

# Designing Advanced Air Mobility Infrastructure: A Multidisciplinary Capstone Project

## Project Purpose

Incorporate innovative infrastructure design to accommodate emerging electric Vertical Take-Off and Landing (eVTOL) mobility into existing airport design and operations, by engaging professional community of professional engineers, industry experts, jurisdictional authorities, and policy leaders.



## Project Need

Determine optimal eVTOL infrastructure design solution based on engineering, economic, environmental, social, political, constructability and sustainability considerations.

## Airport Case Study Site Conditions

Characteristic	Metric/Description
Airport Land Area	401 acres
FAA Designation	General Aviation/ Reliever Airport
Terminal Building	7,200 sq. ft.
Runway	1-runway, 5,500 ft in length, 100-ft. wide
ILS Category	Category 1, Instrument Landing System
Approach Lights	MALSR, Medium Intensity Approach Light System with Runway Alignment Indicator Lights
Airport Master Plan	Planned 1,000-ft. runway extension
FAA, Total Ops	28,100 (2020)
FAA, Based Aircraft	139 (2020)

## eVTOL Models



## eVTOL Utilization

1. Passenger
2. Cargo
3. Medical
4. Military
5. Humanitarian

## Design Process

### Civil Engineering Project Tasks

1. Transportation Operations and Design
2. Terminal Complex and Airfield Layout
3. Site Layout and Functional Design
4. Stormwater and Drainage Design
5. Structural and Geotechnical Design
6. Environmental and Sustainable Design

### Construction Engineering Project Tasks

1. Project Cost Estimate and Project Schedule
2. Construction Subcontractors
3. Project Risk Identification Reduction Plan
4. Temporary Structures Design
5. Environmental & Societal Impacts
6. Create Construction Safety Plan

## Student Designs and Engagements



### Figure Captions - Example Deliverables

- A - Vertiport TLOF Perspective
- B - Terminal/Ground Transportation
- C - Site Layout Alternative
- D - Site Layout Alternative
- E - 3D Perspective Grading Plan
- F - Revit Structural Model
- G - SAP2000 Structural Model
- H - Terminal Layout Plans
- I - Terminal Layout Rendering
- J - Signalized Intersection Design
- K - Student Presenter -Technical Briefing
- L - Student Presenter - Business Bowl
- M - Project Construction Schedule
- N - Project Schedule Gantt Chart
- O - Construction Site Layout Plan

## Capstone Design Objectives

1. Airfield modifications
2. Connection with existing facilities
3. eVTOL taxiway/apron improvements
4. eVTOL maintenance and charging facilities
5. eVTOL terminal design and construction
6. Ground transportation improvements
7. Stormwater drainage improvements
8. Project constructability
9. Site logistics and safety
10. Project phases, schedule and cost estimates
11. Deliverables and presentation to Expert Panel

## Capstone Design Participants

- 48 Civil Engineering students
- 17 Construction Engineering students
- 8 Professional Engineers
- 3 Professional Engineer Faculty
- 9 Industry Experts
- State Aeronautics Commission
- U.S. Congressional Representative

## Professionalism

1. Team weekly effort and progress reports, weekly time keeping, engineering costs
2. Final design-built deliverables, expert panel presentation, team/self-evaluations

## eVTOL Expert Panel Feedback - May 3, 2022

"Student teams created great designs for eVTOL vertiports. I can't wait to take these ideas back to my airport authority to share with colleagues and elected officials on what we can do to prepare for the future." ~ Industry Expert-F, Airport Manager

"Project designs developed by student teams turned out far better than I could have ever imagined and have helped advanced the professional dialog in our state on this coming aviation innovation." ~ P.E.-B, State Aeronautics Commission, Project Manager

"It is very impressive to see the level of collaboration and engineering rigor student teams have conducted to develop their design solutions for this project." ~ P.E.-F, Jurisdictional Authority, Sr. Engineer (Chair, Expert Review Panel)