GATEWAYS TO BLUESKIES

Q&A Session

November 3, 2022

3:30 – 5:00 PM ET

(Please mute all mics.)

The Gateway to Blue Skies: Clean Aviation Energy Competition is sponsored by NASA's Aeronautics Research Mission Directorate's (ARMD's) University Innovation Project (UI) and managed by the National Institute of Aerospace (NIA).

Agenda

- Welcome & Introductions
- Context for 2023 Competition
- General Technical Remarks
- General Programmatic Questions
- Questions Received in Advance
- Additional Questions (Time Permitting)
- Wrap Up

GATEWAYS TO BLUESKIES

NIA Program Team

Janice Kurbjun Miller

Program Lead

Genevieve Ebarle

Program Coordinator

Stacy Dees

Program Manager

Shelley Spears

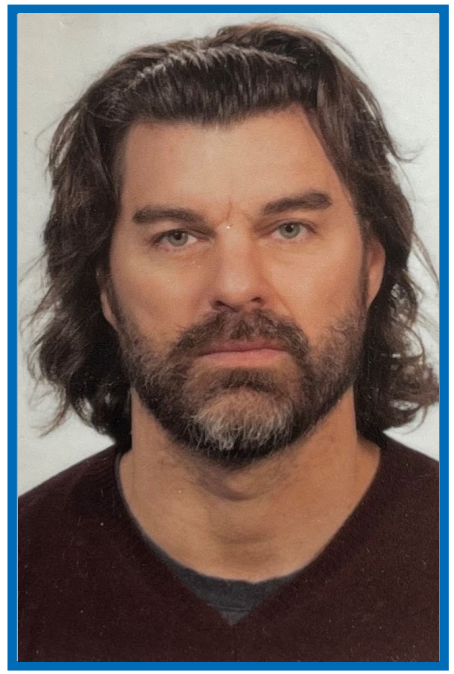
Program Director

GATEWAYS TO BLUESKIES

NASA Sponsors

University Innovation Project

Steven Holz,
Blue Skies Chair
NASA Langley Research Center



Andrew Provenza,
Blue Skies Co-Chair
NASA Glenn Research Center

Koushik Datta,
UI Project Manager
NASA Ames Research Center

Mina Cappuccio,
UI Deputy Project Manager
NASA Ames Research Center

GATEWAYS TO BLUESKIES

Context for Competition

Overview of the Competition & Purpose

- Purpose is to encourage diverse, multi-disciplinary teams of college students to explore and contribute unique systems-level ideas and analysis of the source-to-flight lifecycle of future zero-emissions aviation propulsion energy sources.

- Choose a potential alternative energy source that can reasonably be applied to aviation, and which could be a solution to aviation's major climate impacts and move the industry toward a zero-emissions future. Examine the TRL, manufacturing, and supply chain of that energy in terms of feasibility, viability, and climate impact.

- What is the vision for a zero-emissions future in aviation?

GATEWAYS TO BLUESKIES

General Technical Remarks

Proposal and Video Expectations

- What are we looking for in the proposal?
- What are we looking for in the video?

- What **DO** we want to see in the challenge?
  - Energy sources that are less explored but have propulsion potential for ***most*** *commercial flights longer than 2 hours.*

- What do we **NOT** want to see:
  - Supply chain analysis of today's Sustainable Aviation Fuel, as defined by the Department of Energy: https://www.energy.gov/eere/bioenergy/sustainable-aviation-fuels

GATEWAYS TO BLUESKIES

General Technical Remarks

Technical Clarifications

- There is some nuance to alternative energies derived from natural sources and ‘biofuels’ - and their relation to Sustainable Aviation Fuel (SAF)

- Where should analysis begin and end for the source-to-tank lifecycle?
  - Analysis should **BEGIN** with sourcing, extraction and refinement, if applicable
  - Analysis should **END** when the energy source is on board and ready for consumption.
    - This competition **DOES NOT** address disposal or end-of-life for selected energy source.
    - Analysis of consumption is built into the competition: Teams must justify their selected energy source in terms of its ability to achieve a zero-emissions future.

GATEWAYS TO BLUESKIES

General Technical Remarks

Technical Clarifications (cont'd)

- Technology and the environment are the focus of the competition. Social, political, and financial are ancillary factors that may be relevant and can be mentioned in justification.

- A battery is storage, not an energy source.

- Competition has Minimal Constraints
  - It will be up to your team to make and outline assumptions, based on research informing your vision of the future of aviation. Teams must make appropriate justifications of selected concepts and subsequent analysis.

Programmatic Remarks

- Faculty advisors must sign the proposal for submission to be valid
- Evaluation and scoring structure has changed for 2023!
  - Finalists selected based on proposals
  - Final scoring starts with research paper/infographic and ends with presentation at the Forum.
  - In other words, you **CAN** and **NEED TO** provide updates between the proposal and final research paper!
- Be sure to read the Competition Guidelines in full before diving into analysis
  - Special emphasis is placed on analyzing innovative energy sources.
  - Adherence to the Competition Guidelines are the foundation upon which your submission will be judged!
  - Carefully review the evaluation criteria.
- YOU are selling your proposed concept to the judges!

Competition Announced
(July 26, 2022)

Next Deadline →

Proposal & Video Due
(February 28, 2023)

Selection Notifications
(March 28, 2023)

Blue Skies Forum in Cleveland, OH
(June 1-2, 2023)

Competition Guidelines PDF

GATEWAYS TO BLUESKIES

Q&A:

Technical Questions

- **Does “environmentally harmful emissions” include only carbon or all potential emissions?**
  - Studies show that many types of non-carbon emissions still have environmental impacts. Consider the environmental impacts of any emissions your energy source or system may produce.
- **What level of commercial airplane should our project be geared towards? Similar question: The guidelines mention providing enough energy to support a 2-hour flight, but they don’t mention the size and weight of the aircraft. Do we choose our own specs and limitations?**
  - The key word is ***most*** for “most aviation flights longer than 2 hours.” Your team will need to research, outline, and justify what these flight lengths will be, and what aircraft may be likely serve these flights in the 2050s timeframe, especially if that design needs to change to accommodate new propulsion.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **If we do create our own parameters, can we use NASA's blended wing as our airframe design? Similar question: Do we need to consider the wing design for the alternative source of energy?**
  - While the proposal should not focus on airframe design, certain airframes can impact the viability of certain energy sources, which could be a consideration when justifying your energy source.
- **Although 2 hours is the minimum flight target, what would be the ideal flight time that we should be aiming for?**
  - Teams should research and self-determine (and subsequently, outline and justify) what "most aviation flights longer than 2 hours" constitutes for the industry in the 2050s.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **How will ‘feasibility of technological advances by 2050’ be judged?**
  - One should be able to use their research to justify what would be feasible by 2050. Judges will be working from the outlined evaluation criteria, which values well-researched, coherent justifications for assumptions and concepts. See Technical Merit & Rationale: **Sound justification of assumptions** for the selected energy source and its source-to-flight lifecycle (Page 11, Competition Guidelines).
- **Is there a rate on how feasible the fuel can be by 2050?**
  - If you mean, “will you be rated on how feasible judges think the fuel is?”, the answer is no. Judges will evaluate how well thought out your case for feasibility is and how you present that in writing. Should your team be selected as a finalist, your presentation will be similarly evaluated.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **For a "reasonable assumption of plane redesign," could you elaborate on "reasonable"? What limitations are there on engine redesign?**
  - We do not expect your team to design a new airplane. Look at existing research for airplane designs that may accommodate the parameters your energy source may allow. While there are no direct limitations on the redesign of an engine, be mindful of where the technologies and research are now, and the time left to develop/implement them by the 2050s.
- **How much emphasis should be placed on viability versus sustainability?**
  - That is up to the group. Neither a sustainable idea that is not shown to be viable nor a viable non-sustainable idea would be the best option to pursue for this competition.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **Can we assume that the landscape assessment is limited to the U.S., or would our considerations extend to global aviation? Similar question: Do we need to consider the whole world's aviation infrastructure or just the U.S. infrastructure?**
  - One could focus on just the U.S., but the aviation market is a global one. What happens outside of the U.S. has major impacts on the U.S. aviation industry, so judges may ask questions about the global market in their evaluations and during finalist team presentations.
- **Should teams attempt to scale economic analysis from 2022 to 2050?**
  - Economics is part of the bigger picture of development, viability, and sustainability of your proposal. While many teams may not go in depth on the economics analysis, use your best judgement for any analyses to include scaling factors, such as inflation.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **Is hybrid considered one alternative source of energy?**
  - You may consider a hybrid system but should focus on the main energy source of that system.
- **Does the banned SAF encompass all biomass and waste-derived fuels? What exactly does SAF include?**
  - This competition is not seeking analysis of SAF, as defined by the Department of Energy (DOE). Take a look at the DOE's SAF page for a better idea of what is considered SAF, for purposes of this competition. Energy sources that are bio- or waste-derived but do not fall into the DOE's definition are eligible for pursuit.

Q&A:
Technical Questions

- **Would hydrogen directly injected into an aircraft engine made of biomass conversion be considered a biofuel?**
  - We need clarification before answering. Please email us directly with a rephrased question (blueskies@nianet.org), or drop it in the chat if you are on the call.
- **Can the energy or fuel source be extracted or powered in a new way, but come with the same result (ex. hydrogen)?**
  - Yes, energy sources such as hydrogen, as well as novel ways to get those energy sources, may be considered.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **To what extent should we talk about the engine cycle, and how the fuel will be used in the engine itself?**
  - Teams may want to discuss engine cycle and how the energy source will be consumed by the engine in the energy source justification and feasibility. However, this discussion is not a necessary piece of your proposal. The depth of discussion on energy consumption will be unique to each team and selected energy source.
- **To what extent should we talk about the storage of fuel on the airplane?**
  - Storage on the airplane is the final destination of this fuel before use. If new technologies or techniques are necessary for this storage, it may be worth mentioning them on some level.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **Would solid-state batteries with a focus on regenerative systems, solar, piezoelectric, thermoelectric, be acceptable for competition parameters? Similar Question: Are perovskite solar cells (an innovative, less researched, clean energy collection method) considered researching solar energy, and would this be a valid research focus?**
  - If you choose electricity as your aviation energy source (which is allowed), it is up to your team and your research to decide how that will be generated, transported, and stored.
- **Will teams be disqualified if they focus on electric (battery storage) or hydrogen fuel sources?**
  - Teams may use electric or hydrogen as a fuel source.

GATEWAYS TO BLUESKIES

Q&A:
Technical Questions

- **Are battery swapping/takeoff assist devices (supplementary systems) allowed in this project?**
  - Battery swapping would be a way of getting an energy source to the aircraft, which is within the scope of the project. Vehicle takeoff is less in scope of the project, but if an assisting technology is necessary or recommended to make your energy source viable, it would be beneficial to mention it.
- **How early in the start of the life cycle is required, meaning harvesting of raw materials to manufacturing depth up to delivery of the aircraft?**
  - The generation/creation of usable energy source materials should be considered as part of the lifecycle.

Q&A:
Technical Questions

- **Do the emissions involved in manufacturing need to be included in the project as far as the refinement process of our materials?**
  - Emissions from the generation/creation of usable energy source materials should be considered as part of the lifecycle.
- **What resources exist, and are approved, to determine the products of various chemical combustions?**
  - Teams are expected to identify and use their own resources in their proposals. Peer reviewed academic and scientific resources written by subject matter experts are recommended sources in your information search.

GATEWAYS TO BLUESKIES

Q&A:

Miscellaneous Questions

- **What is the preferred method of balancing technology readiness with new concepts?**
  - For technology readiness, NASA's Technology Readiness Level Chart is widely utilized at both NASA and in industry. Similar scales exist in industry for manufacturing and other readiness evaluations. As far as balancing technology readiness with new concepts, it is OK to utilize ideas that have a lower TRL (because they are new), as long as teams justify assumptions and rationale for technology development and implementation.

Q&A:
Miscellaneous Questions

- **In the rubric section for landscape assessment, there are technical, social, political, financial, and environmental factors listed. How much of an emphasis should we put on each aspect of the proposal?**
  - The technical aspects are the main focus of the proposal. The direction, development, and adoption of new technologies are affected by the other listed factors, which may affect feasibility and viability of selected energy sources. These should be taken into consideration and/or mentioned when appropriate.
- **In what ways would it be preferred to measure the social and political impacts?**
  - There is no specific preference. The impacts should be mentioned if/when relevant to the overall system.

Q&A:
Miscellaneous Questions

- **What are the expectations for our research sources? Is it acceptable to use research papers we find online, or are we expected to perform a lab experiment and discuss with chemists/researchers?**
  - We do not expect the students to need to perform lab experiments for this proposal. Peer reviewed literature and conversations with relevant experts in the appropriate fields are acceptable resources.
- **We are interested in attending an IEEE/AIAA symposium and they are requesting papers/reports. Are we allowed to submit our project material to this conference?**
  - Yes, submitting to and presenting at industry symposia is allowed. However, we ask that teams refrain from posting research on publicly accessible websites or servers until after the June 1-2, 2023 Blue Skies Forum.

GATEWAYS TO BLUESKIES

Q&A:

Programmatic Questions

- **Are students graduating in December allowed to participate?**
  - Yes, as long as they were students during the Fall Semester when you began working on the project. However, it is important to note that if your team is selected as a finalist, your university may not be able to support travel costs to the Forum for anyone who is no longer an active student. Eligibility for an internship depends on continued college/university enrollment.
- **Can we have an external entity help with the video by hiring or asking someone with experience?**
  - Videos should be produced by the team, and it is discouraged to hire for video production. Multi-disciplinary teams will be the most successful in this competition, so if it makes sense to add a creative member to the team, it may help position the team for success with the video and infographic. That said, just as teams may (and should) seek subject matter experts for their research, teams may access outside resources to design and produce the video.

GATEWAYS TO BLUESKIES

Q&A:
Programmatic Questions

- **For the video, are we expected to make 3D or 2D graphics and animations?**
  - 3D or 2D graphics and animations are not required nor expected, but they may help convey a concept effectively. Overall, the level of video production is up to each team to determine what's needed to convey the proposed concept. Take note of the video expectations and evaluation criteria outlined in the Competition Guidelines to determine how your team will present its concept in video form (see pages 9-11).
- **What is the desired format of the final proposal report?**
  - The proposal report should be submitted as a PDF that adheres to information laid out in the Competition Guidelines (See pages 7-8).

GATEWAYS TO BLUESKIES

Q&A:
Programmatic Questions

- **Does the allotted page limit for the report include the references, title, etc., or is that for the body of the report?**
  - The allotted page limit for the proposal does not include cover page, abstract page, or appendices such as references. PLEASE NOTE that all pertinent information to your concept should be included in the main body of the proposal. Judges are not required to read beyond seven pages, and appendices are meant for references and calculations only (see Competition Guidelines , page 8).
- **Are additional members able to join a team after the submission of the NOI but before the submission of the proposal?**
  - Yes. Team members may join up until the proposal submission, at which point the team size and membership is set, with all team members listed on the proposal itself.

GATEWAYS TO BLUESKIES

Q&A:
Programmatic Questions

- **How technical/detailed do you want the report to be?**
  - The proposal needs to reflect the total scope planned for the final paper, addressing all aspects described in the Competition Guidelines , page 4 (2023 Competition Theme Description and Details). It should be at the “convincing” level - demonstrating a strong basis of research analysis having already been conducted. Include enough detail to convince the judges that your proposed concept has been well researched and developed, that it is credible and viable with sound justification, and provide confidence that your team can further refine and develop your concept if selected as a finalist. Remember, special emphasis should be placed on analyzing innovative energy sources.

GATEWAYS TO BLUESKIES

Live Q&A

Open Call for Additional Questions

GATEWAYS TO BLUESKIES

Future Questions?

PLEASE SEND ALL FUTURE QUESTIONS TO:
blueskies@nianet.org

Each question will be responded to directly, as well as posted on the FAQ webpage for everyone to see.

We encourage you to visit the FAQ webpage frequently for updates:
https://blueskies.nianet.org/faq/

View the complete 2023 Blue Skies Competition Guidelines PDF

GATEWAYS TO BLUESKIES