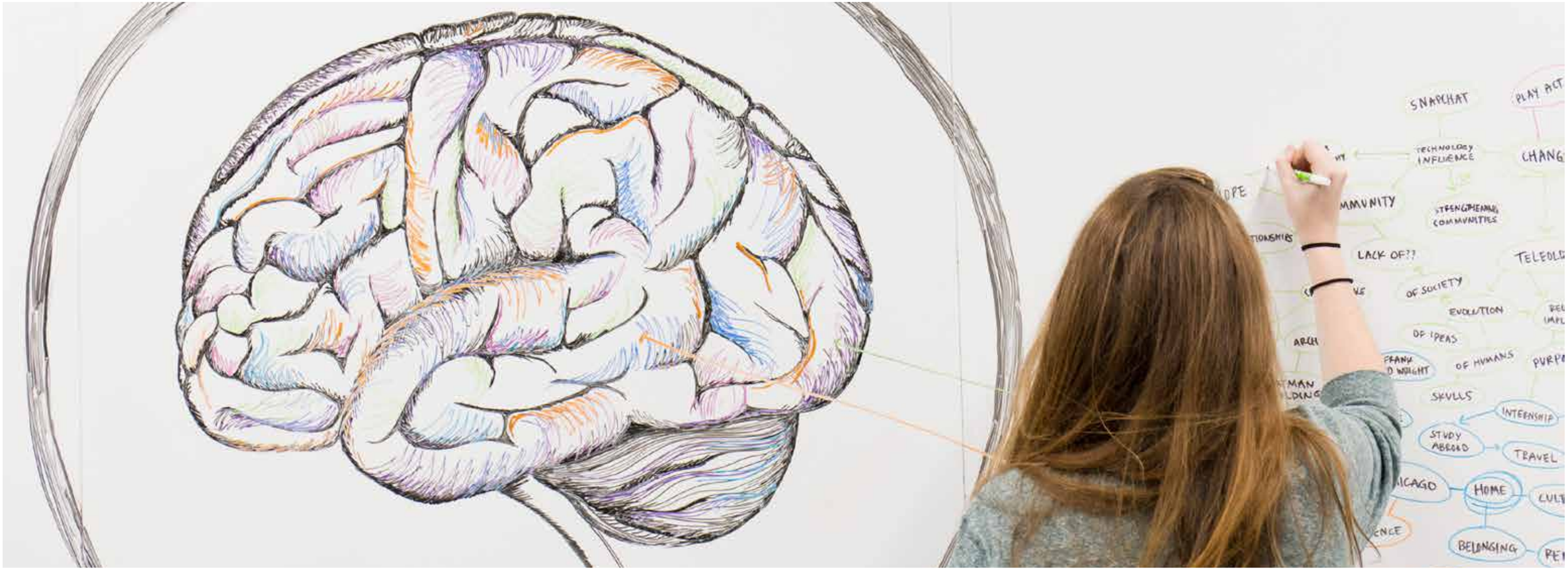



WILSON HGA

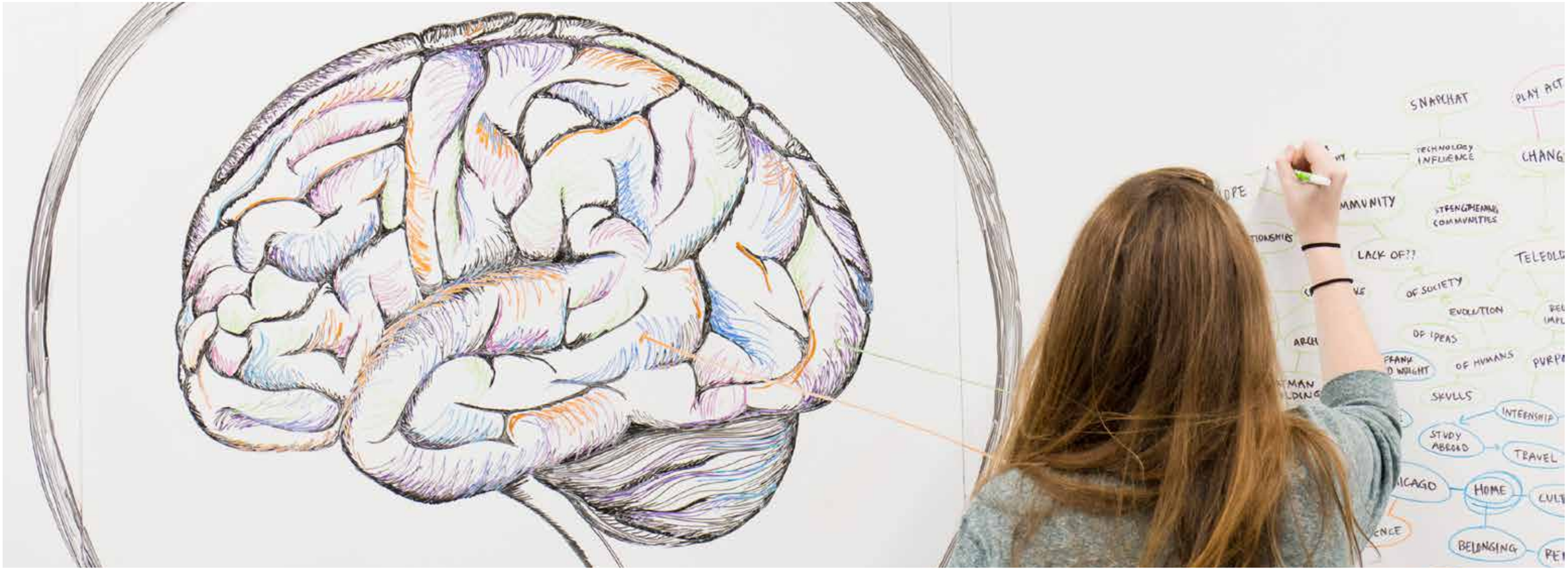
# DIFFERENT MODELS FOR DELIVERING ENGINEERING FACILITIES

## SCUP 2019: North Atlantic | Rochester

Chris Martin • Principal
Wilson HGA

Cristianne Peschard • Project Architect
Wilson HGA

Angie Foss • Assoc. Dean of Operations
SNHU: COE Technology and Aeronautics




WILSON HGA

## LEARNING OUTCOMES

- Engineering curricula and pedagogy  addressing societal challenges
- Current trends in engineering education
- Fulfilling the mission of more inclusive programs
- Facilities that support these goals

# PRESENTERS:

Chris Martin

**Principal**

Angie Foss

**Associate Dean of Operations**
**SNHU CETA**

Cristianne Peschard

**Project Architect**

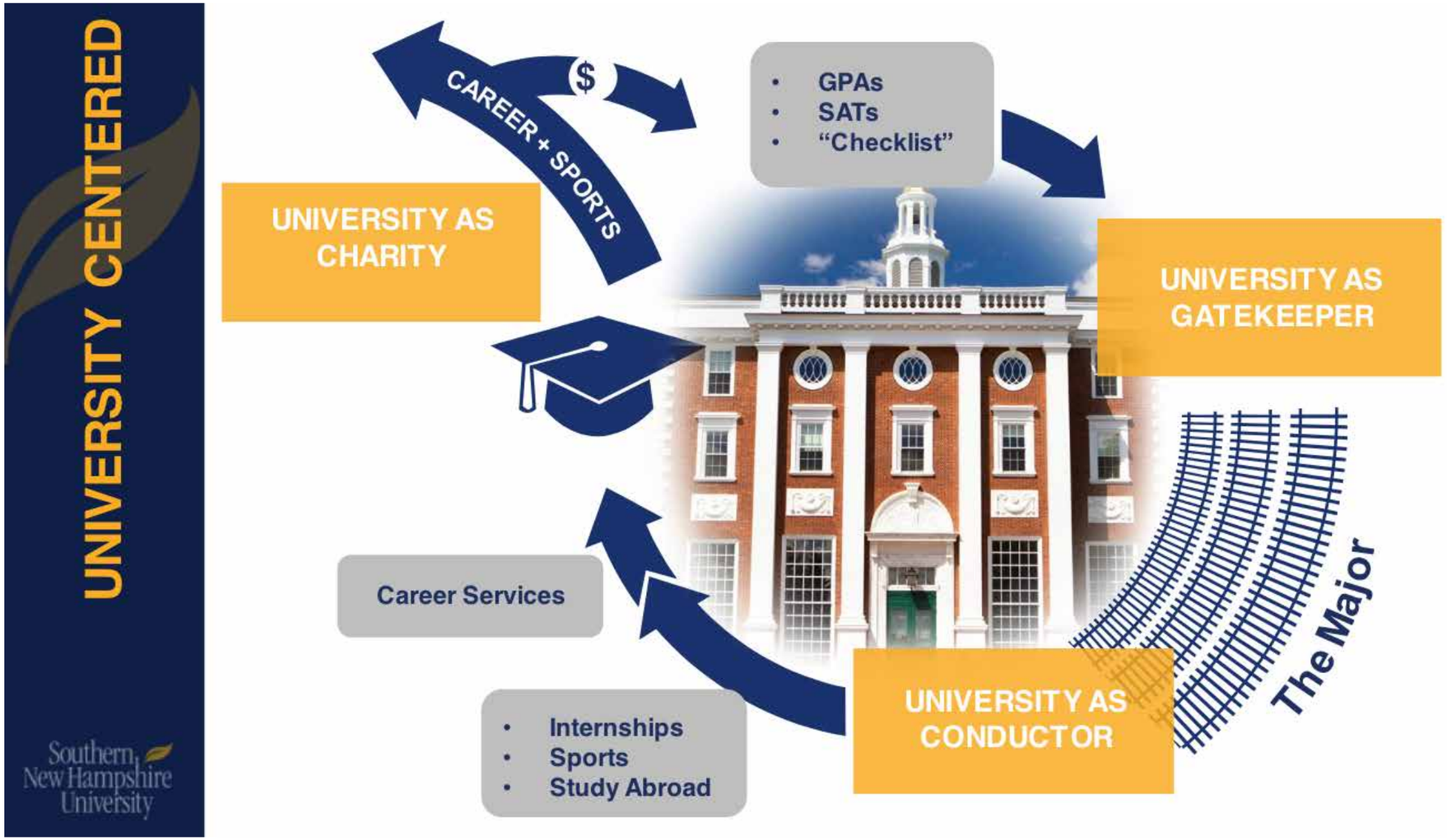
# SOUTHERN NEW HAMPSHIRE UNIVERSITY

**Mission: "...expand access to education by creating high quality, affordable and innovative pathways to meet the unique needs of each and every learner"**

- Private, nonprofit
- Campus located in Manchester, New Hampshire (more than 3,000 students)
- 2013 Strategic Plan to serve 40,000 students by 2018...currently 130,000
- Over 200 programs, from certificate to doctoral levels including business, education, liberal arts, social sciences and STEM

# SOUTHERN NEW HAMPSHIRE UNIVERSITY

## Academic "Disruptor"




*Sources: SNHU Strategic Plan*

# SOUTHERN NEW HAMPSHIRE UNIVERSITY

## Academic "Disruptor"

- Subscription?
- Co-op?
- Life-long Access

- GRIT
- Knowledge & Skills
  - Cognitive Map
    - Resources (Time & Money)

UNIVERSITY AS CAREER PARTNER AND COMMUNITY

Student Profile

Student Goals

- Program
- Career
- Time
- Skills Knowledge
- Personal Development
- Job and Career

- Degrees
- Certifications
- Micro credentials
- Just In Time

Credentialing

UNIVERSITY AS CREDENTIALER

UNIVERSITY AS CURATOR

**Performance Based Assessment**

- Clinical
- Project Based
- Workplace
- Machine Based

Competencies

Personalized Learning Map

UNIVERSITY AS TRANSLATOR

- PLA
- Courses
- CBE

- International
- Peer to Peer
- Workplace
- Military Service
- Athletics
- Clinicals/Apprenticeship
- Other Providers (MOOCs, Lynda and Bootcamps)

*Sources: SNHU Strategic Plan*

# INTRODUCTION: THE DANIEL WEBSTER STORY

## SNHU was exploring ways to get involved in STEM

## "You cannot just add water and grow an engineering program"

- Acquired DWC
  - **STEP 1:** Minimum to win: "Teach out"
  - DWC used CDIO *Conceive, Design, Implement and Operate*
  - Had ABET accreditation
  - **STEP 2**: SNHU Engineering Annex
  - **STEP 3**: New CETA building and beyond

**SNHU Welcomes Daniel Webster Students (and Programs) to Campus**

January 19, 2017

**Shane Carley**
Writer

When Southern New Hampshire University (SNHU) stepped in to help Daniel Webster College (DWC) in Nashua keep its doors open last year, school officials knew it would mean adding program offerings beyond the university's traditional majors in the arts and sciences, education and business. But SNHU's drive to meet every challenge remains the same.

# ENGINEERING TRENDS

## Disrupt the way Engineering is taught

- Other institutions have started doing it
- Project-based, hand-on
- Equip students with the tools to design their own path of study
- Micro-credentials to bridge the gap between engineering and engineering technologies
- Start with ABET-accredited degrees and expand

# ENGINEERING TRENDS

## Innovation Hub

- Where problem-solving occurs
- Collaboration space
- Design Sequence: Project based/hands-on
    - CDIO - Conceiving, Designing, Implementing, Operating
    - Competency-based curriculum and assessment models.
    - Physical AND pedagogical changes toward interdisciplinary teaching

# ENGINEERING TRENDS

## Content and Curricular Innovation

- Employer's needs for versatile, and well-tuned soft skills
- Online learning - Blended, remote and flipped classrooms
    - AR / VR
- Move toward engineering degree vs specific discipline.
- Engineering Technology Programming - programs that can keep up with employer demand

*Sources: American Society of Mechanical Engineering; National Academies*

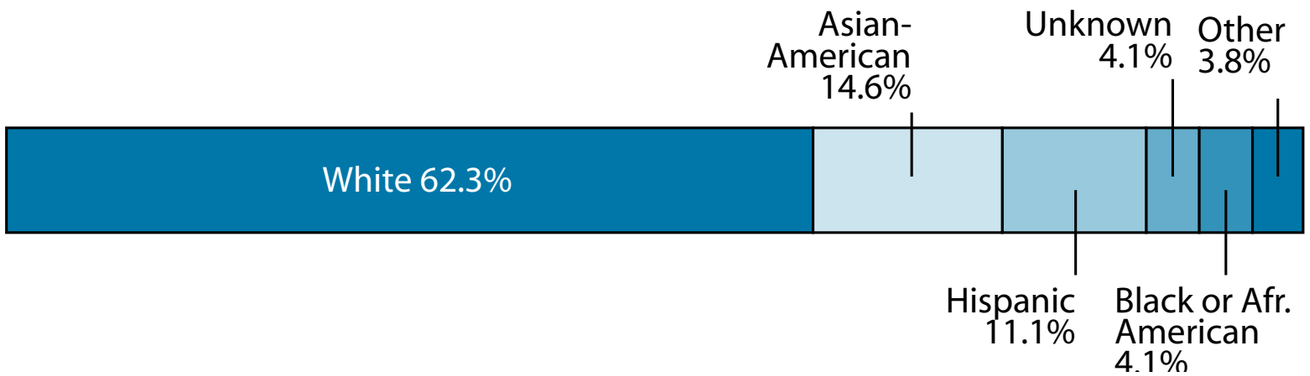
# THE OPPORTUNITY + GOALS

## Attract, Foster, and Retain, and Graduate under represented populations

- Percentage of women in engineering
- Percentage of minorities in engineering
- Representation in the faculty
- Evidence that representation has gone down in the field

**Bachelor's Degrees by Gender, 2017**

**Bachelor's Degrees by Ethnicity, 2017***

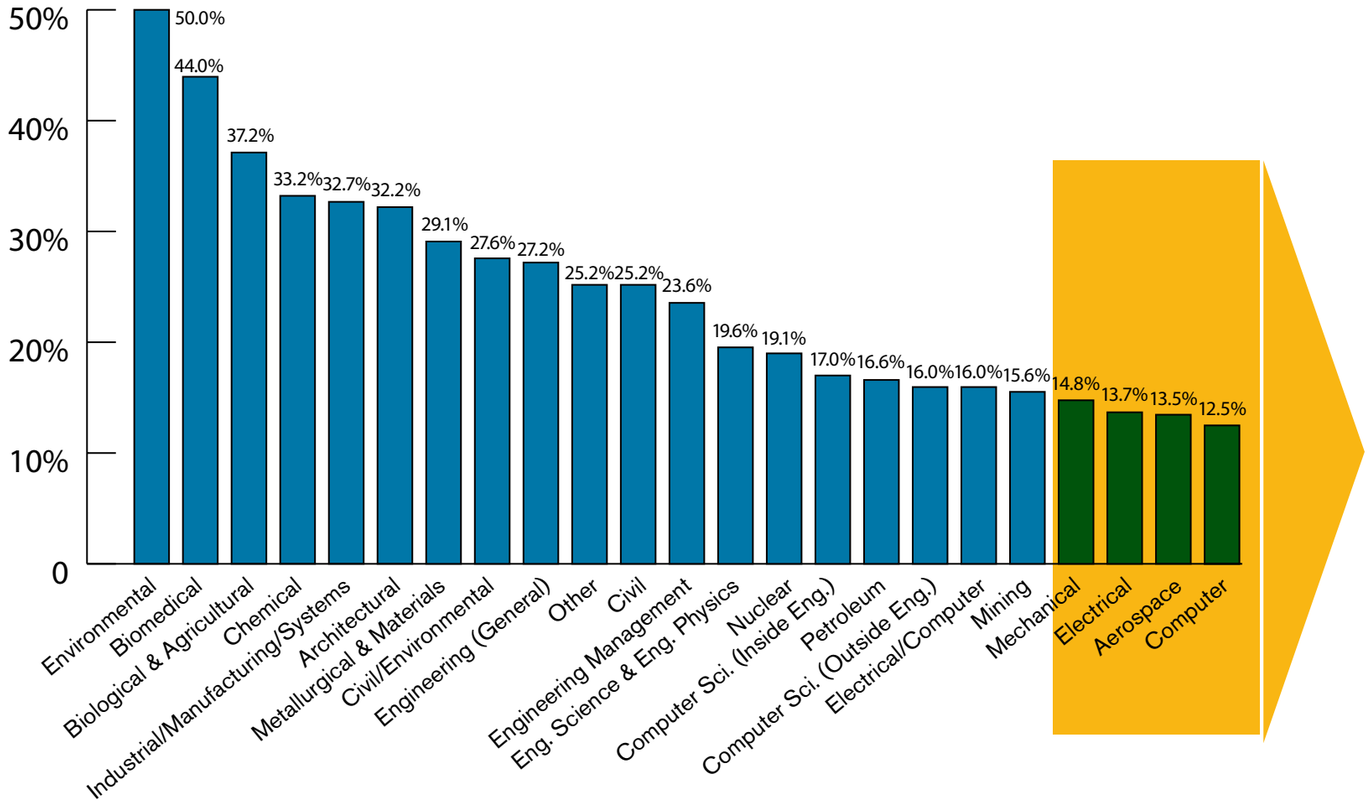



*Sources: American Society of Engineering Education*

# THE OPPORTUNITY + GOALS

## Transform Engineering Disciplines

- Guided by SNHU mission as Academic disrupter
- Affect disciplines that traditionally are more segregated



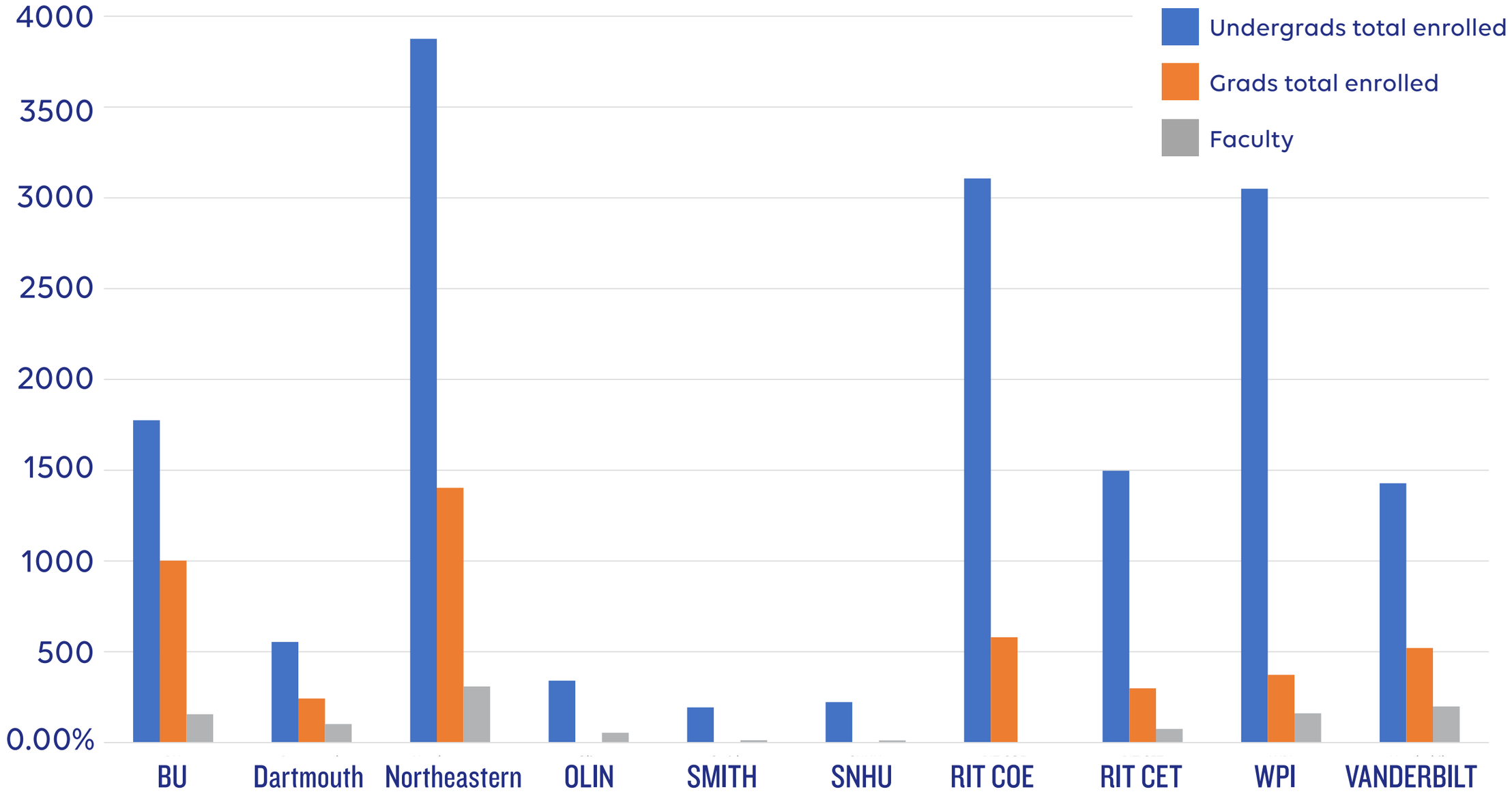

*PERCENTAGE OF BACHELOR's DEGREES AWARDED TO WOMEN BY DISCIPLINE: 21.3% OF TOTAL*

*Smallest, Female representations in the SNHU Faculty:*

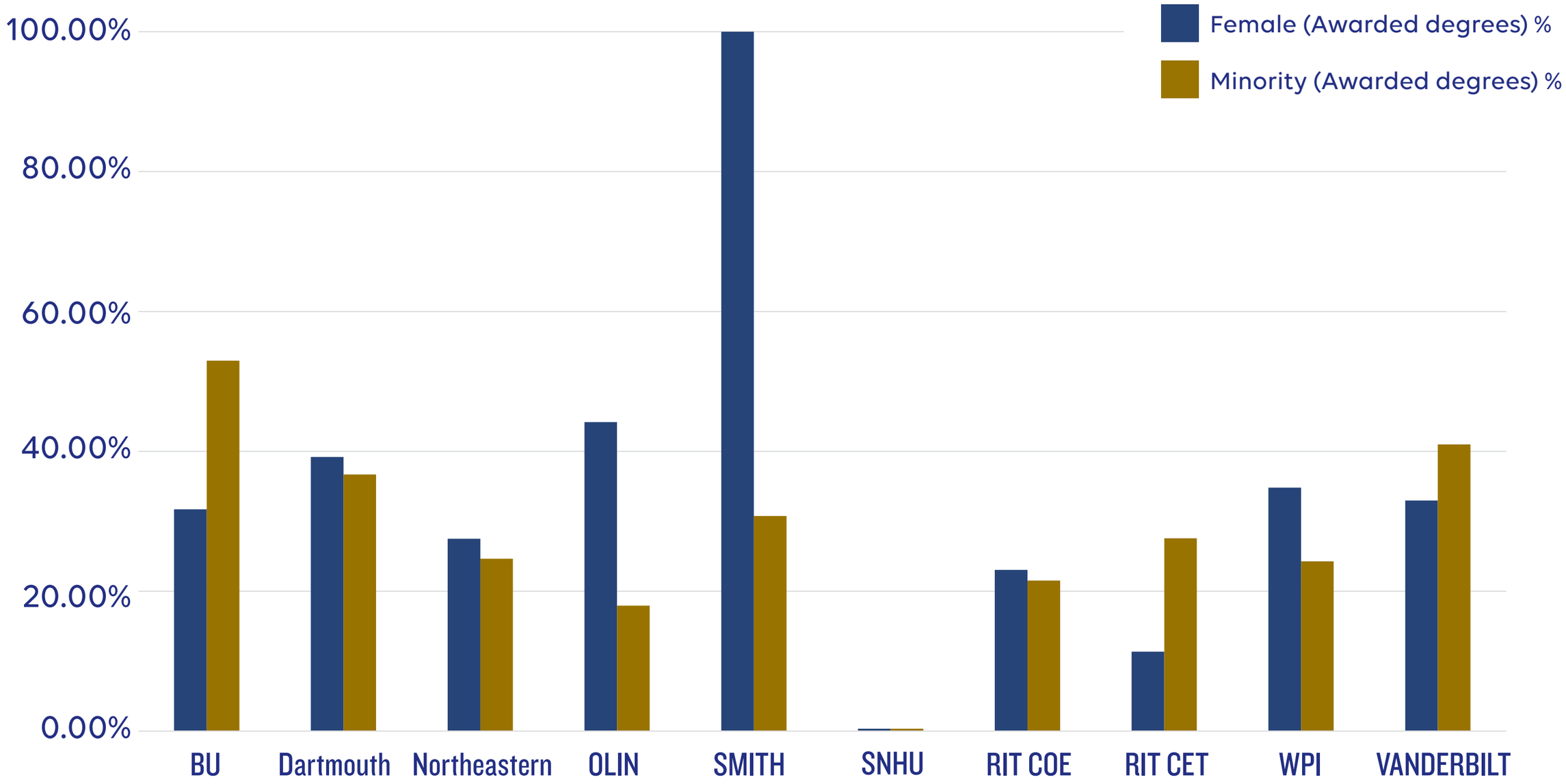
- *Mechanical*
- *Electrical*
- *Aerospace*
- *Computer*

*Sources: American Society of Engineering Education*

# BENCHMARKING STUDENTS AND FACULTY



# BENCHMARKING DIVERSITY IN ENGINEERING



# ENGINEERING TRENDS

## What Engineering students are looking for:

**ACCESS TO TECHNOLOGY:**
Tied to residential life

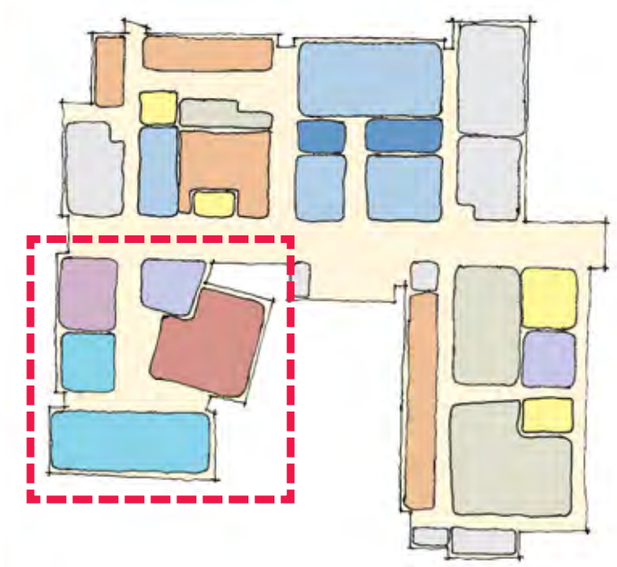
**MORE COLLABORATIVE SPACE:**
Different types

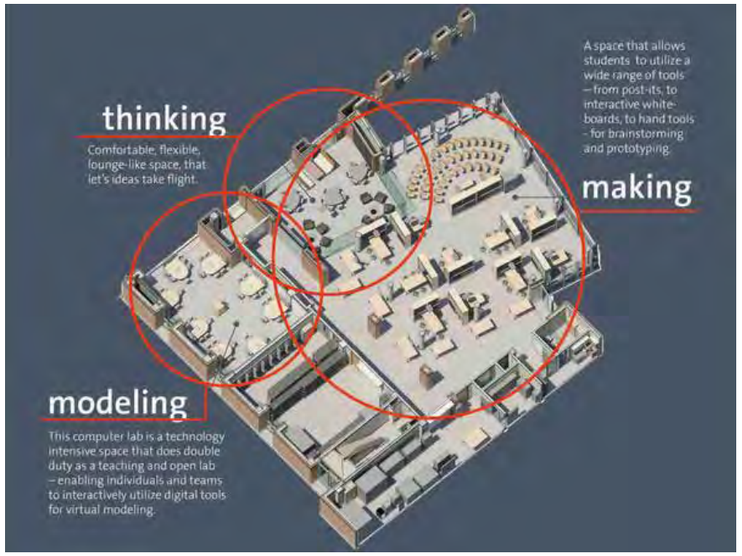
**EMPOWER STUDENTS:**
Self-directed, group centric

**'SYSTEMS THINKING':**
Holistic approach to problem-solving

**BUY-IN:**
A 'different' path to graduation

# HOW ARE OTHERS DOING THIS? Trinity University



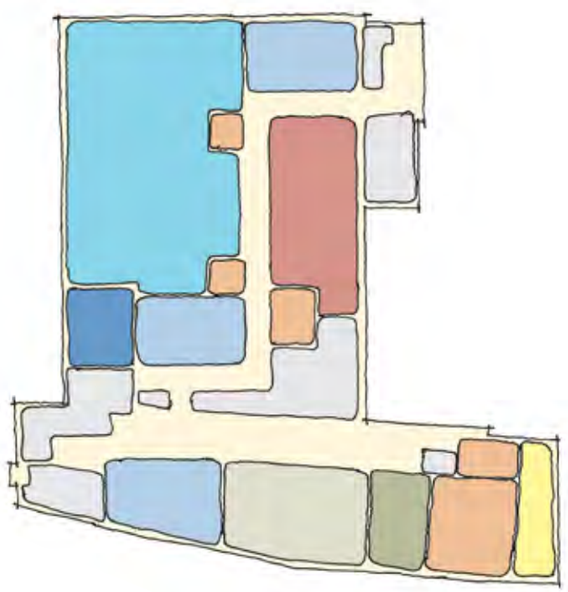


## CENTER FOR SCIENCES & INNOVATION

- 155,000 GSF / $130M / 2014
- Science & Engineering teaching and research
- Collaborative ideation spaces
- Design, development, and implementation
- Overlap of three academic units: art and humanities, science and engineering, and business and social sciences

*Architect: EYP*

# HOW ARE OTHERS DOING THIS? Boston University



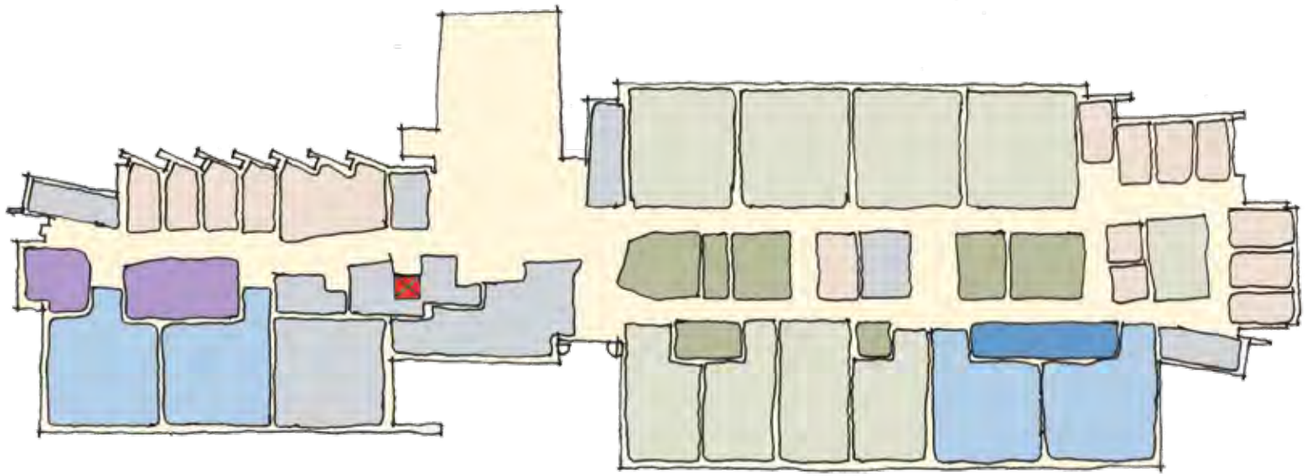
## ENGINEERING PRODUCT INNOVATION CENTER

21,000 SF / $10M / 2013

- Partnerships with local industries
- Prototyping equipment
- Computational facilities
- Meeting rooms
- Prototype design and development
- Research labs

# HOW ARE OTHERS DOING THIS?

## Smith College



### FORD HALL

- 140,000 SF/ $73M / 2017
- Engineering and Molecular Sciences
- Great Hall
- Building gives students and faculty access to mechanical systems and monitors

*Architect: Bohlin Cywinski Jackson*

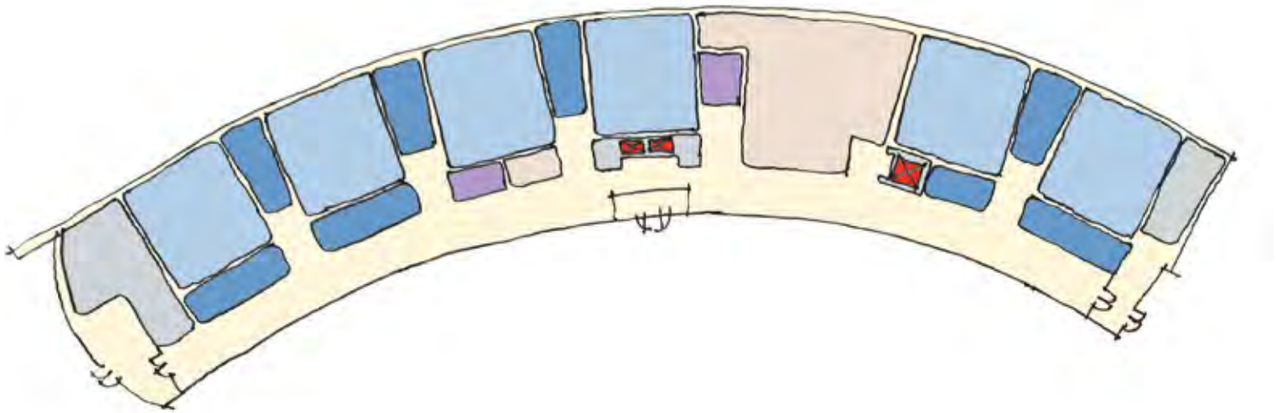
# HOW ARE OTHERS DOING THIS?

## Smith College

- First women's college to offer engineering
- Grew from class of 20 to 100 (2000-2008)
- Create a culture that fosters inclusion
- Small classes, interactions outside the classroom
- First year project: Build a hand tool

# HOW ARE OTHERS DOING THIS?

## Olin College of Engineering



### ACADEMIC CENTER

- 2003
- 27 classrooms and labs
- Wood shop, mini shops, machine shop
- Media center
- Seminar and meeting rooms
- Faculty research labs

*Architect: Perry Dean Rogers Partners*

# HOW ARE OTHERS DOING THIS?

## Olin College of Engineering

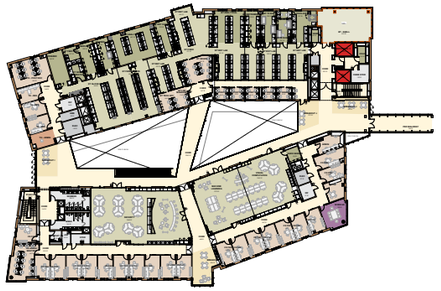
- Project-based, ABET-accredited
- People can walk in and out of a class without students noticing: Engaged in projects
- Keep faculty in the mix: Office Location

# HOW ARE OTHERS DOING THIS?

## Dartmouth College

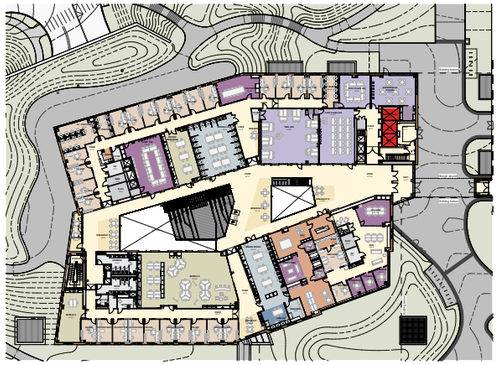
THAYER SCHOOL OF ENGINEERING/COMP SCIENCE BUILDING

- 300,000 SF/ $146M / 2021
- Engineering and Computer Sciences
- Biotech, energy technologies, cyber-security
- Designed around central collaboration space



**Level 2**
Complex Systems
Mobile X
Security

**Level 1**
Maker Space / Design Lab
DALI (commercialization)
Visual Computation
Machine Learning



**Level 0**
Material Science
Imaging Core
Project Labs

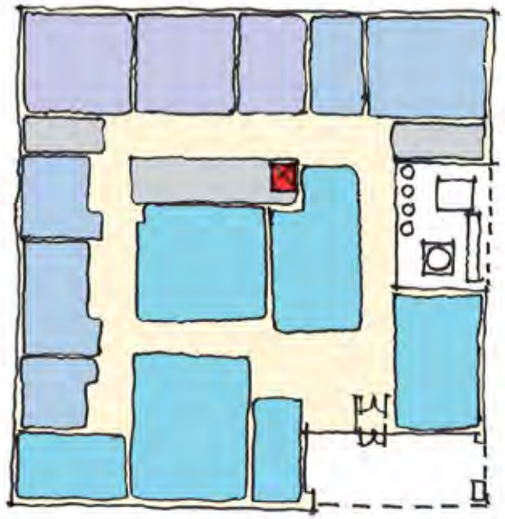
# HOW ARE OTHERS DOING THIS?

## Dartmouth College

- +1 model (Bachelor of Engineering, BE)
- New concepts in their facilities, the Couch lab “tricks” students into hanging out in a lab because it is a cool place
- Inclusion culture
    - Building can remain open, dangerous equipment has a kill switch
    - Machine shop manager
    - Help non-stem students catch up
- Vending machines to buy pieces for projects: Students don’t pay, but they understand how much things cost

# HOW ARE OTHERS DOING THIS?

## Manchester Community College



### ADVANCED TECHNOLOGIES BUILDING

- 2018
- Ductwork, piping, electrical systems all exposed - building as instructional tool
- Availbale to manufacturers, contractors and industry
- Manhole, HVAC lab

*Architect: Lavallee Brensinger Architects*

# HOW ARE OTHERS DOING THIS?

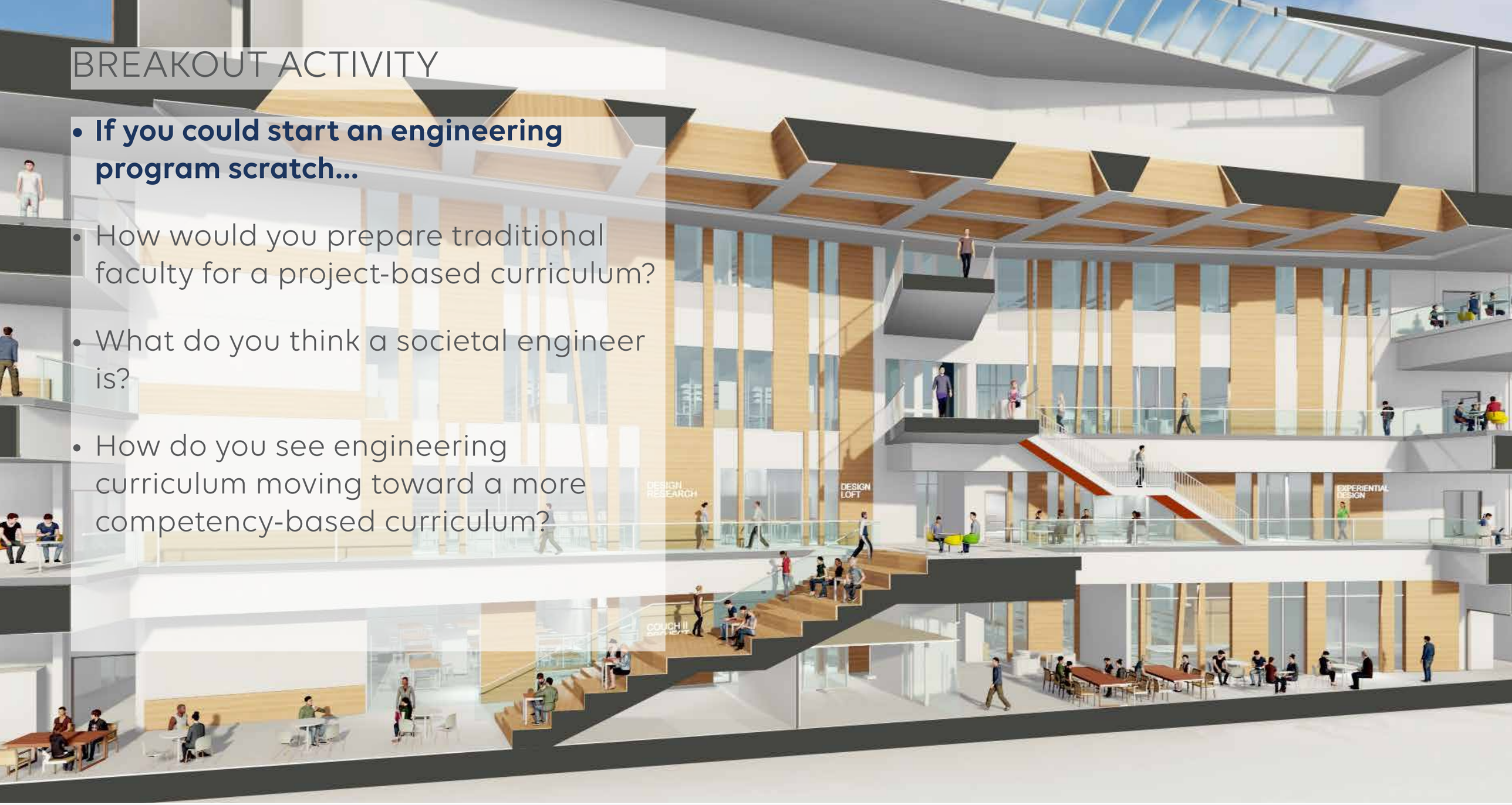
## Manchester Community College

- Engineering technology
- Experience real life job situations
- Partner with local employers to identify needs
- 100% hiring rate for HVAC and Electrical graduates

*Architect: Lavallee Brensinger Architects*

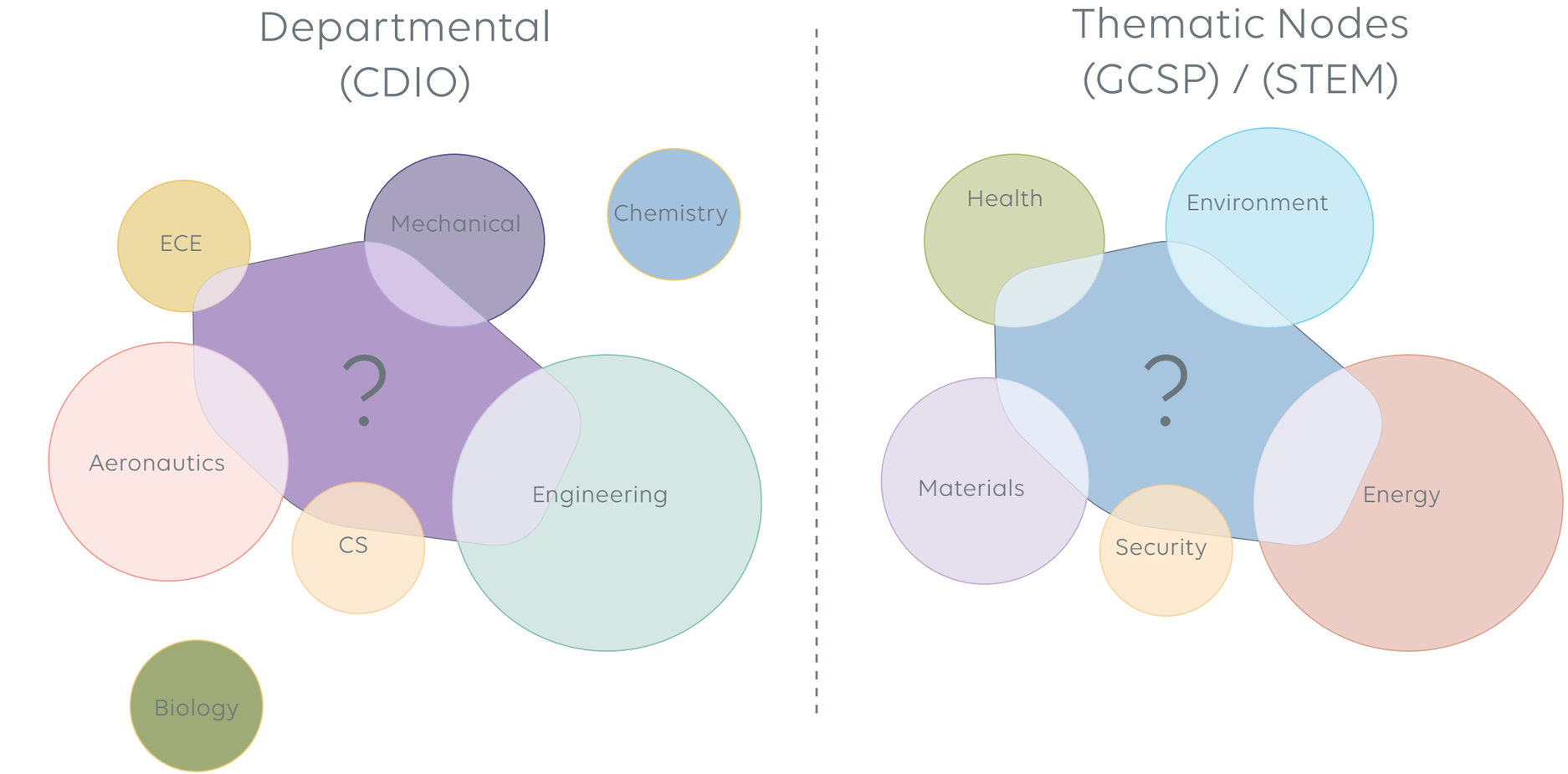
# BREAKOUT ACTIVITY

- **If you could start an engineering program scratch…**
- How would you prepare traditional faculty for a project-based curriculum?
- What do you think a societal engineer is?
- How do you see engineering curriculum moving toward a more competency-based curriculum?



# THE OPPORTUNITY

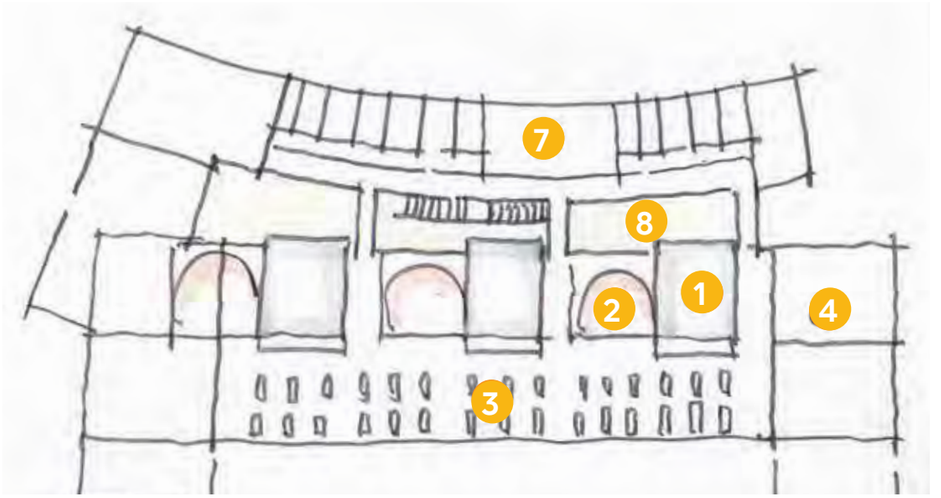
## Thematic Organization



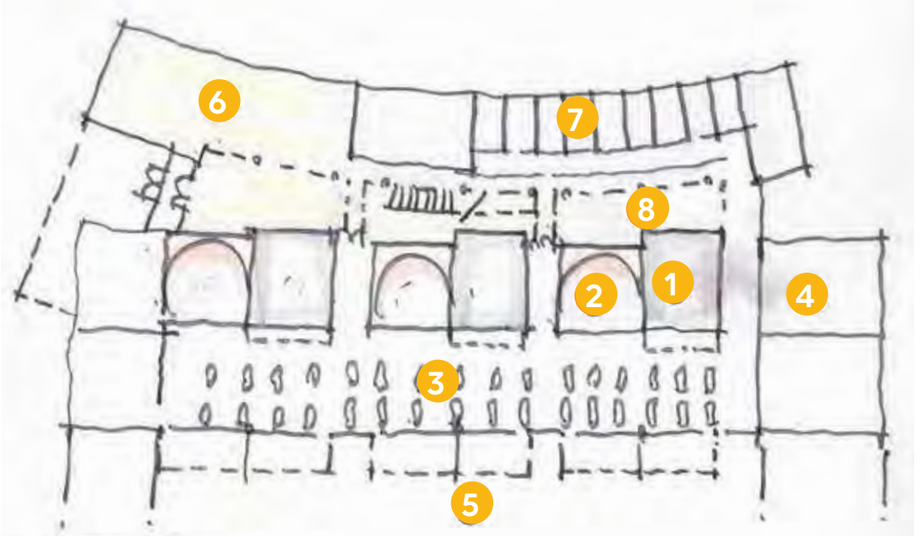
# SNHU: COLLEGE OF ENGINEERING, TECH AND AERONAUTICS CETA

## Engineering "Innovation Hub"

1. Ideation Lounge
2. Modeling Suite
3. Assembly Studio
4. Fabrication
5. Outdoor Work Area
6. Student Living Room / Cafe
7. Classroom / Office
8. Google Spine




Level 2



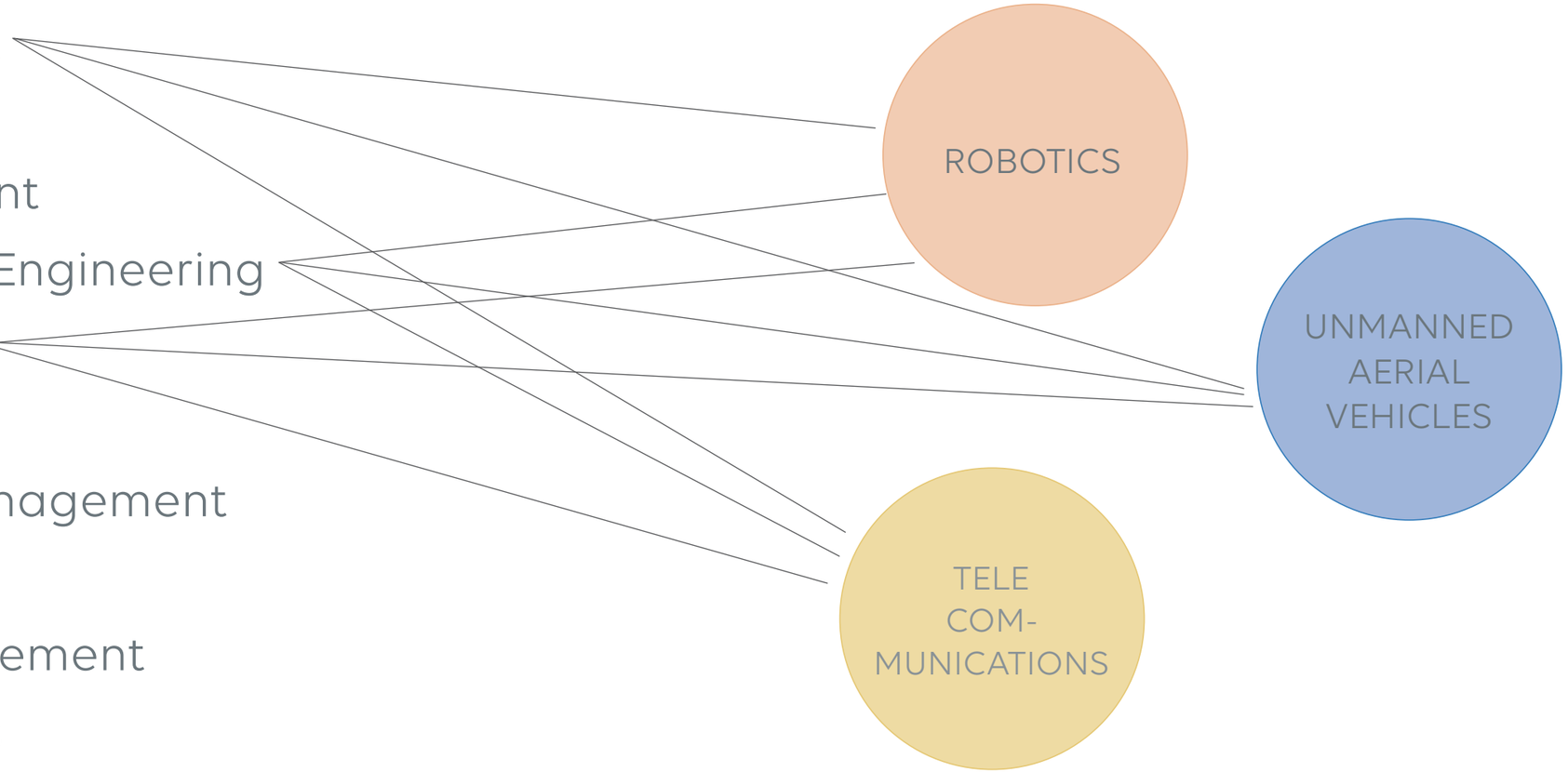

Level 1

# THE OPPORTUNITY

## CETA Academic Programs Today

- Aeronautical Engineering
- Computer Science
- Construction Management
- Electrical and Computer Engineering
- Mechanical Engineering
- Aviation Management
- Aviation Operation & Management
- Air Traffic Management
- Flight Operations Management
- Information Technologies

## Concentrations

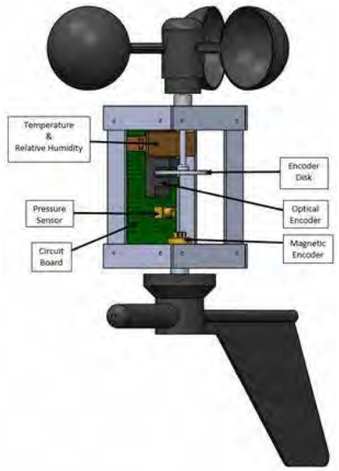



ENGINEERING DESIGN 1

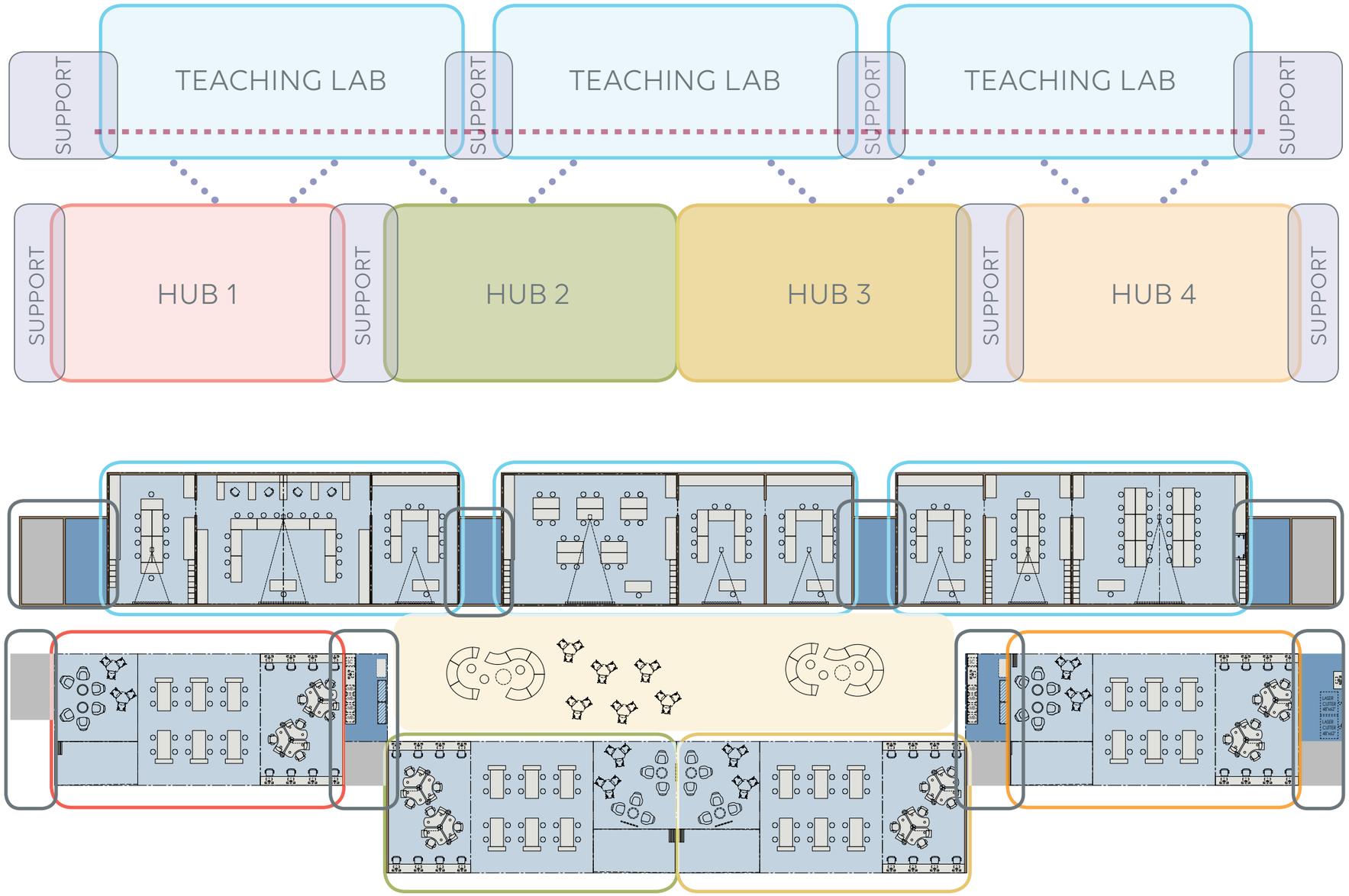
# THE OPPORTUNITY

## CETA Academic Goals

- More interdisciplinary
    - Freshman engineering design course is open to non-majors
- Concentrations working around projects
- Shifting to more competency-based curriculum
- All CETA engineering students to have a strong engineering core



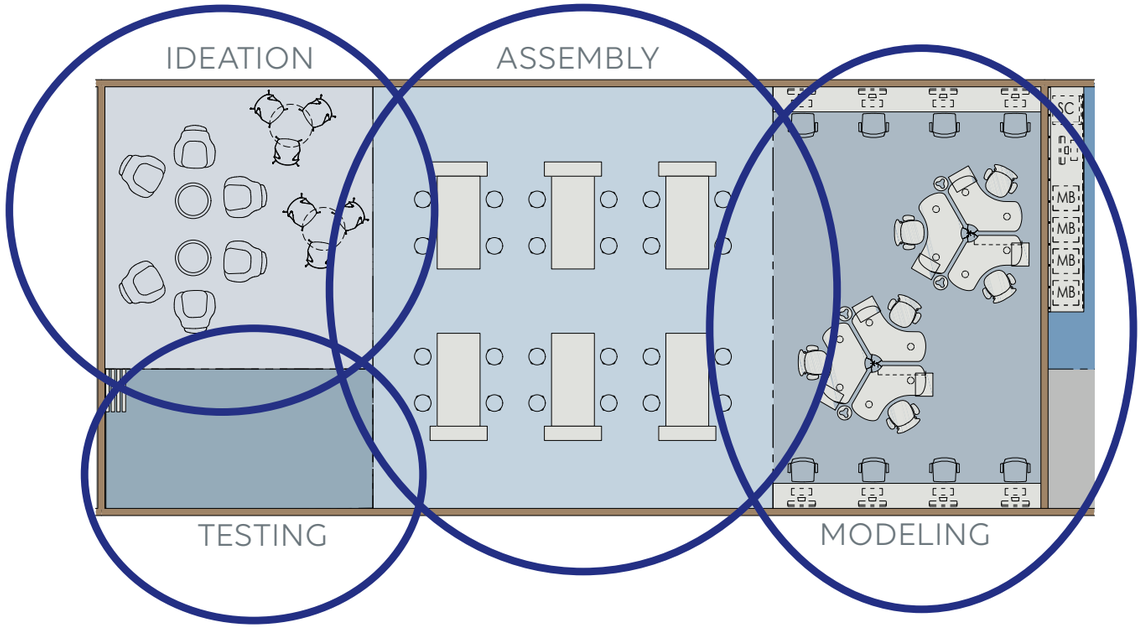
# TEACHING LABS / CDIO HUBS

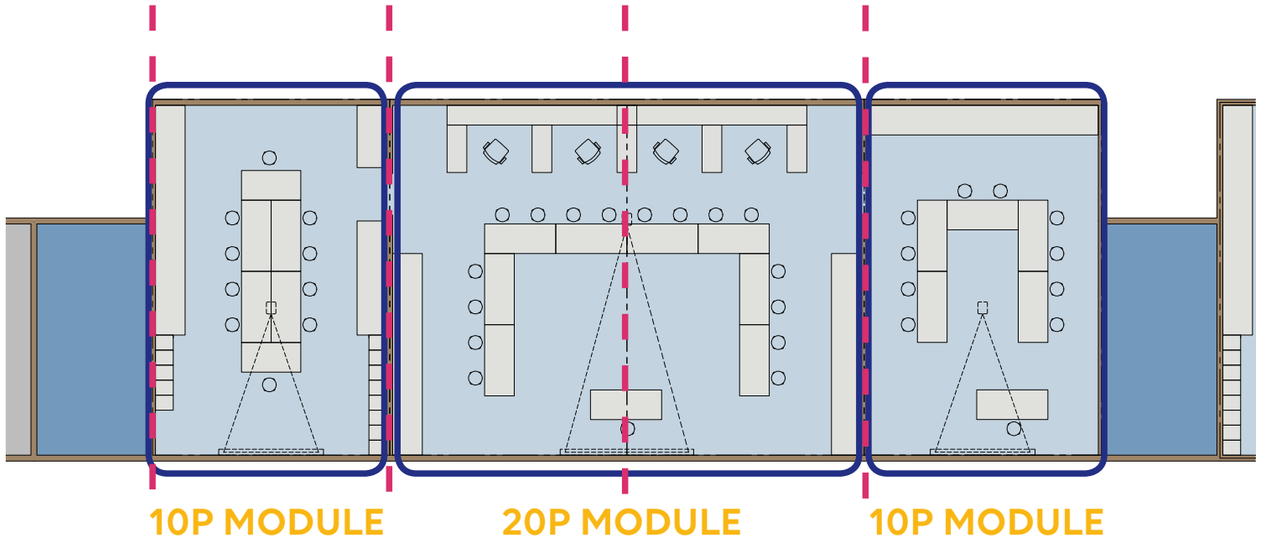


# FLEXIBILITY / ADAPTABILITY

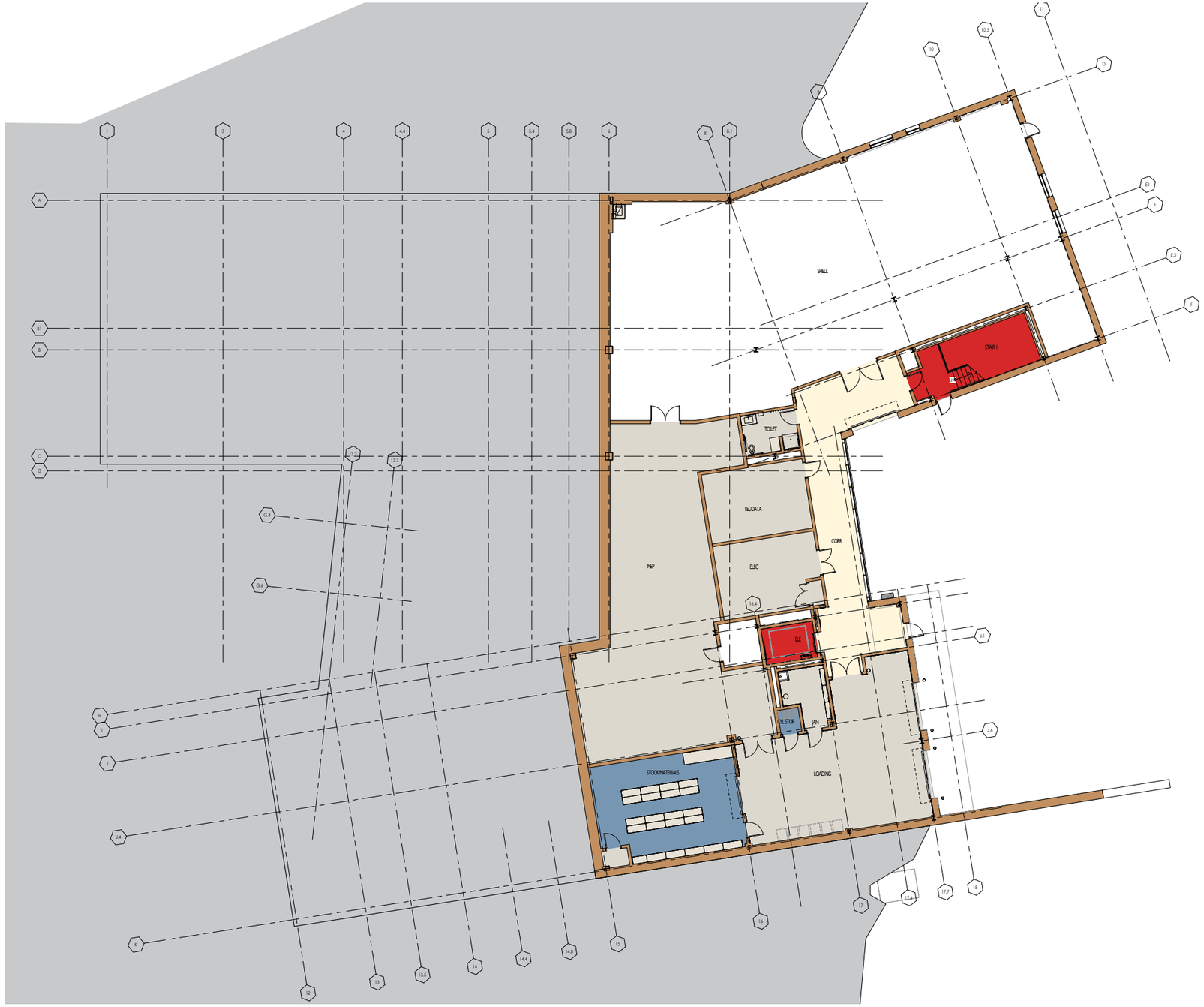
## CDIO Hubs

- Space can be sub divided
- Flexible / Movable furniture
- Services at ceiling
- Visible
- Link to teaching labs/atrium
- Modular design, bookend support



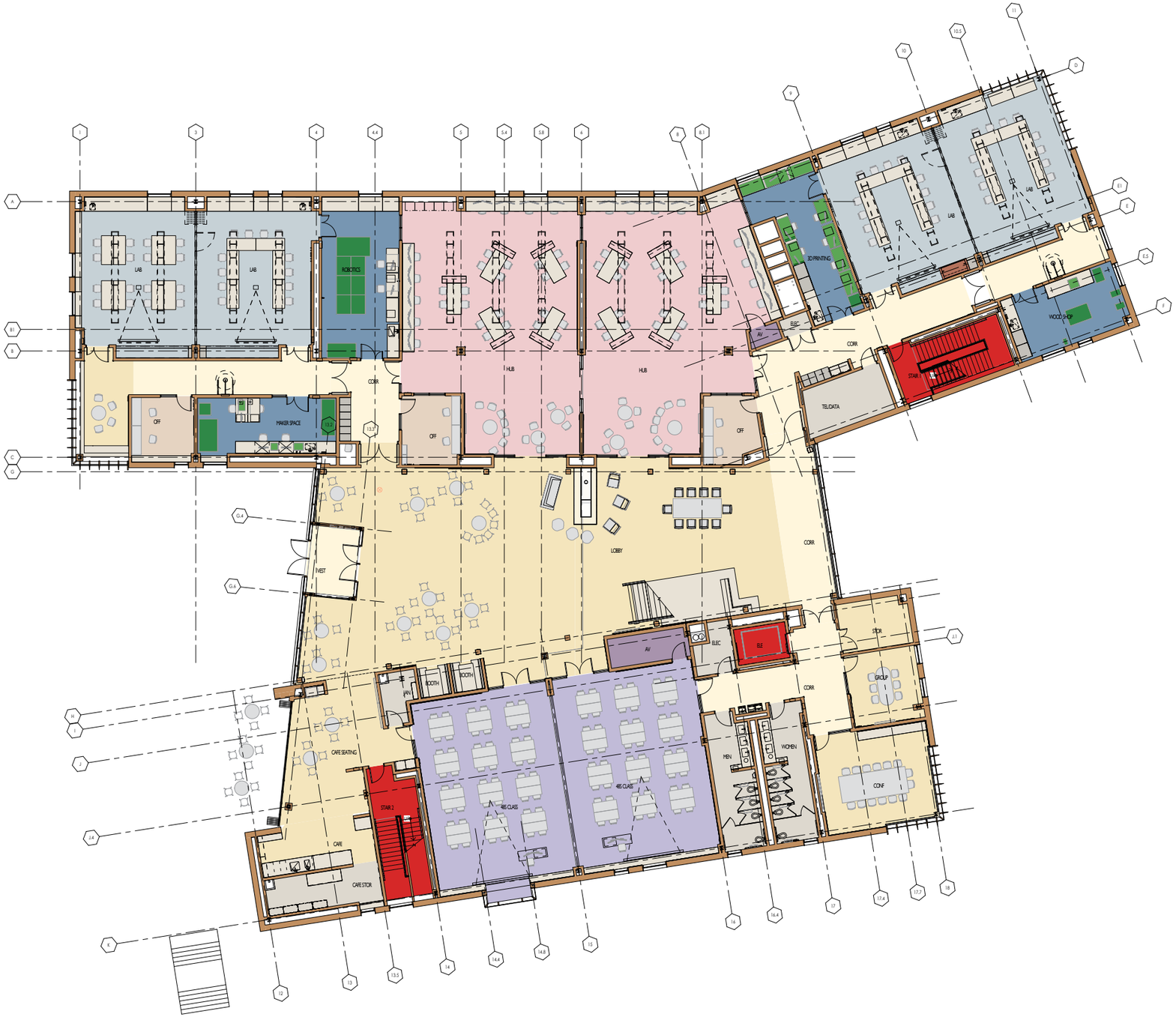
# LEVEL 0




SPACE TYPE KEY

- CDIO HUBS
- TEACHING LAB
- TEACHING SUPPORT
- OFFICES
- OFFICES SUPPORT
- COMMUNITY
- CLASSROOM
- CIRCULATION
- SHELL
- SUPPORT

# LEVEL 1




SPACE TYPE KEY

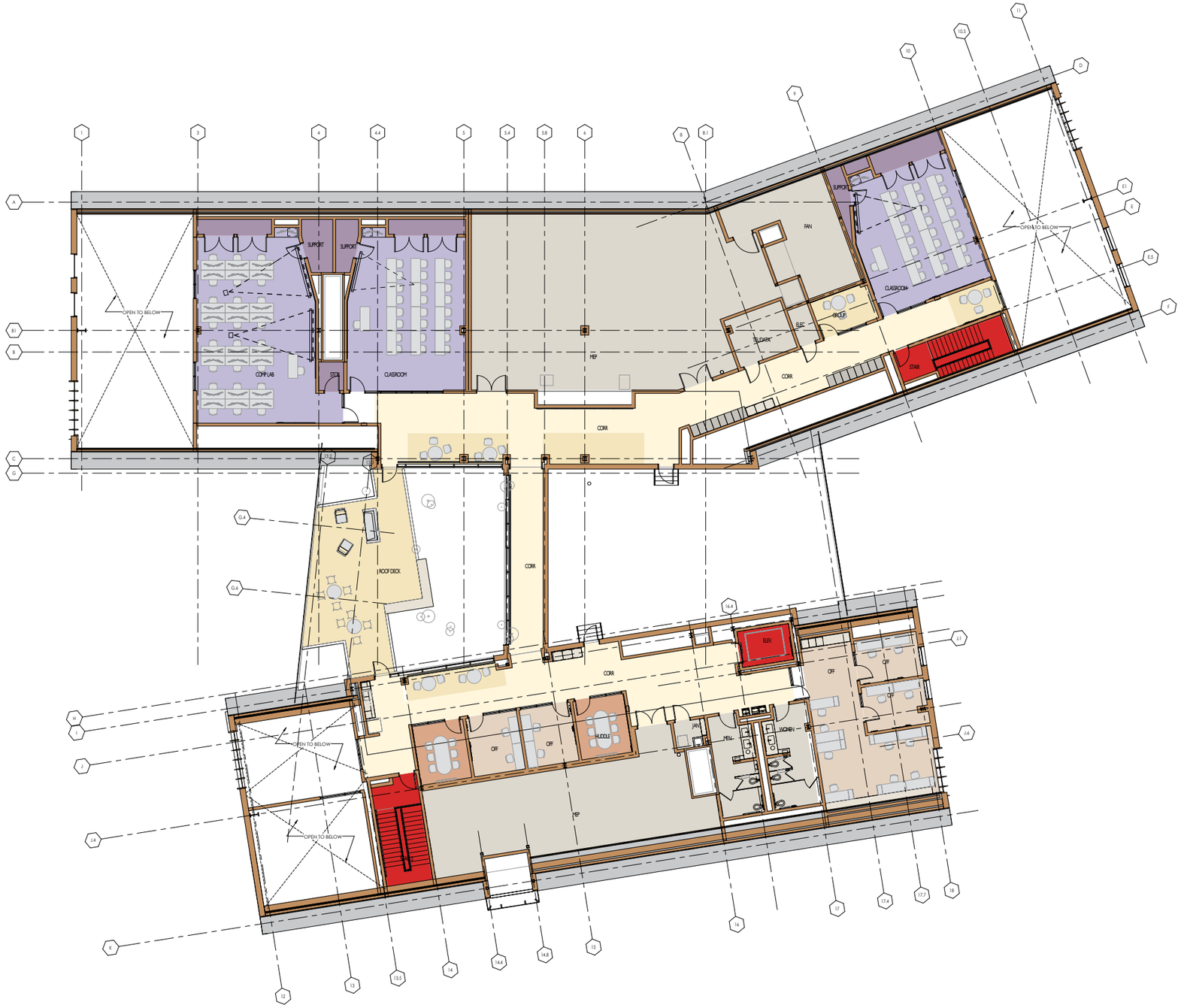
- CDIO HUBS
- TEACHING LAB
- TEACHING SUPPORT
- OFFICES
- OFFICES SUPPORT
- COMMUNITY
- CLASSROOM
- CIRCULATION
- SHELL
- SUPPORT

# LEVEL 2

SPACE TYPE KEY

- CDIO HUBS
- TEACHING LAB
- TEACHING SUPPORT
- OFFICES
- OFFICES SUPPORT
- COMMUNITY
- CLASSROOM
- CIRCULATION
- SHELL
- SUPPORT

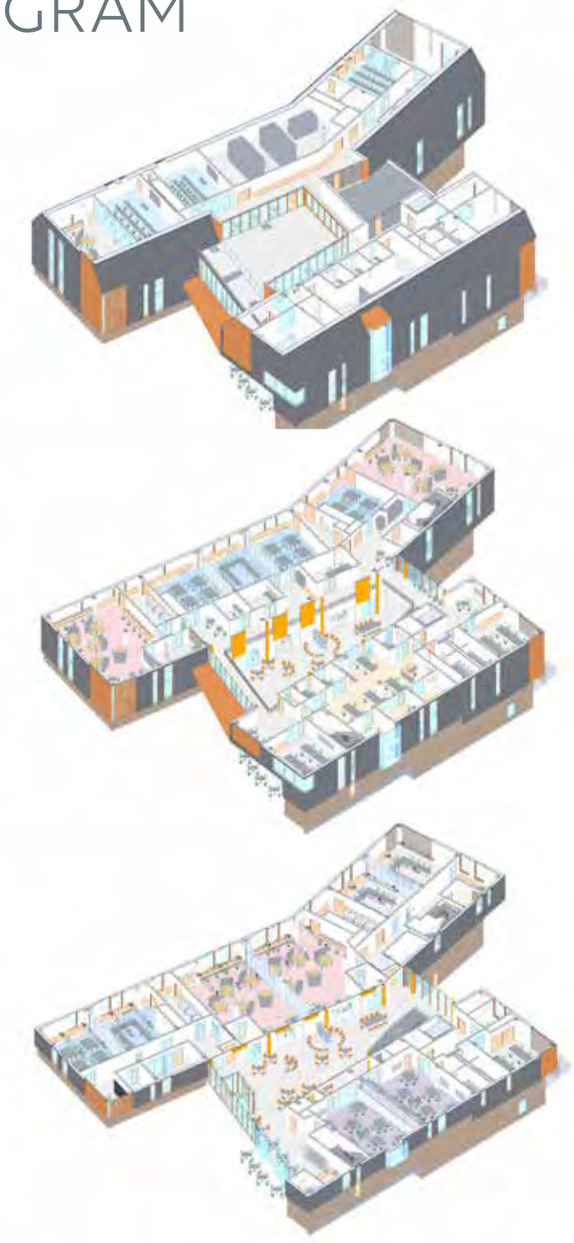
# LEVEL 3




SPACE TYPE KEY

- CDIO HUBS
- TEACHING LAB
- TEACHING SUPPORT
- OFFICES
- OFFICES SUPPORT
- COMMUNITY
- CLASSROOM
- CIRCULATION
- SHELL
- SUPPORT

# CETA PROGRAM



| | | | |
|---|---|---|---|
| Office | - | 4,756 | SF |
| Community | - | 9,745 | SF |
| Classroom | - | 5,337 | SF |
| • (1) 96s classroom | | | |
| • (2) 24s classrooms | | | |
| • (1) computer lab | | | |
| CDIO 'Hubs' | - | 7,279 | SF |
| • (4) Ideation | | | |
| • (4) Modeling | | | |
| • (4) Assembly | | | |
| Teaching labs | - | 6,367 | SF |
| Teaching Support | - | 3,749 | SF |
| Shell | - | 4,196 | SF |
| Building Support | - | 1,014 | SF |

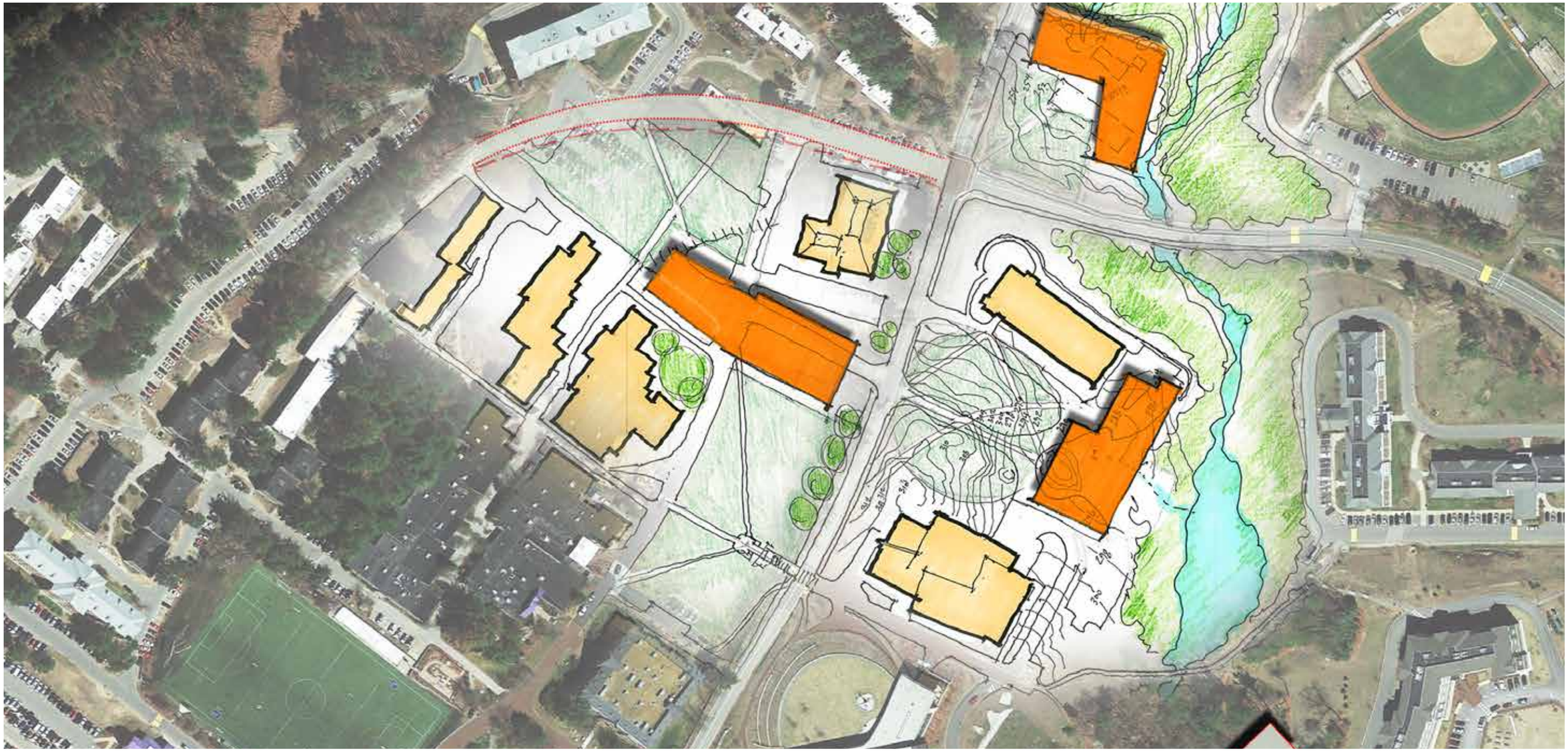
**TOTAL PROGRAM** ..... 42,443 NSF

..... 68,247 GSF

..... Efficiency - 62.2%

# SITE SELECTION

# SITE SELECTION



# BUILDING AS A LEARNING TOOL

## Hands-on Experience for Engineering students

6.1.18: Angie Foss taking a chunk of Sunapee Hall down in the Demolition Excavator.

6.1.18 : Angie Foss and Billy, a Machine operator, posing for a picture on the Demolition Excavator.

11.5.18: Construction Management students in class with CM Project Manager at the CETA construction trailer

WILSON HGA

# THANK YOU!