Industry Day for Draft Engineering Brief No. 105, Vertiport Design

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FAA Airport Engineering Division, AAS-100

Date: March 29, 2022
Agenda

Introductory Remarks
Overview of the Draft Vertiport Design EB
Review of Top Industry Issues:
  - FATO Sizing
  - FATO Load Bearing Requirements
Lunch Break
Review of Industry Issues:
  - Controlling Dimension Definition and ICAO Harmonization
  - Composite Aircraft MTOW limited to 7000lbs
  - Exclusion of Hybrid and Hydrogen-powered aircraft
  - Exclusion of Taxiway and Parking Guidance
General Questions and Comment Period
Next Steps and Schedule
Overview of Draft Engineering Brief No. 105, Vertiport Design
Purpose of the Vertiport Design EB

To provide interim guidance to airport owner operators and infrastructure developers for the design of vertiports for vertical takeoff and landing (VTOL) operations.
Previous Vertiport Advisory Circular

• FAA Advisory Circular (AC) 150/5390-3, *Vertiport Design*, cancelled in 2010 due to lack of compatible aircraft.

• Need standards to address facilities required for the boarding and discharging of passengers and cargo by VTOL/STOL aircraft.

• Future standards needs to be performance based.
  • These facilities may have a variety of configurations depending on the level of throughput that is expected at that facility and the characteristics of the aircraft they plan to support.
Vertiport Research

• Investigate VTOL aircraft technologies and determine the maturity of each technology.

• Evaluate the performance and characteristics of VTOL aircraft to help develop design standards and guidance.

• Research steps include:
  • Literature review and gap analysis;
  • Conceptual Testing and Simulations; and
  • Operational Testing.
Engineering Brief 105

- Defined as interim guidance for vertiport facilities based on the composite aircraft
  - Anticipated use for existing infrastructure and new vertiport sites
  - Emphasis on safety-critical areas
- Outline:
  - Introduction
  - Vertiport Design/Geometry
  - Marking, Lighting, Visual Aids
  - Charging/Electric (support from NREL)
  - On-Airport Vertiports
  - Site Safety Elements
- Comments due April 18, 2022
- Emailed to: vertiports@faa.gov
## Composite Aircraft for EB

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propulsion</td>
<td>Electric battery driven</td>
</tr>
<tr>
<td>Propulsion units</td>
<td>2 or more</td>
</tr>
<tr>
<td>Battery Packs</td>
<td>2 or more</td>
</tr>
<tr>
<td>MTOW</td>
<td>7000 lbs. or less</td>
</tr>
<tr>
<td>Aircraft Length</td>
<td>50 ft. or less</td>
</tr>
<tr>
<td>Aircraft Width</td>
<td>50 ft. or less</td>
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<table>
<thead>
<tr>
<th>OPERATING CONDITIONS</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation location</td>
<td>Land based (ground or elevated) no amphibian/float operations</td>
</tr>
<tr>
<td>Pilot</td>
<td>On board</td>
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<tr>
<td>Flight Conditions</td>
<td>VFR</td>
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<table>
<thead>
<tr>
<th>PERFORMANCE</th>
<th>REQUIREMENT</th>
</tr>
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<tbody>
<tr>
<td>Hover</td>
<td>Out of ground effect in normal operations and during FC</td>
</tr>
<tr>
<td>Takeoff</td>
<td>Vertical</td>
</tr>
<tr>
<td>Landing</td>
<td>Vertical</td>
</tr>
<tr>
<td>Downwash/Outwash</td>
<td>Must be considered in TLOF/FATO sizing and ingress/egress areas to ensure no endangerment to people/property in the vicinity, and no impact to safety critical navigational aids and surfaces, supporting equipment, nearby aircraft, and no impact to overall safety</td>
</tr>
</tbody>
</table>
Engineering Brief 105

- TLOF - Touchdown and liftoff area
- FATO - Final approach and takeoff area
- Safety Area

Vertiport EB Recommendation

- TLOF: 1 CD
- FATO: 2 CD
- Safety Area: 3CD
  (½ CD to each side)
- Size for 50 ft aircraft: 150 ft
Next Steps

• FAA will develop a performance-based AC on vertiport design
  • Will address autonomy, different propulsion methods, high tempo facilities and instrument flight rules (IFR) capability.
  • VTOL aircraft using alternative fuel sources
  • VTOL aircraft with MTOW over 7,000 pounds
  • Late 2024/Early 25

• Update to engineering brief likely following additional research and performance/operational data
  • Late 2023/Early 24
Upcoming Research

• Currently completing conceptual testing and modeling/simulations
• Future research planned for operational testing in the following areas:
  • Landing-area scatter
  • Approach/departure profiles
  • Rotorwash/downwash
  • Thermal Runaway
  • Noise
• Further collaboration with NREL on charging/electrification research

Research depends on OEM support and continued collaboration
FATO Sizing
Summary of Industry Comments re: FATO Sizing

• The sizing for the FATO is overly prescriptive and conservative
Minimum width and length of the FATO is 2CD. CD is the controlling dimension of an aircraft which represents the longest distance between the two outermost opposite points on the aircraft.
FATO Sizing – Discussion

- Given the persistence in the lack of certain performance data, particularly with respect to landing scatter, engine failures during the take-off and landing segments of flight as well as downwash characteristics and impacts of VTOL aircraft. We have determined that in the interim, a reduced FATO sizing requirement is inadequate to cover the range of VTOL aircraft and operational conditions that will be routinely encountered.

- This necessitates that we are somewhat conservative in our design recommendations and look towards Transport heliport design requirements in order to ensure safe operations.

- Based on performance claims made by certain aircraft OEMS, it was determined that the minimum acceleration distance required to achieve Effective Transitional Lift (ETL) that is included within the transport heliport design requirements is not required for emerging VTOL aircraft.
FATO Load Bearing Requirements
Summary of Industry Comments re: FATO Load Bearing Requirements

• There should be a pathway to less restrictive FATO load bearing requirements in line with the GA heliport design guidance that states the FATO does not need to be load bearing if the TLOF is appropriate marked and load bearing.

• The requirement increases the cost of new infrastructure
FATO Load Bearing Requirements – Draft EB

Content

• The FATO is defined as a load bearing area

• This implies that the entire FATO should be capable of supporting the dynamic loads of the design VTOL aircraft
FATO Load Bearing Requirements – Draft EB Content

<table>
<thead>
<tr>
<th>General Aviation</th>
<th>Transport</th>
<th>Vertiport EB Recommendation</th>
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<tbody>
<tr>
<td>TLOF: 1 RD</td>
<td>TLOF: 1 RD but not less than 50 ft</td>
<td>TLOF: 1 D*</td>
</tr>
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</table>
| FATO: 1 ½ D     | FATO Length: 2 RD but not less than 200 ft  
|                  | FATO Width: 2 RD but not less than 100 ft   | FATO: 2 D* |
| Safety Area: 1/3 RD (minimums depend on marking) | Safety Area: ½ RD but not less than 30 ft | Safety Area: ½ D* |
| Size based on 50 ft aircraft: 91 ft | Size based on 50 ft aircraft: 230 ft | Size based on 50 ft aircraft: 150 ft |

* Based on aircraft design, RD is converted to D, the largest aircraft dimension in length or width.
FATO Load Bearing Requirements – Discussion

• The limited data available to validate VTOL aircraft performance, especially in failure conditions, calls for a wider touchdown and liftoff area TLOF and load bearing final FATO than currently required for a general aviation heliport to accommodate a potentially wider landing scatter and decreased climb performance in different scenarios.

• This is relevant to the structural design of vertiports

• The dynamic load-bearing FATO enhances safety and operational efficiency in the interim while the lack of validated aircraft performance data persists.
Controlling Dimension Definition and ICAO Harmonization
Summary of Industry Comments – Controlling Dimension Definition and ICAO Harmonization

• Propose harmonization with EASA's D value definition which is based on the diameter of the smallest circle enclosing the VTOL aircraft projection on a horizontal plane

• This definition helps to clarify the max diameter given the wide variety of designs currently in development.
Controlling Dimension Definition and ICAO Harmonization – Draft EB Content

• This Controlling Dimension is defined as the longest distance between the two outermost opposite points on the design VTOL aircraft measured on a level horizontal plane that includes all adjustable components extended to their maximum outboard deflection.
Controlling Dimension Definition and ICAO Harmonization – Discussion

• The intent of both the FAA and EASA definitions is the same, which is to estimate the largest dimension of the aircraft in order to determine the appropriate dimensions of the safety critical areas of the vertiport.

• We have engaged in a technical exchange with EASA and further discussions are being scheduled with EASA to deliberate harmonization where feasible.
Composite Aircraft MTOW Limited to 7000lbs
Summary of Industry Comments – Composite Aircraft MTOW limited to 7000lbs

• Limiting the design to 7000 lbs suggests vertiports should not be futureproofed for anything larger.
• This requirement corresponds to the sizing of a small helicopter, per the Heliport Design AC.
Composite Aircraft MTOW limited to 7000lbs – Discussion

• The EB guidance is correlated to the composite VTOL aircraft described in the EB which was developed based on interactions with original equipment manufacturers. The aircraft data that was garnered from the manufacturers all revealed aircraft with MTOW under 7000 pounds.

• The EB revisions will also include aircraft that do not currently conform to the composite aircraft included in this EB, to include aircraft with MTOW over 7000 pounds.
Exclusion of Hybrid and Hydrogen-powered Aircraft
Summary of Industry Comments – Exclusion of Hybrid and Hydrogen-powered aircraft

• There are those OEMs who are looking at hybrid designs as a potential alternative to all electric in the near future

• No mention of future accommodation for hybrid aircraft
Exclusion of Hybrid and Hydrogen-powered aircraft – Draft EB Content

• The AC on vertiport design will also address VTOL aircraft using alternative fuel sources such as hydrogen and hybrid.

• Future guidance will be provided on other emerging energy concepts such as hydrogen.
Exclusion of Hybrid and Hydrogen-powered aircraft – Discussion

• The EB guidance is correlated to the composite VTOL aircraft described in the EB which was developed based on interactions with original equipment manufacturers. The aircraft data that was garnered from the manufacturers all revealed aircraft that are electric battery driven utilizing distributed electric propulsion.
• Recognize that hybrid VTOL concepts may still be needed to accomplish other essential operations especially those of longer range, as range is limited in all-electric VTOLs.
• Accommodating hybrid aircraft at a vertiport would increase the required infrastructure,
• Future guidance will address different propulsion methods and VTOL aircraft using alternative fuel sources such as hydrogen and hybrid.
Exclusion of Taxiway and Parking Guidance
Summary of Industry Comments – Exclusion of Taxiway and Parking Guidance

• The EB should note that taxiing is an accepted practice on a vertiport

• For ground taxis, the FAA should allow infrastructure and vehicle operators to put in place vertiport/aircraft-specific procedures and designs for movement into a stand

• The FAA should allow for planning at the state/local level
Exclusion of Taxiway and Parking Guidance – Discussion

• The EB revision will provide guidance on vertiport taxiways, taxi routes and helicopter parking.

• Additional time and data is needed to complete the requisite research to support this guidance.

• The suggestion to note in the draft EB that taxiing is acceptable and taxi routes are expected at vertiports is agreeable.

• The ground taxiway and air taxiway separation distance dimensions for VTOLs may slightly differ from those for helicopters.
Vertiport Design EB - Next Steps and Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Date</th>
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<tbody>
<tr>
<td>End of Industry Comment Period</td>
<td>April 18, 2022</td>
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<tr>
<td>Complete adjudication of all Industry comments</td>
<td>May, 2022</td>
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<tr>
<td>FAA Office of Airports Submits Draft EB to FAA Legal</td>
<td>June 2022</td>
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<tr>
<td>FAA Office of Airports receives legal comments (estimate)</td>
<td>July 2022</td>
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<tr>
<td>Final Vertiport Design EB for Signature</td>
<td>Summer 2022</td>
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