NASA Advanced Air Vehicles Student Competition 2016-2017

NASA invites students to propose ideas and designs for future aircraft that use less fuel, produce less harmful emissions, and make less noise.

Technical Area 1: Commercial Supersonics Technology Project

Background:

For the first time in the history of commercial aviation, we have taken a step backward. We had the capability to fly faster than sound with commercial transports, as demonstrated by the Concorde. There are no commercial supersonic aircraft flying today. How do we enable people to cover large distances (across continents and oceans) quickly without placing an excessive burden on our environment?

Supersonic vehicle research addresses the development of tools, technologies, and knowledge to help eliminate today's technical barriers to practical commercial supersonic flight: sonic boom, fuel efficiency, airport community noise, high-altitude emissions, structural weight and flexibility, airspace operations, and the ability to design future vehicles in an integrated, multidisciplinary manner.

NASA Aeronautics focuses on sonic boom reduction methods and approaches. The aeronautics research includes design tools for vehicles with low sonic boom, and defines the necessary approaches and techniques for objectively assessing the levels of sonic boom acceptable to communities living in the vicinity of future commercial supersonic flight paths.

Knowledge and data from this work will inform the efforts of both national and international regulatory organizations in the development of design standards for future supersonic commercial aircraft.

In addition, such research lays the groundwork for overcoming other challenges facing commercial supersonic flight including energy efficiency, reduced pollutants emitted into the atmosphere, and acceptable noise levels in the airport area.

The table below summarizes NASA's vision of the environmental and performance goals for future supersonic commercial vehicles. These goals have been chosen to define increasingly capable supersonic aircraft that are compatible with a greener world from the perspectives of noise, emissions and energy usage (fuel efficiency). These parameters and goals are based on NASA's internal estimates of the required future capabilities of these vehicles. The N+1, N+2 and N+3 (also known as Near Term, Mid Term and Far Term) designations are related to the estimated Initial Operational Capability (IOC) dates for these increasingly capable vehicles.

NASA's Current Technology Goals for Future Supersonic Vehicles

	N+1 (Near Term) Supersonic Business Class Aircraft (2025)	N+2 (Mid Term) Small Supersonic Airliner (2035)	N+3 (Far Term) Efficient Multi-Mach Aircraft (Beyond 2035)
Environmental Goals			
Sonic Boom	70-75 PLdB	70-75 PldB	65-70 PldB
Airport Noise (cum below stage 3)	ICAO Ch. 14 w/margin	ICAO Ch. 14 w/margin	15 EPNdB below Ch. 14
Cruise Emissions (Cruise NOx g/kg of fuel)	Equivalent to current Subsonic	< 10	< 5 & particulate and water vapor mitigation
Performance Goals			
Cruise Speed	Mach 1.6-1.8	Mach 1.6 -1.8	Mach 1.3-1.6 overland, higher over water
Range (n.mi.)	4000	4000	4000 - 5500
Payload (passengers)	6-20	6-90	100 - 200
Fuel Efficiency (passenger-miles per lb of fuel)	1.0	1.0	3.5 – 4.5

Supersonic Business Jet Challenge

Submit a technical paper of your design for a highly efficient and environmentally friendly (low noise) aircraft with an Initial Operational Capability (IOC) of 2025. A successful design will address the efficiency, environmental and performance challenges described below. *The low boom design aspects of the vehicle can be considered, but should not be the focus of student designs. We are specifically looking for new ideas and designs to aid in the other performance aspects of a supersonic business jet listed above.*

Supersonic Business Jet Design Goals:

- Cruise speed = Mach 1.6-1.8
- Design Range = 4000 nautical miles
- Payload = 6-20 passengers
- Fuel Efficiency = 1.0 passenger-miles per pound of fuel
- Take-off field length < 7,000 feet

Undergraduate junior or senior level students (Teams only):

Using the design limits above, propose configurations and systems to achieve *one or more* of the following:

- Supersonic cruise efficiency
- Take-off and Landing noise
- High-lift for take-off and landing

Graduate students (Teams or Individuals):

Propose an integrated vehicle design that simultaneously achieves supersonic cruise efficiency, take-off and landing noise, and high-lift for take-off and landing of the supersonic business jet defined above. In addition, propose solutions for integration of the new jet with the next generation air transportation system, including efficient airport operations.

Submission & Evaluation

All papers will be submitted electronically in English on or before June 1, 2017.
Papers will be reviewed by NASA personnel against a standard set of criteria including: creativity and innovation, literature review, baseline comparison with current aircraft of similar passenger capacity, cost and feasibility analysis, and point by point design discussion.

Eligibility & Awards

All competitors should be full time students at an accredited US higher education institution (colleges and universities). The winning team or teams may be invited to attend a NASA sponsored event to present their paper, tour a NASA facility, and interact with NASA engineers.

Joint NASA/DLR Aeronautics Design Challenge Timeline:

Notice of Intent: Requested by Feb 1, 2017
Papers Due: June 1, 2017
Reviews: June-July 2017
Announcement of Finalists for US participants: August 2017
Announcement of Finalists for DLR participants: TBD
Technical Symposium for participants (US and DLR) to be held at or near NASA Langley Research Center, October 2017