 |
| 60 | Villanova University                                   | 0    | 70.83 |
| 61 | Instituto Tecnológico de Santo Domingo                 | 0    | 69.93 |
| 62 | University of Iowa                                     | 0    | 69.47 |
| 63 | Higher Colleges of Technology - Al Ain Women's College | 0    | 68.50 |
| 64 | University of Maryland - Baltimore                     | 0    | 68.40 |
| 65 | University of North Carolina at Charlotte              | 0    | 68.32 |
| 66 | University of North Carolina at Greensboro             | 0    | 68.12 |
| 67 | University of North Carolina at Wilmington             | 0    | 67.45 |
| 68 | University of North Carolina at Chapel Hill            | 0    | 65.53 |
| 69 | University of North Carolina at Asheville              | 0    | 63.62 |
| 70 | University of North Carolina at Pembroke               | 0    | 63.33 |
| 71 | University of North Carolina at Western                | 0    | 61.63 |
| 72 | University of North Carolina at Salisbury              | 0    | 60.00 |
| 73 | University of North Carolina at Charlotte              | 0    | 58.90 |
| 74 | University of North Carolina at Charlotte              | 0    | 58.73 |
| 75 | University of North Carolina at Charlotte              | 0    | 58.00 |
| 76 | University of North Carolina at Charlotte              | 0    | 57.65 |
| 77 | University of North Carolina at Charlotte              | 0    | 56.92 |
| 78 | University of North Carolina at Charlotte              | -10  | 56.65 |
| 79 | University of North Carolina at Charlotte              | 0    | 55.67 |
| 80 | University of North Carolina at Charlotte              | -10  | 53.15 |
| 81 | University of North Carolina at Charlotte              | -10  | 51.57 |
| 82 | University of North Carolina at Charlotte              | 0    | 50.70 |
| 83 | University of South Alabama                            | 0    | 50.60 |
| 84 | Brigham Young University                               | 0    | 50.60 |
| 85 | Purdue University                                      | 0    | 48.55 |
| 86 | University of Colorado at Boulder                      | 0    | 48.27 |
| 87 | Colorado School of Mines                               | 0    | 47.55 |
| 88 | New Mexico Institute of Mining and Technology          | 0    | 46.47 |
| 89 | Lafayette College                                      | 0    | 34.93 |
| 90 | Villanova University                                   | 0    | 31.53 |
| 91 | Instituto Tecnológico de Santo Domingo                 | -10  | 24.42 |
| 92 | University of Iowa                                     | -10  | 20.58 |
| 93 | Higher Colleges of Technology - Al Ain Women's College | -100 | DQ    |

### University of Michigan

- Project Title: *LuVESS: Lunar Vacuum-Enabled Sample Solution*
- Faculty Advisors: Professor George Halow, Professor Steve Battel, and Dr. Jonathan Van Noord



# End-of-Year Survey (1st year)

|   | Competency Dimension | Pre-Course Response (n = 12) | Post-Course Response (n = 12) |
|---|----------------------|------------------------------|-------------------------------|
| <b>Quantitative Likert-Like Scale Scores (1-5)</b>                    | Leadership           | 3.9                          | 4.0                           |
|   | Teamwork             | 4.0                          | 4.4                           |
|   | Risk Management      | 3.3                          | 2.7                           |
|   | Systems Thinking     | 3.7                          | 4.4                           |
| <b>Quantified Qualitative Responses to Open-Ended Questions (1-3)</b> | Leadership           | 1.63                         | 1.92                          |
|   | Teamwork             | 2.25                         | 2.38                          |
|   | Risk Management      | 1.66                         | 2.50                          |
|   | Systems Thinking     | 2.17                         | 2.42                          |

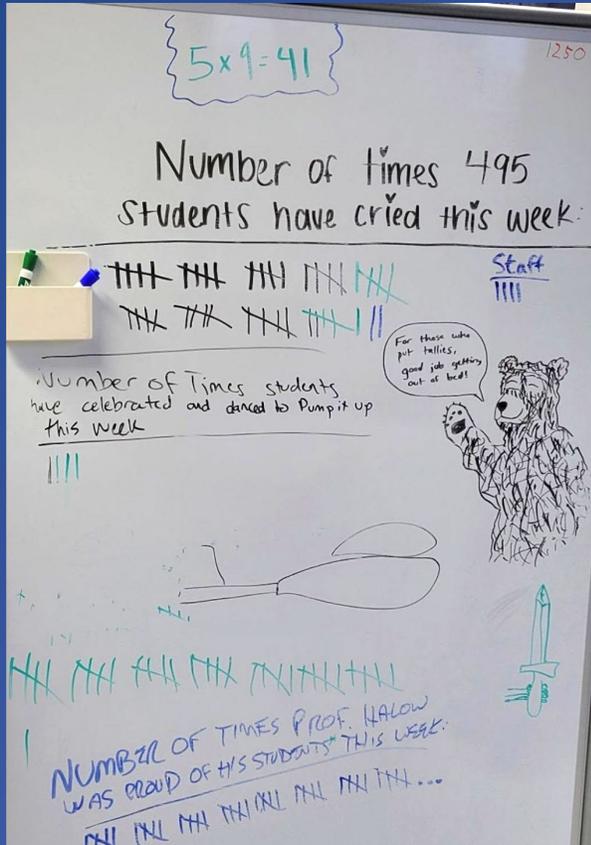
Note: Risk Management scores were discussed in student focus groups and competency growth was most significant in this area.

Qualitative Score degradation was explained by students as they did not know a priori how sophisticated Risk Management was – hence the low post-course score.

-  Increase between 5-10% from pre-course response
-  Increase of > 10% over pre-course response
-  Decrease from pre-course response

TRANSFORMED EXPERIENCE

# Student Experiences

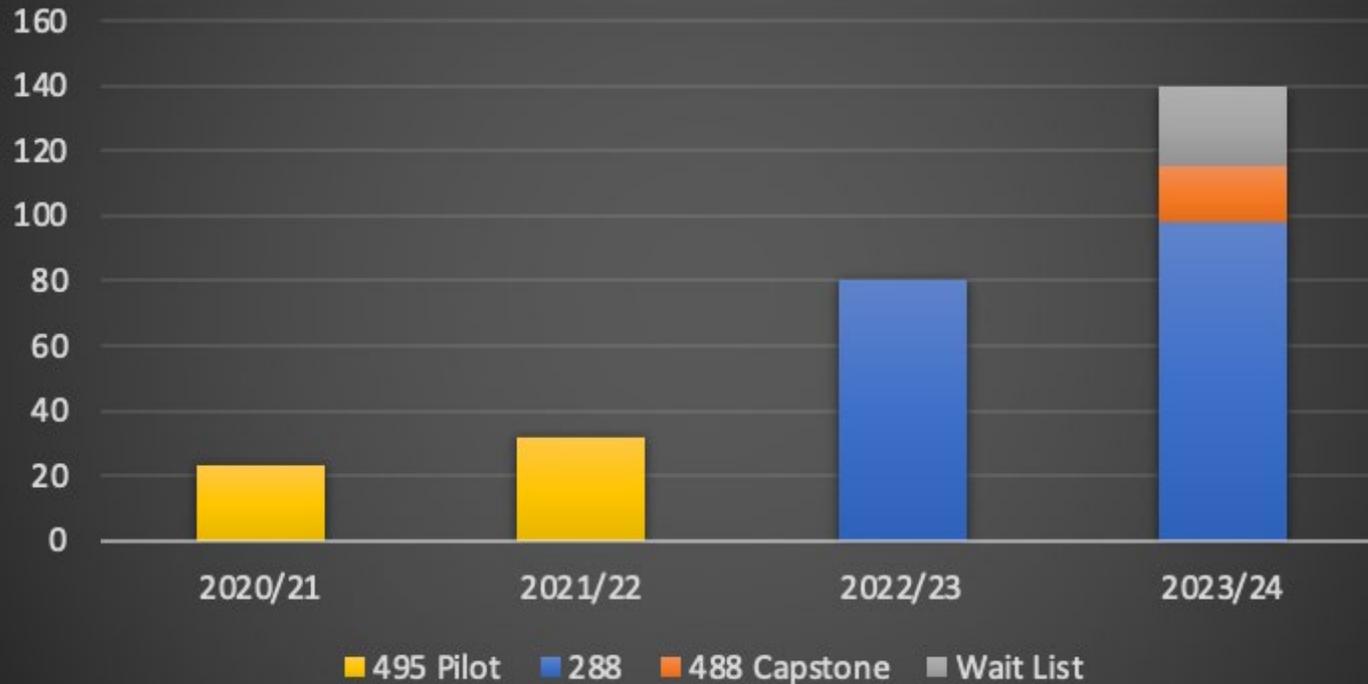


# Student Evaluations

| Dimension   | AEROSP 495 |
|---|------------|
| This course advanced my understanding of the subject matter                                 | 5.0        |
| My interest in the subject has increased because of this course                             | 5.0        |
| I knew what was expected of me in this course   | 5.0        |
| Overall, this was an excellent course   | 5.0        |
| I had a strong desire to take this course   | 5.0        |
| I developed a greater understanding of my ethical responsibilities                          | 5.0        |
| I developed a greater understanding of my responsibilities as a professional                | 5.0        |
| This course improved my ability to communicate technical information, designs, and analyses | 5.0        |
| I developed a greater understanding of the impact of engineering on society                 | 5.0        |
| I developed a greater understanding of the impact of engineering on the environment         | 4.8        |
| I now have a greater understanding of contemporary issues in this field                     | 4.9        |

# Student Demand

## x88 Demand



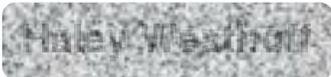
Enrollment continues to accelerate briskly:

- **Capacity-limited; AEROSP 288 standing-room only**
  - CAGR 71% (83% at free-demand)
- **Female/URM enrollment solid at 31%**
  - Instructional team 78% female/URM
- **8 teams total, up from 3 in first year**
- **Cross-departmental representation 34% during pilot, but < 5% now**
  - Easy for non-Aero to fit 4 credits into packed curriculum (pilot), but not 11 (full x88)

## TRANSFORMED EXPERIENCE

# Student Testimonial



→   
to me ▾

Mon, Jul 31, 8:58 AM (13 days ago)



You know what's so crazy

In all of the bazillion trainings I'm going through in the first month of work, everything seems so repetitive and like I've already learned it because...well I have.

Fishbone diagrams, 8D approach, FMEA, root cause, six sigma, preventative action, Gantt charts, design reviews, the list goes on and on.

Thanks for putting me through this all two years ago so I can just zone out now 🤔🤔

No, but foreal, the curriculum is really so applicable to industry!! Especially in an environment where I'm not applying a lot of my technical chemical engineering knowledge, it's nice to know I at least have a little bit of a leg up on people.

I guess this is when a normal human would say thank you. They say people with driver personalities like me struggle with that?? Weird.

How are you doing??

TRANSFORMED EXPERIENCE

# Corporate Testimonials



Mon, Dec 12, 2022, 1:17 PM



to me ▾

Hi George,

Just a quick note on the executive presence topic...

You are getting this right 😊 Every student that I have interacted with has a level of business acumen that I would value at two years of working experience.

This is not everywhere. Having early-career, new hires that can be counted on to organize/run a meeting, communicate effectively within a professional environment, and understand implications of cross-functional interactions and processes is a major benefit.



Thu, Oct 5, 10:09 AM (9 days ago)



George:

I am writing to offer my many thanks for hosting [redacted] during our visit to the University of Michigan and for the opportunity to dialogue with the student leaders on pathways to strengthen [redacted] relationship with the university and the student body. Moreover, the X88 students demonstrated team cohesion, facility with systems engineering fundamental principles and practices during their first SRR of the [redacted] project, and responded well to feedback from all of the reviewers. We also enjoyed our conversation with [redacted] on aviation environmental policy over dinner and look forward to continuing the dialogue. Lastly, we all thought that your enthusiasm and dedication to the teaching mission of the University of Michigan was evident and infectious, and we look forward to partnering on future engagements.

Best Wishes,



[engin.umich.edu](http://engin.umich.edu)

