COLLEGE OF
Engineering, Architecture and Technology

ENDEAVOR

VISION STATEMENT

CEAT's new undergraduate ENDEAVOR will allow students to explore and experiment with engineering principles, systems, new technologies and entrepreneurship. Faculty can deliver with pedagogies focused on how undergraduate engineering, architecture and engineering technology students understand, apply and innovate the challenges of the 21st century. ENDEAVOR is a platform for interdisciplinary and collaborative learning and solutions that lead to entrepreneurial enterprise.

GOALS & OBJECTIVES

A collaborative effort between industry, CEAT leadership, faculty, students and alumni contributed to the development of the goals and objectives for this project, outlined below:

1 **The facility will be a flagship for undergraduate programs, a transformational game changer that improves academic outcomes, serves as a hands-on platform for engineering principles, improves outreach programs and instills a passion for engineering, architecture and technology.**

2 **The facility will provide environments that encourage interaction and cross-pollination among all disciplines through spaces for gathering, instructing and studying, connecting all CEAT students through technology and innovation.**

3 **The facility will form laboratory clusters that create interdisciplinary synergy, industry-aligned learning, encourage an entrepreneurial spirit and be accessible to all undergraduate students.**

4 **The physical facility will be a learning platform for building science, sustainable energy and building systems as instructional tools.**

5 **The facility will continually respond and evolve with changes in people, technology and pedagogies by being adaptable, reconfigurable, scalable and open at all times.**

LAB THEMES

MECHATRONICS + ROBOTICS + DIGITAL MANUFACTURING

The Mechatronics + Robotics + Digital Manufacturing cluster provides space for students to design, fabricate and test robotic systems, aero and land vehicles, autonomous systems, and manufacturing systems. The cluster includes an advanced maker space, 3D printing and a test arena where robotics, vehicles, and digital manufacturing processes can be tested.

Departments and Curriculum

- MAE – Mechatronics, Senior Design
- MET – Mechatronics, Senior Design
- IEM – Manufacturing Processes, Robotics, Autonomous Vehicles, Warehousing Systems, Senior Design
- BAE – Senior Design, Precision Agriculture/ Autonomous Vehicles
- ECEN – Senior Design
- EET – Senior Design

FLOW SYSTEMS

The Flow Systems cluster is focused on instruction of compressible and non-compressible fluids. Instructional spaces include a wind tunnel, flumes and piping apparatus for hands-on experience in the exploration and visualization of the principles of fluid dynamics. Flow equipment in this laboratory are of relevant size that can be used to closely approximate industrial flows, calculations and environmental events.

Departments and Curriculum

- ARCH/AE – HVAC
- CIVE – Applied Hydraulics, Hydrology
- CHE – Process Flow, Design
- MAE – Experimental Fluids
- FPST – Fire Protection Hydraulics
- IEM – Design of Experiments
- MET – Fluid Power, Pneumatics, Electro Hydraulics
- BAE – Hydrology
- ENSC – Fluid Mechanics

PROCESS AND TRANSPORT + ENVIRONMENTAL

The Process and Transport + Environmental Laboratory provides an opportunity for students to learn how industrial chemical processes are composed using pilot scale systems. Each piece of equipment is a pilot size process that can support instruction in multiple courses, such that, interdisciplinary assignments will exist. Students will be able to apply theory learned over many courses to processes that are used in industry; and compare the experimental results with theoretical predictions. This laboratory provides crucial lessons where aspiring engineers will gain hands-on experience in industrial-relevant production and separation processes, use of working equations, sample analysis, simulations, data acquisitions, remote sensing and automatic control. These industrial pilot size processes can be used to support both environmental related topics as well as explore processes that benefit remote populations in underdeveloped countries. The Environmental Wet Design Lab includes Gas Chromatography, Ion Chromatograph, High Performance Liquid Chromatography, Infrared Spectrometer, Ultra Violet Spectrometer, and an Analytical Potentiometer.

Departments and Curriculum

- CHE – Separations, Reactions, Heat Transfer and Fluid Mechanics, Unit Operations Support, Petroleum Engineering, Design
- MAE – Application of Data Acquisition and Controls, Transport Processes, Corrosion Studies
- CIVE – Environmental Processes and Sustainability, Engineers Without Borders
- BAE – Advanced Topics, Biological Processes, Transport Processes, Design
- MET – Applied Thermodynamics, Controls, Data Equation, GSHP Systems
- ECEN – Communications and Remote Control

MATERIALS + SUSTAINABLE BUILDING

The Materials + Sustainable Building cluster is divided into three sub-clusters: dirty materials, clean materials and sustainable building. In the dirty materials laboratory, students will explore and become familiar with the nature and characteristics of soil, geology, metallurgy, corrosion, polymers and concrete. The clean materials laboratory focuses on material analysis using standard industrial characterization techniques, and explore characteristics of a wide range of materials. Students will be able to test designs and materials that they produce through standard manufacturing techniques and additive manufacturing. The equipment is similar to that used in industry. The sustainable building laboratory will allow students to apply lessons learned about properties of materials as they develop designs using various materials and sustainable building concepts.

Departments and Curriculum

- ARCH/AE – Steel, Timbers
- CMT –Site Development, Soils
- CIVE – Soils, Geo-tech, Engineering Materials
- MAE – Composite Materials, Metallurgy, Advanced Design Methods, Space Craft, Aero Structures, Mechanical Design
- MET – Physical Metallurgy, Dynamics

MEASUREMENT + SENSORS + ELECTRONICS

The Measurement + Sensors + Electronics cluster is where students learn how to build electronic components, interface with electronic components and equipment, and control processes. Students will use industrially relevant sensors to instruct control equipment to run processes. Lessons learned in this laboratory provides the fundamental basis used in advanced design projects.

Departments and Curriculum

- MAE – Measurements, Senior Design
- ECEN – Embedded Computer Systems, Computer Architecture, Digital Logic, Network Analysis Electron Devices, Senior Design
- EET – Circuit Analysis, Fundamentals of Electricity, Senior Design
- IEM – Internet of Things, Senior Design
- MET – Basic Instrumentation, Senior Design
- ENSC – Basic Circuits

ENERGY & POWER + RF COMMUNICATIONS

The Energy & Power + RF Communications lab cluster provides for energy generation, storage, and smart micro-grids and power electronics. Energy and power systems are capable of blending sustainable energy sources with commercial power and provide students with hands-on experience building these systems. RF and Communications range from teaching students how to build and integrate the antenna for cell phones to providing remote control systems for industrial processes.

Departments and Curriculum

- ECEN – Power Electronics, Power Systems, RF Communications
- CMT – Micro-grid Development
- CIVE – Engineers Without Borders
- BAE – Energy, Power
- IEM – Data Analytics, Stochastic Optimization

THERMAL SYSTEMS

The Thermal Systems cluster embodies the ENDEAVOR concept by including interdisciplinary course laboratories, industrially sponsored thermal systems design, engines dynamics, and a heat exchanger maker space. Fundamental concepts of Thermodynamics will be taught with hands-on experiences that will grow into design courses that will produce equipment and concepts for both industry and internal ENDEAVOR consumption.

Departments and Curriculum

- ARCH/AE - HVAC
- MAE – Heat Exchanger, Thermal Fluids and Thermal Systems Design
- MET - Thermal Fluids
- ENSC - Thermodynamics
- BAE – Experimental Methods and Heat and Mass Transport

INDUSTRY ALIGNED LABS

The Industry Aligned Laboratories provide opportunities for private industry collaborators to enhance academic outcomes through showcased laboratories. Industry partners can provide equipment and set up laboratories supporting both instruction and investigation of topics related to development of collaborative senior design projects that are aligned with the development of human resources specific to their industry.

Possible Collaborations

- Building Systems
- Petroleum and Energy
- Manufacturing Processes
- Warehousing Systems

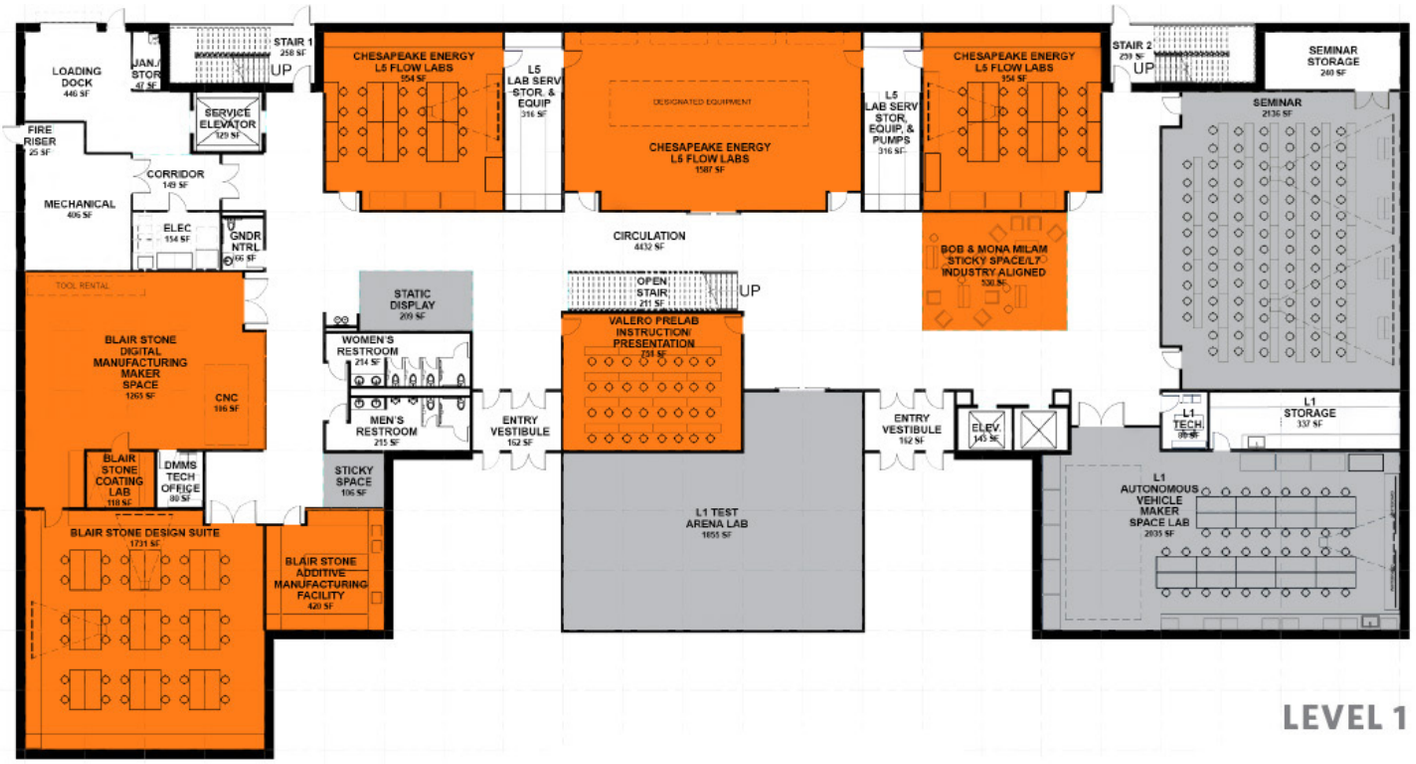
FABRICATION + MAKER SPACES

The Fabrication + Maker Spaces provides capability to fabricate and repair components and to assemble projects. This cluster contains equipment including 3D metal and plastic printers, CNC capability, and a small paint booth. ENDEAVOR maker spaces will support courses, design projects, and student entrepreneurial pursuits. Exhibiting students at work in maker spaces is an important goal of the project as these spaces will be highly visible and will activate and energize the collaborative environments.

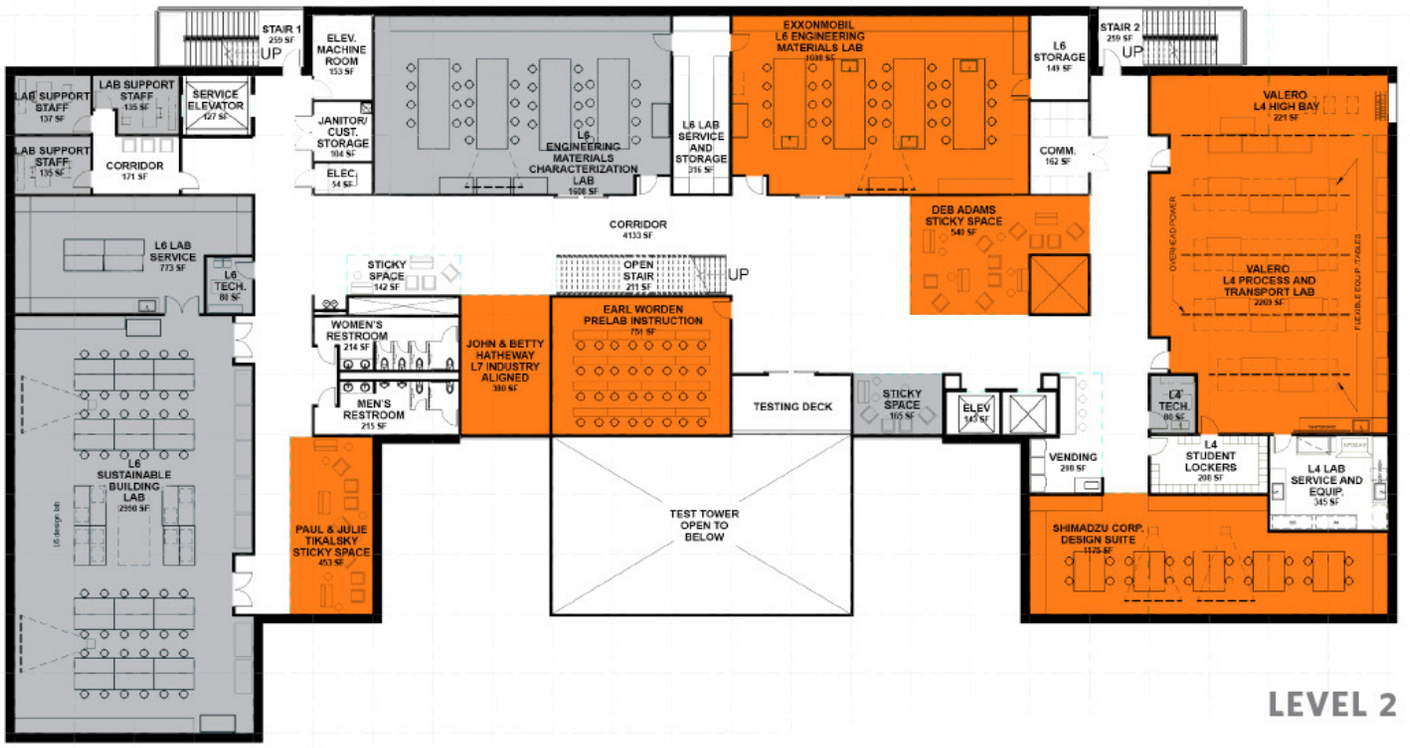
BUILDING AS AN INSTRUCTIONAL TOOL

The ENDEAVOR Building will in-itself be an important teaching tool. Portions of the building structure and building systems will be exposed to serve as an important visual learning tool. Special detailing and designs will be highlighted throughout the building with color-coding and informational signs. The building structure will have strain gauges installed at strategic locations to showcase aspects of the forces on a building's structure. In addition, seismographs, meteorological stations, and building energy consumption will be used to study energy usage and see effects of earthquakes on the building. Building systems performance data will be accessible online, and include energy, seismograph, weather, and strain gauge data. An exterior energy deck will feature sustainable technologies which students can also monitor through the building data system.

FLOOR PLANS - LEVELS 1 & 2

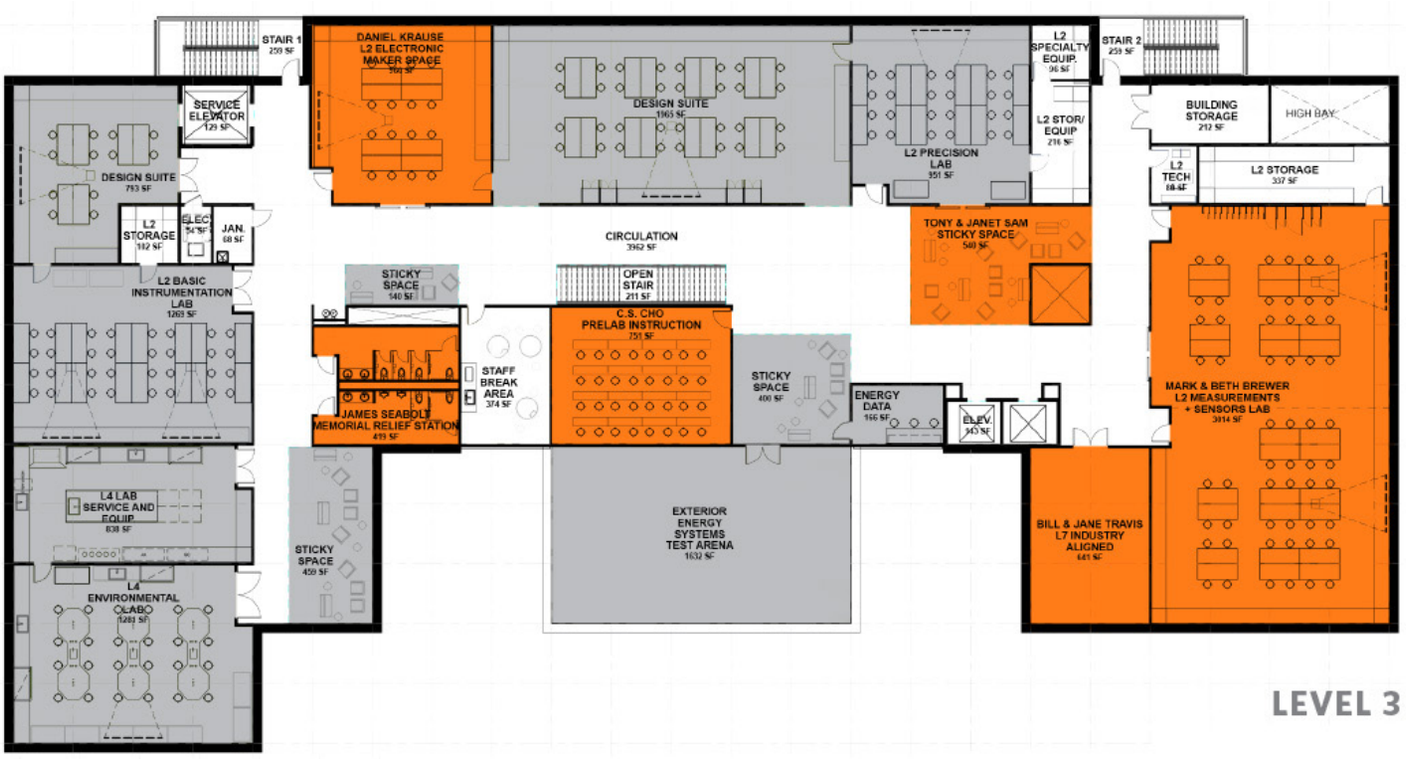


LEVEL 1

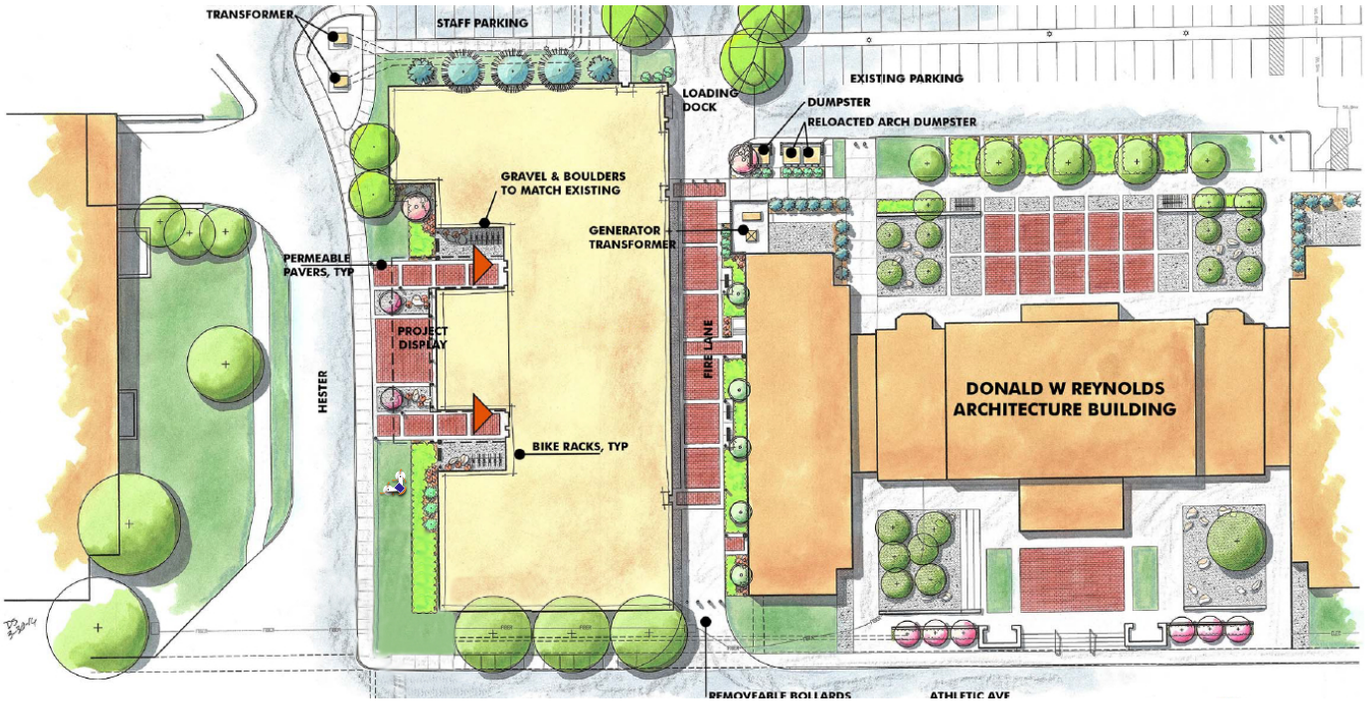


LEVEL 2

FLOOR PLANS - LEVEL 3



SITE LOCATION



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