AIAA/IEEE EATS Students Design Challenge 2021

CALL FOR PROPOSALS

INTRODUCTION

The aeronautics industry is in the midst of another revolution since the last century. On one side, ecological awareness is providing a strong push to reduce harmful emissions, and the overall environmental footprint of aviation in general. From the other side, new trends and needs in mobility are rising towards more autonomous vehicles. The reduction of weight, fuel consumption and noise has been a continuous goal for many years, in order to improve aircraft performance. Linked to these challenges, new concepts have been rising and, in particular, in the "Urban Air Mobility" or UAM sector that will utilize electric vertical take-off and landing (eVTOL) aircraft.

The "dream" of an electrically propelled flying car is now starting to become reality, and several demonstrators have been proposed worldwide. However, autonomy and performance are still limited, and one main question is to know how far we can go in performance, taking into account the technology evolution. This is the spirit of the following Challenge: What is the max payload (in kg) that can be achieved for an eVTOL aircraft, with no CO_2 emission by the vehicle, according to the specifications below?

CHALLENGE

QUESTION = What is the max payload (in kg) that can be achieved for a eVTOL, with no CO_2 emission by the vehicle, according to the specifications below?

SPECIFICATION

- Range: 100km (54nm) + 25km (13nm) of backup;
- Cruise speed: 135 kts;
- Operating altitude relative to the ground: 150m (500 ft), and maximum altitude above sea level: 1,070m (3,500 ft);
- Maximum Take-Off Weight (MTOW): 2.5 metric tons;
- The largest aircraft planform dimension should fit within a 15-meter diameter circle;
- Anticipated Entry into Service (EIS) 2030;
- Participants can select the energy storage system of their choice, but the propulsion system must comprise electrical components, either fully electric or hybrid of electric and conventional, and must produce zero CO_2 at the vehicle level.

GLOSSARY

- A/C: aircraft
- FDC: flight deck crew (e.g. pilot)
- MTOW: Maximum Take Off Weight
- PAX: passengers (not including FDC);
- UAM: Urban Air Mobility;
- eVTOL: electric Vertical Take Off and Landing

INFORMATION TO BE PROVIDED

Aircraft Design Consideration:

- General description and architecture of the aircraft: length, span, shape, number of wings (if any);
- Type and number of propulsors? (e.g. fans (ducted or unducted) or propellers, with or without pitch control, or collective and cyclic control for a rotor, if used)
- Description of how the electric power train is integrated in the vehicle (including energy storage and its source up to the propeller, total losses and how the heat is managed, etc.). *For all components, please provide mass and volume.*

Electric Propulsion System Design:

- What system for power generation? Provide mass, power, volume, voltage, operating temperature;
- What system for energy storage? Provide mass, energy, volume, operating temperature;
- Electrical power distribution system: for all components, please provide mass, voltage, operating temperature, volume;
- Electrical motor: voltage, torque, mass, volume;
- Electrical power system architecture, fault tolerance considerations, total efficiency
- System Safety Assessment approach: Considerations for Engineering Failure Modes and Effects

Continued on reverse.

Concepts of Operation to meet the aircraft and electrical system design:

- Flight Management: Onboard Flight Deck Crew, Remotely Piloted or Autonomous?
- Passengers: number of passengers and-or cargo? (define both the total mass and handling PAX and-or cargo)
- Energy refill strategy;
- Operating limitations

For all presented figures, the following data shall be provided:

- Details of the calculations made, hypotheses and justification (example: energy density of batteries);
- Details of aerodynamics calculation per flight phase: take-off, cruise, transition, landing;
- Detailed mass breakdown: structure, seats, propulsive chain, electrical distribution, etc...

Keep in mind that the answer to the question is not unique, and creativity is very important in your proposal. Moreover, what is important is to clearly explain:

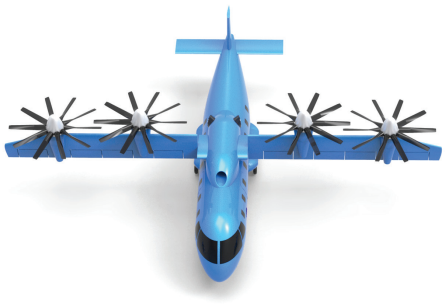
- the hypotheses and assumptions that you are taking,
- their justification (literature survey is strongly recommended),
- the methodology and tools that you are adopting for solving the problem,
- the limits of validity of some hypotheses or calculation.

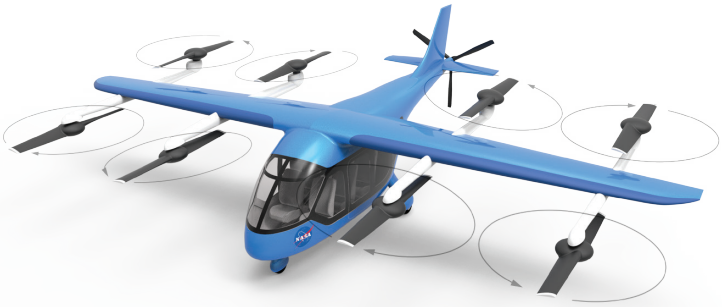
SUBMISSION AND RANKING

The Proposal shall be a written report in English of **30 pages maximum**. It is not mandatory to have a hardware demonstrator. A video with a maximum of 5 minute duration can be submitted with the proposal.

Every proposal will be evaluated by a jury panel, according to the following ranking:

- Originality (25 points)
- Technical content (25 points)
- Feasibility (25 points)
- Report quality and clarity (25 points).





ELIGIBILITY

More than one design may be submitted from students at any one school.

Teams can consist of the following:

- Undergraduate students
- Graduate students
- Combine Undergrad and Graduate students

SCHEDULE

- **November 2, 2020** – Submission opens
- **June 1, 2021** – Submission deadline
- **July 1, 2021** – Winner announcement
- **August 2021** – Awards at EATS

Website for submissions:
http://bit.ly/2021EATSStudent

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CONFLICT OF INTEREST

It should be noted that it shall be considered a conflict of interest for a design professor to write or assist in writing RFPs and/or judging proposals submitted if (s)he will have students participating in, or that can be expected to participate in those competitions. A design professor with such a conflict must refrain from participating in the development of such competition RFPs and/or judging any proposals submitted in such competitions.

CONTACT

All information including any updates will be posted on the EATS website. **propulsionenergy.aiaa.org/EATS**

All questions related to this RFP should be addressed to:
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