Problem Statement No.: 24-1027

Integration of Hydrogen-Powered Aircraft with Airports - Opportunities and Challenges

Recommended Allocation: $600,000

Tags: Operations, Airport-Planning, Sustainability, Environment, Policy

Staff Comments: Problem Statements 24-1021 and 24-1027 both cover the topic of hydrogen fuels in an airport setting. The two could be combined into a single project, with 1027 being the primary problem statement. The budget of $600,000 set by the author of 24-1027 should be sufficient to cover the combined effort. ACRP Research Report 236: Preparing Your Airport for Electric Aircraft and Hydrogen Technologies and Synthesis 85: Alternative Fuels in Airport Fleets may provide useful background information.

Average Airport Employee Review Rating (out of 5): 3.67

ACRP Oversight Committee (AOC) Disposition: This problem statement received an average rating of 3.42 on a scale of 1 to 5 among voting AOC members. The research and objectives of Problem Statements 989 (excluding the topics of SAF and solar energy), 1021, and 1027 were combined into ACRP Project 03-75 and funded at $650,000.
Problem Statement No.: 24-1027

*Integration of Hydrogen-Powered Aircraft with Airports- Opportunities and Challenges*

**Topic Areas**
- Operations
- Airport-Planning
- Sustainability
- Environment
- Policy

**Background**

With the continued increase in Technology Readiness Level (TRL) for hydrogen-powered aircraft (demonstrated by multiple preliminary hydrogen-powered flight tests), the introduction of these aircraft in airline fleets is imminent. The integration of hydrogen-powered aircraft could be very challenging for airports as these new aircraft will require significant updates to airport infrastructure, on-site resource allocation, and operations.

**Objective**

The outcome of this research will be an industry-driven consensus on the challenges and opportunities associated with operating and integrating hydrogen-powered aircraft with conventional aircraft fleets at existing (and upcoming) airports.

**Research Approach**

**Resources**
- Up-to-date case studies where the energy requirements, space and water availability are assessed.
- Up-to-date studies highlighting the challenge of up-scaling hydrogen for its use in aviation, as well as the energy requirements mapped at a regional level.
- Considerations on ramp up phasing based upon airport size, scale, service, and geography. Operations on stands.
- Safety perimeter from refueling point / facilities, depending on aircraft design, and refueling location, which will probably not be at the wings as with current aircraft.
- Evaluation of refueling while other ground service operations are taking place, for example during boarding or deplaning, as well as any extra procedures during the turnaround process.
- Evaluation of refueling a hydrogen aircraft at a stand while a conventional Jet A-1 aircraft is also being refueled nearby.
- Emergency procedures and equipment in case of hydrogen flexible hose pullout and hydrogen leakage mix with hazardous materials, and whether the experience in the hydrogen road (or rail) transport sector can help to inform any of the above.

**Operations**
- Specifications to account for winter operations or other specific weather conditions. Evaluation of how these will affect airport operations related to hydrogen aircraft.
o Leak management procedures in the industry and how these can be adapted to an airport environment.
o Evaluation of safe maintenance procedures, for example if the aircraft tanks need to be completely emptied, boil-off management, or indoor maintenance procedures.

Infrastructure
o Case studies highlighting best internal distribution of hydrogen depending on the airport and aircraft pair, and infrastructure implications of this.
o An up-to-date estimation on the costs of infrastructure and ownership format is required.

Cost Estimate and Backup

$600,000

Related Research

ACRP Research Report 236: Preparing Your Airport for Electric Aircraft and Hydrogen Technologies

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Ernst & Young-Parthenon (EY-P)
Problem Statement No.: 24-1027

Integration of Hydrogen-Powered Aircraft with Airports- Opportunities and Challenges

Airport Employee Comments

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<tr>
<td>Relatively new subject/technology, any resource guidance would be beneficial.</td>
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<tr>
<td>Combine with 24-989.</td>
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<td>I think this is applicable because even if hydrogen powered aircraft aren't widely integrated for 10-15 years it's important to start planning now.</td>
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<tr>
<td>Great topic! This has attention from airport, airlines, manufacturers, and regulators. This is well-aligned to be combined with Problem Statement 24-989 Planning for the Emergence of New Aviation Fuels and Energy Sources.</td>
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<td>It’s not clear how this proposed research is distinct from recently published ACRP 236 and why a deeper dive into hydrogen is needed so quickly after completion of that report.</td>
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TRB Committee Comments

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<tr>
<td>AV095 AV030</td>
<td>NEW USERS OF SHARED AIRSPACE (AV095): Recent discussions of hydrogen technologies indicate there are many very important technical challenges with storing hydrogen and different methods to achieve stable operational designs. It is, however, a bit too early to proceed with this proposal at this time.</td>
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<td></td>
<td>ENVIRONMENTAL ISSUES IN AVIATION (AV030): Report 236 is pretty recent, and I don't think the industry is far along enough to cover the highly specific items discussed in the problem statement. It would be worth holding onto this problem statement and re-considering in the future.</td>
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