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Development and Validation of a Vertiport Usability Scale

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Introduction: Urban Air Mobility (UAM), a distinct subset of Advanced Air Mobility (AAM) research, has begun reaching a critical phase in its establishment, particularly with the development and implementation of vertiports. Few studies have assessed consumer perception of vertiports. One particular study focuses on the ideal usage and applicability of vertiports for medical emergencies; however, this current study aims to broaden that perspective by producing a valid scale that other researchers can use. Method: The Vertiport Usability Scale was developed using a multi-stage approach with 1,243 participants. A consensus methodology was employed, whereby participants generated relevant descriptive items, determined which items were most relevant, and provided construct validity to the final scale. Results: The final scale resulted in a single-factor model comprising seven items (convenient, efficient, functional, good location, high quality, usable, and useful). Factor analysis was used to ensure validity, while Cronbach's Alpha and Guttman's split-half tests provided evidence of high consistency and reliability. Conclusion: This scale offers a common language for consumers, designers, engineers, and human factors experts to design future vertiports in line with consumer opinions and needs.

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Introduction

The National Aeronautics and Space Administration (NASA) conceptualizes Urban Air Mobility (UAM) as a safe and efficient method of air operations for both crewed and uncrewed aircraft systems, often in metropolitan areas (Thipphavong et al., 2018). There is currently no valid method for quantitatively assessing vertiport usability. The purpose of this study was to develop a valid and reliable scale for assessing the usability of both current and proposed vertiports. Developing a usability scale with consumer needs in mind is crucial for implementing future vertiports and ensuring seamless integration of general aviation, ultimately improving the user experience for the general consumer. To provide a systematic and uniform implementation of vertiports globally, aviation governing bodies across different countries need to attain harmony while implementing rules and regulations for the establishment of these vertiports. The purpose of this study was to develop a valid and reliable scale for assessing the usability of proposed experimental vertiports.

Literature Review

As metropolitan cities such as New York, Los Angeles, and Miami become more densely populated, innovative solutions to alleviate traffic congestion and improve mobility efficiency have catalyzed UAM development efforts. Active efforts are constantly being made to bring the UAM industry to fruition, with a heavy focus on the domestic and international governing bodies, like the Federal Aviation Administration (FAA), European Union Aviation Safety Agency (EASA), and the Directorate General of Civil Aviation (DGCA), and their policies and regulations. UAM now expands beyond its conceptual phases as a subset of aviation, where it was assumed that AAM is a subset of UAM, which is, in fact, the other way around. UAM is widely recognized as a subset of AAM, and its development follows similar foundational principles. The International Air Transport Association (IATA) mentioned in its January 2020 report that it expects a 4.1% growth in revenue passenger kilometers (RPKs) and a 2.0% increase in the freight ton-kilometers (FTKs). However, after the global COVID-19 outbreak, IATA made several revisions to the original report, indicating a steep decline in the aviation industry growth projections (IATA, 2020). Covering a span of five years, IATA noted in its January 2025 report that the RPK rose by 10.0% year-on-year (YoY), which is significantly higher than in previous months (IATA, 2025).

Considering the already successful and promising tests various UAM-oriented companies have conducted, the possibility of UAM establishment seems to be moving from concept to deployment. Companies like Archer Aviation have already established collaborations in Abu Dhabi to launch their first commercial electric air taxi flights (Archer Aviation, 2024). At the same time, Eve Air Mobility, a subsidiary of Embraer, has also revealed its full-scale plan for an eVTOL prototype to improve commuting times for the general public while also reducing the average amount of carbon emissions while operating a motor vehicle (Eve Air Mobility, 2024). Companies like commercial aircraft manufacturer Airbus have also been researching UAM prospects, where Airbus recently announced its *CityAirbus* prototype that aims to reduce the traffic and carbon emissions issues in major metropolitan cities (Airbus CityAirbus, 2024). With advanced technological capabilities and competition pressure, it seems it is only a matter of time before these services become standard. Beyond the United States of America, companies are also heavily focusing on establishing UAM technologies worldwide while also attempting to standardize their methodology and operations.

Numerous research efforts have explored consumer perceptions of UAM and consumer perceptions of highly automated aircraft (Hughes et al., 2009; Marte et al., 2018; Ragbir et al., 2020; Rice et al., 2014; Rice et al., 2016; Rice et al., 2019; Shaheen et al., 2018). According to researchers, after analyzing the user and non-user perspectives on UAM, it has been widely understood that the biggest concerns for consumers would be safety, passenger screening, the preference for a piloted aircraft, as well as cybersecurity (Al Haddad et al., 2020). Another objective for exploring the vertiport usability scale is the acceptance of driverless vehicles among consumers. Anania et al. (2018) examine the variability of automation acceptance between people based on gender and nationality. The concept similarly expands to the development and usage of vertiports to supplement automation within the aviation industry, particularly in UAM. Asgari and Jin (2019) utilize trend analysis and mathematical models that have been constructed from previous real-world introductions and integrations of technologies into human lives around the world. However, to understand the progression of UAM, it is imperative to understand how consumers perceive usability after the successful implementation of UAM in subsequent years.

Another study by Ragbir et al. (2018) aimed to find how different variables like nationality, weather conditions, and distance affect the level of consumer willingness to fly in autonomous aircraft. The findings suggest that different consumer groups may need to be targeted differently when being introduced to different automation technologies. Based on these relevant findings, a usability scale is being developed to assess vertiport usability as a supplementary step in the implementation of the overall UAM ecosystem. Findings indicate that there is often apprehension toward boarding autonomous flights in inclement weather, with Americans exhibiting highly negative attitudes towards these technologies unless weather conditions are perfect (Ragbir et al., 2018). In addition to cultural differences, gender differences are also present when accepting UAM. Women are less willing to fly in autonomously piloted aircraft, with fear being the most significant mediator (Rice & Winter, 2019).

A more recent study concluded that implementing consumer-friendly designs and features in a vertiport is essential, as it directly impacts the willingness to pay (WTP) for services among consumers (Ison, 2025). The study also emphasizes the need for integrating UAM technologies with public transportation systems and advanced security technologies and strategies to keep the UAM system sustainable while maintaining profitability. This establishes a strong premise to conduct our study to assess usability as well. A study by Zhao et al. (2025) found participants strongly preferred small and nearby vertiports. Value was also added if multi-model options were available with connections to public transport.

Justification for a Vertiport Usability Scale

AAM and UAM are realistic for widespread use because of their vertical takeoff and landing (VTOL) capabilities, which allow these aircraft to operate without a runway. In the context of emergencies where ground access is not feasible, VTOL capabilities would prove beneficial in reaching persons who would otherwise be inaccessible with conventional aircraft.

For this reason, vertiports are one of many necessary considerations in the design and implementation of UAM. The FAA has previously established vertiport location and design criteria, considering the development form or the necessary alterations to the surrounding landscape, weather conditions, economy, and accessibility. Due to apparent similarities, pre-existing helicopter landing pads have served as a basis for the design of vertiports (NiklaB et al., 2020). However, most helipads do not provide the capacities necessary for the widespread implementation of UAM because they lack the infrastructure consumers require (e.g., waiting areas, food and drink, customer service, etc.).

The ICAO-published heliport manual requires that heliport locations allow for land transport accessibility and parking options and consider noise-sensitive sites (i.e., noise pollution). Several studies have investigated vertiports in urban areas. However, their usability in various locations has not been thoroughly explored. To determine vertiport usability, it is desirable to create a valid quantitative scale that can accurately assess the various components of vertiports and provide consumers, designers, and engineers with a common language to judge multiple potential vertiports.

Usability

Usability can be described as the quality of a user's experience when using a product. Bevan et al. (1991) define usability as "the ease of use and acceptability of a product for a particular class of users carrying out specific tasks in a specific environment." (p. 24). One of the most widely used scales is the System Usability Scale (SUS), which is represented in approximately 43% of industrial usability studies (Lewis, 2018; Sauro & Lewis, 2009). The SUS contains ten questions that range from frequency of use to complexity to learning associated with use. Bangor et al. (2008) describe the SUS as very flexible and unaffected by minor word changes. However, one of the limitations of the SUS is that it does not provide a practical way for users to assess a product that does not exist yet. Another limitation is that it is not explicitly tailored to vertiports. Therefore, although the items from the SUS will be used in the item generation phase of the current study, creating a new scale specific to vertiport usability is warranted for the present study.

Previous Studies

A previous study conducted by Winter et al. (2020) explores the concept of air taxis and develops a statistical model to identify factors related to consumers' willingness to fly. It assessed 16 different predictors to assess a consumer's willingness to fly in an automated aircraft. The research also concludes that increasing awareness of the existence of the concepts of UAM, as well as their implementation in the future, will increase willingness for consumers to adopt new technology. A second study by Rice et al. (2022) explored vertiport and air taxi features valued by consumers in the United States and India. The primary concerns of users were safety and security. The top five features of a vertiport in the United States were emergency exits, restrooms, security cameras, security personnel, and an emergency phone. Consumers from India had similar concerns among their top five vertiport items: emergency services, emergency exits, healthy food, emergency alarms, and first aid kits. This research suggests that consumers are concerned with safety (emergency exits, cameras, and first aid kits), security (guards and alarms), and convenience (restrooms and food). The findings from Rice et al. (2022) were also used in the item generation stage of the current study.

Adding on to the scope of this research, the factors that also impact people's willingness to fly on a fully autonomous commercial airliner were perception of complexity of aircraft automation, a consumer's familiarity with it, the influence of the fun factor associated with autonomous flying, and even the age and gender of participants (Rice et al., 2019). This study helps showcase perceptions toward adopting autonomous aircraft and the logistics behind making it a reality. Winter et al. (2021) developed a vertiport location scale that focused primarily on determining the ideal location for vertiports during natural disasters or emergencies. This scale can be helpful when deciding where to place a temporary vertiport to deliver food, medicine, news, and other emergency supplies; however, it does not reflect consumer opinions about the usability of the vertiport itself. The current study fills this gap.

The Value of a Validated Instrument

The validity of an instrument is paramount to ensure researchers are conducting appropriate and meaningful research on human participants (Edmonds & Kennedy, 2017; Gawron, 2008). Validity ensures the researcher measures what they intend to measure. For example, if a teacher were attempting to measure their children's writing skills using a scale to measure reading comprehension, they would be using an invalid instrument. Using an invalid instrument increases the likelihood of a Type 1 error (Banerjee et al., 2009).

Using a consensus methodology (Hinkin, 1998) ensures construct validity, while factor analysis provides further validity evidence. In addition to validity, reliability is essential to a valid scale- in fact, it is impossible to have validity without reliability. Consistency is tested via Cronbach's Alpha, while reliability is tested using Guttman's split-half test.

Methodology

The current study developed and validated a scale that can assess public perceptions of the usability of a vertiport. The development of this scale followed a multi-stage consensus method described by Hinkin (1998) and supported by various publications that have successfully utilized this framework to develop valid and reliable scales (Rice et al., 2014; Rice et al., 2015; Rice et al., 2020). The process involves four stages: item generation, nominal paring, Likert-scale paring, and factor analysis and sensitivity testing, which are discussed in detail below.

Stage 1: Item Generation

The item generation stage involved asking participants to complete a short questionnaire listing five words or phrases that are relevant to vertiport usability. In addition to participant responses, researchers reviewed vertiport literature and included all relevant items. Additionally, three subject-matter experts in the field of uncrewed aerial vehicles (UAV) and UAM reviewed the current list to determine whether additional words or phrases should be added.

Participants

The first set of participants included one hundred and ninety-four adults (92 males; 102 females) who completed the questionnaire via a convenience sample using Amazon's *Mechanical Turk* (MTurk). The average age of participants was 38.78 (SD = 11.52) years old, with 81% reporting as Caucasian, 6% as African descent, 5% as Asian descent, 4% as Hispanic descent, and 4% as Other. Participants were limited to those residing in the United States, had completed at least 500 prior tasks on MTurk, and had approval ratings of 98% or higher.

Procedure, Materials, and Stimuli

Participants in the initial group of respondents were directed to Google Forms to complete the questionnaire. Before providing their list of five words or phrases, they were provided with a brief description of vertiports: *A vertiport is the proposed takeoff and landing site for urban air mobility (UAM) aircraft. The UAM aircraft can be either remotely operated or a fully automated aerial vehicle, such as an air taxi.* Participants then received the following instructions: *In the context of usability related to a vertiport, please enter 5 words or phrases that you feel are strongly relevant to the concept of vertiport USABILITY. In other words, what items or phrases would make the vertiport more user friendly? For example, a vertiport should be convenient, accessible, safe, etc. Each answer should include only a one word or one sentence phrase*.

Results

The first phase of scale development generated 131 words or phrases.

Stage 2: Nominal Paring

The second stage of scale development involved paring down the initial set of 131 words and phrases generated from stage 1. The purpose of this stage was to determine which words/phrases were the most relevant to assessing vertiport usability.

Participants

Two hundred and fourteen participants completed stage 2 of this study (138 males; 76 females). Participants were recruited via a convenience sampling method using MTurk. The average age of participants was 36.40 (SD = 10.30) years old, with 84% reporting as Caucasian, 3% as African descent, 9% as Asian descent, 3% as Hispanic descent, and 1% as Other.

Procedure, Materials, and Stimuli

Participants received the following instructions: *You will be presented with 131 terms and asked to rate how relevant or irrelevant those terms are to vertiport USABILITY (being user friendly). The data collection process is anonymous, and your responses will remain confidential*. They were also provided with the following contextual information on UAM: *A* *vertiport is the proposed takeoff and landing site for urban air mobility (UAM) aircraft. The UAM aircraft can be either remotely operated or a fully automated aerial vehicle, such as an air taxi*. They were then presented with the 131 words/phrases generated in stage 1, coupled with the following instructions: *In the context of vertiports, please review each term or phrase below and determine whether it is relevant or not relevant to vertiport USABILITY (being user friendly).* Participants rated each word/phrase on a 3-point relevance scale, with relevant, not relevant, or don't know response options.

Results

A cutoff threshold was established a *priori* for a word/phrase to be kept for the next iteration of items; at least 60% of participants had to score the word as *relevant* to vertiport usability to be included in Stage 3. Utilizing this determination criterion, 44 words/phrases were maintained. The researchers added two additional terms based on their expertise: 'compatible with various UAM vehicles' and 'easy to use emergency features.'

Stage 3: Likert-scale Paring

The purpose of Stage 3 was to pare down the list of relevant items further. In this stage, participants were asked to determine how relevant each remaining item was to vertiport usability.

Participants

Three hundred and twenty-four participants completed stage 3 of the study (187 males; 136 females, 1 no response). Again, participants were recruited via a convenience sampling method using MTurk. The average age of participants was 37.85 (*SD* = 16.06) years old, with 74% reporting as Caucasian, 6% as African descent, 13% as Asian descent, 5% as Hispanic descent, and 2% as Other.

Procedure, Materials, and Stimuli

Participants received the same instructions as in Stage 2, except that the participants rated the 44 remaining items on a scale ranging from *Not at all related to vertiport usability (0) to Extremely related to vertiport usability (4).*

Results

Similar to the previous stage, an *a priori* cutoff threshold was established for determining which words/phrases would be kept for the scale. An item was required to obtain a score of 3.0 or higher to be selected for inclusion in the final scale. Seven of the forty-four/phrases met this criterion. The seven items included in the final scale are: *convenient, efficient, functional, good location, high quality, usable, and useful.* These items were transformed into statements (See Appendix A for the final scale) and assessed through factor analysis, consistency and reliability tests, and sensitivity testing.

Stage 4: Factor Analysis and Sensitivity Testing

The purpose of Stage 4 was to assess the final vertiport usability scale for validity, consistency, and reliability. In addition, we wanted to ensure the scale could detect differences in consumer perceptions of usability between vertiports. This stage is often referred to as a sensitivity test of the scale.

Participants

Five hundred and eleven participants completed stage 4 of the study (280 males; 224 females; 7 no response). Participants were recruited via a convenience sampling method using MTurk. The average age of participants was 38.63 (SD = 11.23) years old, and 81% reported as Caucasian, 5% African descent, 9% Asian descent, 3% Hispanic descent, and 2% Other.

Procedure, Materials, and Stimuli

Participants received the following instructions: *You will be presented with some scenarios and asked about vertiport USABILITY (being user friendly). The data collection process is anonymous and your responses will remain confidential*. Participants also received brief information on UAM: *A vertiport is the proposed takeoff and landing site for urban air mobility (UAM) aircraft. The UAM aircraft can be either remotely operated or a fully automated aerial vehicle, such as an air taxi.*

Participants were then presented with two scenarios depicting different proposed vertiports. The first scenario presented the following: *Imagine that you live in a major city and want to use a UAM (urban air mobility), also known as an Air Taxi, for a 30-minute flight across the metropolitan area. To use the vertiport, it is an easy 5-minute walk to the location, where you enter the ground-level building. An indoor, air-conditioned waiting area has plenty of comfortable seating, is protected from weather conditions, has a nice choice of food and drinks, along with customer service and WiFi*. The second scenario read as follows: *Imagine that you live in a major city and want to use a UAM (urban air mobility), also known as an Air Taxi, for a 30-minute flight across the metropolitan area. To use the vertiport, you must drive 20 minutes by car to the skyscraper building, find parking, meet with the building security to enter, and travel up the elevator to the top floor. An outdoor waiting area is exposed to the weather conditions, and no customer service is available*. Participants were asked to respond to each of the seven established scale items (see Appendix A) on a scale of *strongly disagree* (-2) to *strongly agree* (2).

Results

Factor Analysis. To determine the factor structure of the proposed scale, a principal components factor analysis with varimax rotation was conducted on each of the vertiport scenarios. The scale had high Kaiser-Meyer-Olkin (KMO) values and significant p-values for Bartlett's sphericity test, supporting the factorizability of the data. Each scale loaded onto one factor and accounted for over 45% of the data's variance. All Cronbach's alpha values were well above the minimum threshold of .7, indicating high internal consistency. Guttman's split-half tests also revealed values well above .7, further supporting the scale's reliability. The full results can be found in Table 1 and item loadings in Table 2. The scree plots can be found in Figures 1 and 2.

Table 1

Validity, Consistency, and Reliability Metrics for the Vertiport Usability Scale

	Scenario 1	Scenario 2
Variance Explained	45.03%	58.53%
Number of Factors (Validity)	1	1
Cronbach's Alpha (Consistency)	.796	.882
Guttman's Split-Half (Reliability)	.799	.843

Table 2

Individual Item Loadings

Items	Scenario 1	Scenario 2
Convenient	.620	.807
Efficient	.675	.788
Functional	.636	.676
Good Location	.697	.796
High Quality	.671	.751
Usable	.687	.749
Useful	.707	.780

Figure 1

Scree Plot of the Factor Analysis from Scenario 1

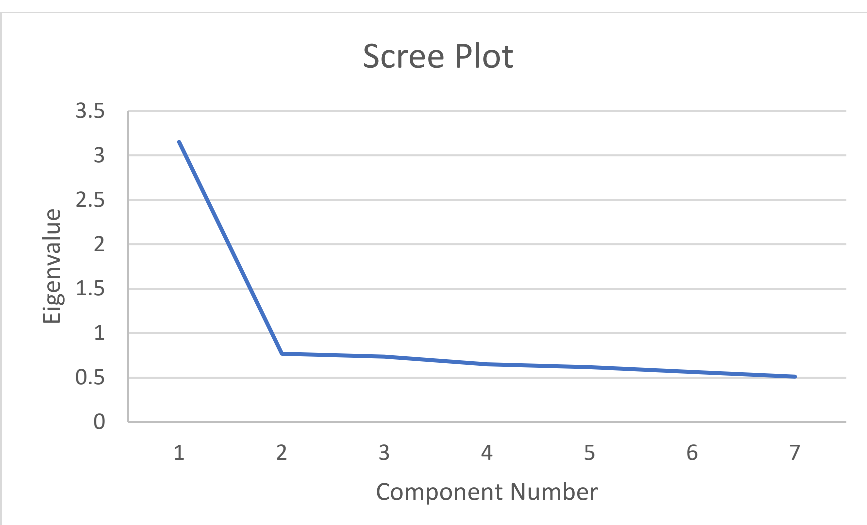
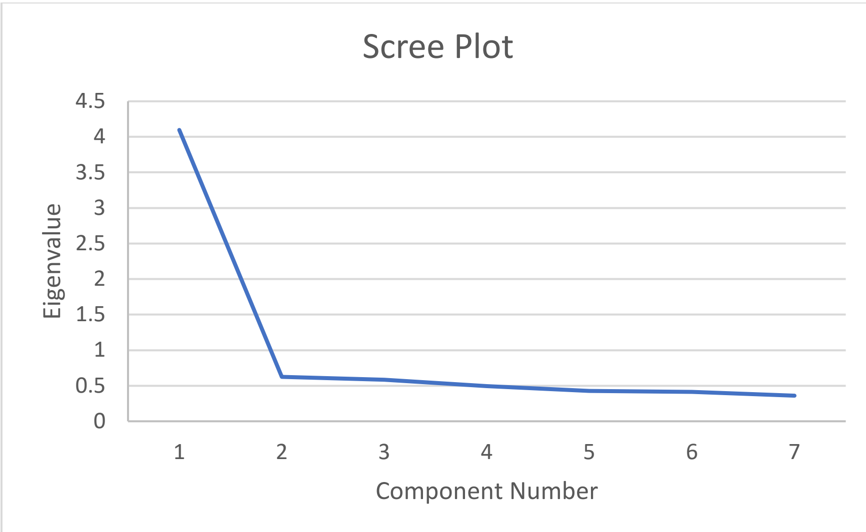


Figure 2

Scree Plot of the Factor Analysis from Scenario 2



Sensitivity. To conduct the sensitivity analysis, the scores from each scale were averaged for the vertiport usability score. The scores of the two scenarios were then compared using a paired samples *t*-test, $t(510) = 9.157$, $p < .001$, $d = .41$. These results indicate that participants rated the first vertiport as having better usability compared to the second vertiport. More so, it provides evidence of the scale's sensitivity to differences in data.

Discussion

The primary objective of this study was to develop a psychometrically valid instrument capable of assessing vertiport usability, a critical component in the UAM infrastructure. The Vertiport Usability Scale was created through a rigorous multi-stage process. Initial stages focused on generating and refining a list of descriptive items that captured key usability dimensions. Subsequent stages employed factor analysis and sensitivity analysis to evaluate the scale's structure and performance. These statistical methods demonstrated the scale's validity and its ability to detect meaningful differences among vertiport designs. The final product was a concise, single-factor model consisting of seven items, offering both reliability and practical utility.

The final items included in the Vertiport Usability Scale, convenient, efficient, functional, good location, high quality, usable, and useful, reflect key dimensions of consumer expectations and operational practicality. *Convenient* suggests that users are considering potential barriers to accessing the vertiport, such as proximity to their departure or arrival points. A vertiport that is conveniently located may significantly influence perceptions of usability, especially for passengers seeking seamless integration with other modes of transportation. *Efficient* complements convenience by emphasizing the importance of minimizing delays and wait times. This item reflects a desire for a streamlined experience, akin to using a taxi, subway, or metro system, where speed and ease of movement are paramount. *Functional* indicates that users expect vertiports to be equipped with essential amenities that support comfort and utility. Features such as temperature-controlled restrooms, sheltered waiting areas, and clear signage contribute to a facility's perceived functionality. *Good location*, while closely related to convenience, carries additional weight when considering strategic placement, such as near international airports, business districts, or resort areas, where demand for UAM services may be highest. *High quality* conveys a preference for modern, well-constructed facilities over temporary or minimal structures, suggesting that aesthetics and durability influence user confidence. Finally, *usable* and *useful* capture the overarching expectation that vertiports should meet consumer needs without introducing unnecessary complexity. These items collectively underscore the importance of designing vertiports that are not only operationally sound but also aligned with user-centered principles.

A well-constructed scale is essential for advancing research in emerging fields like UAM. In this context, the Vertiport Usability Scale meets the dual criteria of psychometric robustness and operational efficiency. Drawing from best practices in scale development (e.g., Rice et al., 2020), the instrument includes multiple items that measure the same construct, thereby enhancing reliability. At the same time, its brevity ensures ease of administration, making it suitable for a variety of research designs and participant populations. The scale's demonstrated sensitivity to group differences further supports its application in comparative studies, allowing researchers to evaluate how different vertiport configurations are perceived by users.

Importantly, the development of this scale addresses a significant gap in the literature. Until now, there has been no standardized tool for evaluating vertiport usability, which has limited the scope and impact of research in this area. Without such a tool, efforts to design and implement vertiports, an essential foundation for widespread UAM adoption, have lacked empirical grounding. The Vertiport Usability Scale not only enables researchers to assess existing designs but also provides an instrument for identifying optimal configurations under varying conditions. Moving forward, this instrument can be used to explore consumer preferences, inform policy decisions, and guide infrastructure development. It also supports future studies to examine additional factors influencing vertiport adoption, such as pricing, routing, frequency, and public sentiment, thereby contributing to a more holistic understanding of UAM readiness.

Future Research and Limitations

This study produced a validated instrument for assessing vertiport usability, marking a significant step forward in the operationalization of infrastructure for UAM. However, the logical progression of this research involves applying the scale in real-world or simulated contexts. Future studies could present participants with a variety of vertiport designs and layouts to evaluate which configurations score highest in terms of usability. This approach would not only test the robustness of the scale but also provide actionable insights for designers and policymakers. Additionally, it is essential to continue monitoring public perceptions and willingness to support UAM initiatives. Public acceptance is likely to be a critical driver in the successful implementation and scaling of UAM systems, and understanding the factors that influence this support will be key to guiding future development.

Despite its contributions, the study has limitations that should be addressed in subsequent research. The use of a convenience sampling method via MTurk restricts the external validity of the findings, as the participant pool may not be representative of the broader population. In addition, the lack of environmental control during data collection introduces potential variability that could affect the reliability of responses. The cross-sectional nature of the study also prevents the analysis of evolving trends in consumer attitudes toward UAM and vertiports. Given that these concepts are still emerging, public opinions are likely to shift as awareness and technological maturity increase. Future research should consider longitudinal designs and explore additional variables that may influence consumer adoption, such as pricing models, route accessibility, and service frequency. These factors could significantly impact the perceived value and practicality of AAM systems from the user's perspective.

Conclusions

A major component of the successful deployment of UAM and AAM is the development of facilities where these vehicles will take off and land. While UAM and AAM remain largely conceptual at this stage, the transition from vision to reality requires robust planning tools. One such tool is the Vertiport Usability Scale developed in this study, which can play a critical role in guiding implementation efforts. By offering a structured instrument to assess usability from the perspective of end users, this scale helps bridge the gap between theoretical models and practical infrastructure development.

The creation of the Vertiport Usability Scale introduces a validated instrument that can be leveraged in future research to enhance vertiport design and functionality. Comprising seven items, the scale is versatile enough to be applied across various study designs, making it a valuable asset for both academic inquiry and industry application. Its ability to operationalize user-centered metrics not only fills a notable gap in the existing literature but also supports the broader goal of making UAM and AAM systems more accessible, efficient, and responsive to stakeholder needs.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used AI to revise and clarify writing after initial drafts were produced.

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Appendix A

Vertiport Usability Scale

Instructions: Please indicate how strongly you agree or disagree with the following statements on a scale from Strongly Disagree (-2) to Strongly Agree (+2), with a neutral option of 0.

1) The vertiport is convenient for me.
2) The vertiport is efficient.
3) The vertiport is functional.
4) The vertiport is in a good location.
5) The vertiport is of high quality.
6) The vertiport is usable by consumers.
7) The vertiport is useful to consumers.