Up in the Air: A Human Factors Approach to Enhancing eVTOL Passenger Experience

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Introduction

- People may be unwilling to ride in electric vertical takeoff and landing (eVTOL) vehicles due to unfamiliarity and uncertainty about their trust in the technology. [1]
- Safety, comfort, and acceptance are important areas that influence a passenger's experience when flying in an eVTOL. [2, 3, 4]
- Poor eVTOL interior cabin design can negatively influence user experience (UX), decrease comfort, and lower acceptance. [5]
- Current cabin designs and configurations differ between companies:

- **Objective**: Use **human factors methods** to **better understand** potential eVTOL passenger concerns and begin addressing issues surrounding the end-to-end passenger experience.

- **Significance**: Practitioners can use the insights gained from this research to **enhance passenger safety, comfort, and acceptance** to facilitate the widespread adoption of this mode of transportation.

Methods

Literature Review*
- Key words and phrases
- Forward/backward treeing
- 34 articles

Competitive Analysis*
- 11 eVTOL companies
- Purpose
- Features
- Materials

Empathy/Journey Maps*
- Doing
- Thinking
- Saying
- Insights/opportunities

Personas*
- Demographics
- Goals
- Motivations
- Frustrations
- Wants
- Needs

Initial Prototypes†
- Paper and sketch concepts
- Balsamiq wireframes
- Figma wireframes and prototypes
- CATIA CAD model

User Feedback‡
- 26 ERAU students
- Questionnaires
- Interviews
- Focus groups
- Usability testing

Second Iteration Prototypes‡
- Redesigns informed by user feedback

* Phase I: Requirements Gathering
† Phase 2: Initial Designs
‡ Phase 3A/B: Iterative Design

Phase 1: Requirements Gathering

Competitive Analysis

Among the 11 most popular eVTOL manufacturers…

- **Number of seats**: 2 – 9
- **Distance on a single charge**: 20 – 288 miles
- **Target release date**: Present – 2028
- **Common purposes**: Zero-emissions/quiet/less congested intercity commutes, leisure and business travel, point-to-point "taxi" service
- **Common features**: Planned fully autonomous flying

Empathy/Journey Maps

eVTOL passengers will engage in these behaviors…

1. Choosing a specific eVTOL service to fly with
2. Booking their flight
3. Finding first mile transportation
4. Navigating through security
5. Waiting for their eVTOL
6. Thinking about safety
7. Indulging in eVTOL comfort
8. Exiting the eVTOL
9. Finding last mile transportation
10. Reflecting on their journey

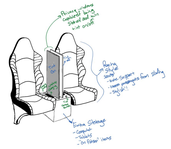
Personas

The people who ride on eVTOLs will…

- Be different ages and genders
- Come from diverse ethnicities and cultural backgrounds
- Have various goals, motivations, and frustrations
- Have different levels of experience with (and affinity for) technology and flying

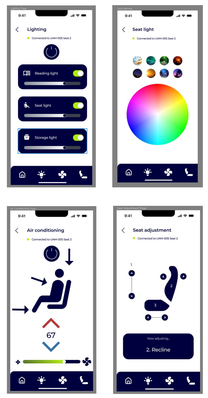
Phase 2: Initial Prototypes

Privacy Partition



Electrochromic Windows

Blue Skies Mobile App



Pilot Barrier

UV Light Self-Cleaning Cabin

Phase 3A: User Feedback

Designs	Positives	Negatives	Improvements
UV Light Self-Cleaning Cabin	+ Lightweight + New and innovative + Reasonably priced	– Lack of trust towards UV cleaning – User unfamiliarity	✓ Alternative cleaning options (e.g., disinfecting wipes) ✓ Educate passengers about the benefits of UV cleaning
Pilot Barrier	+ Can protect flight controls + Reduce pilot stress	– Might block passenger view – May increase the cognitive workload of passengers	✓ Add flight progress (ETA and time elapsed) ✓ Add current temperature ✓ Add weather
Electrochromic Windows	+ Innovative + Provides control over environment	– Expensive to buy and maintain – Limited tint level options	✓ Reduce costs ✓ More tint level options
***Blue Skies* Mobile App**	+ Offers journey customization + Easily accessible	– Too much individual control – Control conflict	✓ Restrict control ✓ Designate seats to passengers
Privacy Partition	+ Protect passengers' privacy from strangers + Offers more storage + Multifunctional	– Can be costly – Can add substantial weight to eVTOL	✓ Create taller partitions for more privacy ✓ Use lighter materials to reduce weight

Phase 3B: Second Iteration Prototypes

Privacy Partition

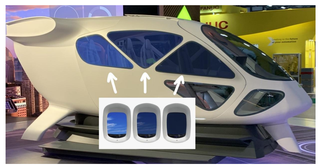
Links to short videos of CAD model

Pilot Barrier

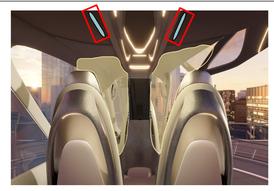
Blue Skies Mobile App

Links to Figma prototype

Electrochromic Windows



UV Light Self-Cleaning Cabin



Conclusions

The public may be hesitant to ride in eVTOLs because of the technology's novelty.

Human factors principles can guide the development of eVTOL designs to improve safety, comfort, and acceptance.

User feedback suggests that our designs are useful, but more research is necessary to refine each concept.

Although this research supports the growth of the eVTOL industry, the real-world passenger experience still remains **up in the air**.

References and Resources

With support from:

supernal