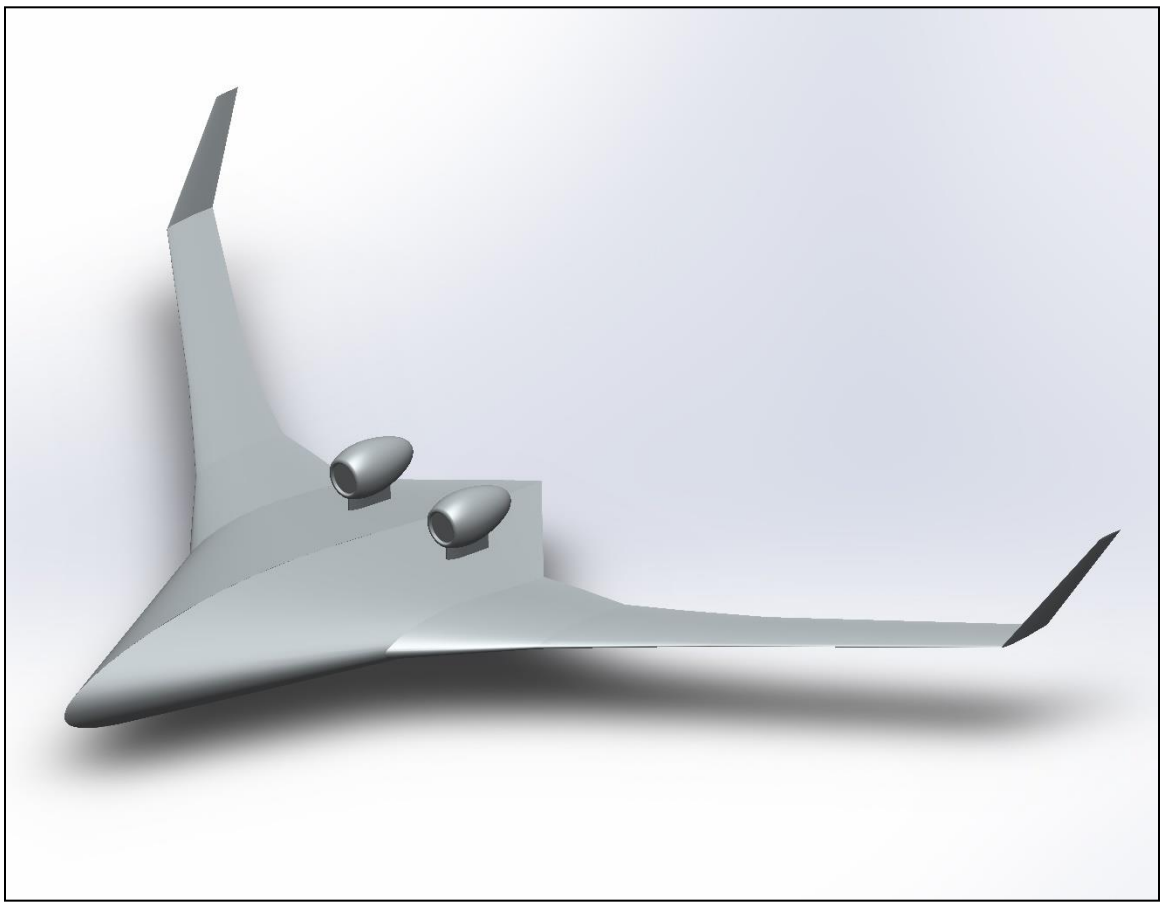
Low Noise Subsonic Challenge:

BLEND-X



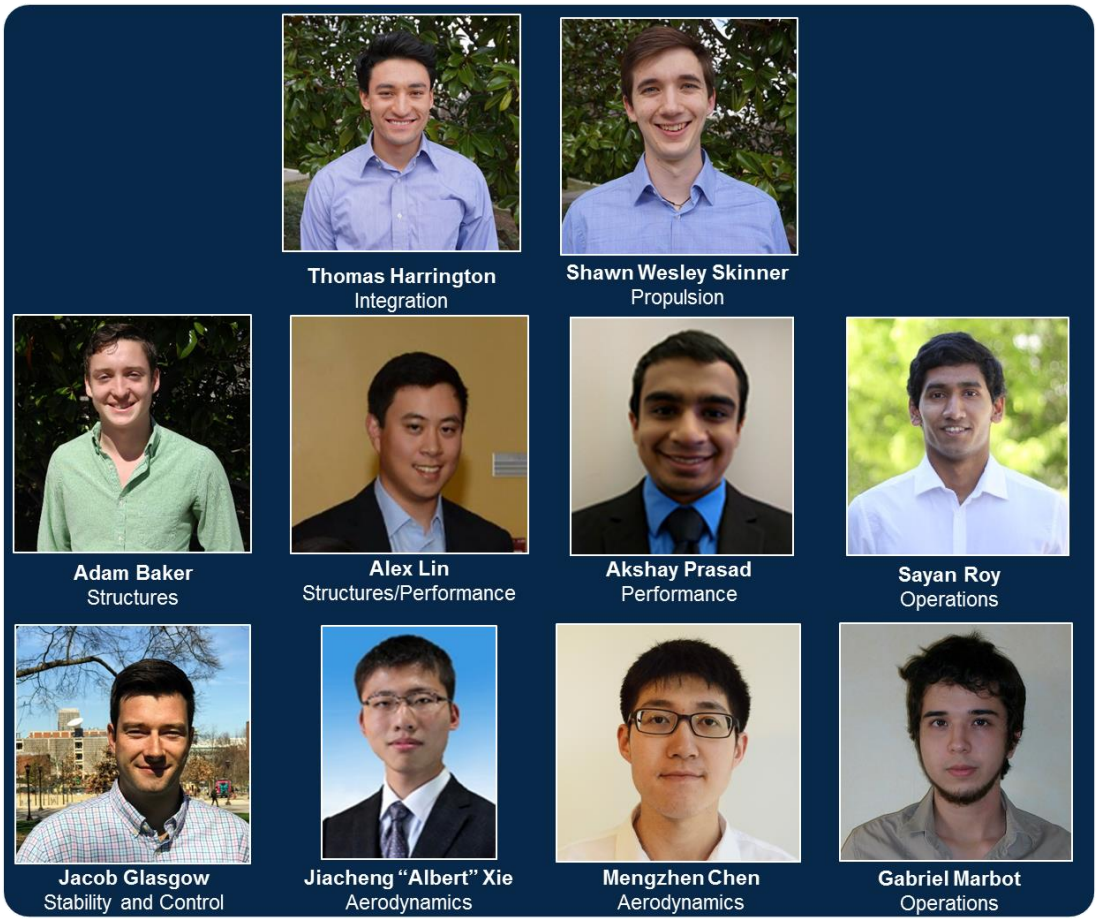
Georgia Institute of Technology Fly Hard Team

Adam Baker
Mengzhen Chen
Akshay Prasad
Jacob Glasgow
Thomas Harrington
Alex Lin
Gabriel Marbot
Sayan Roy
Shawn Wesley Skinner
Albert Xie

12 June 2017

School of Aerospace Engineering
Georgia Institute of Technology

The Fly Hard Team



All students are first year graduate students in the Aerospace Systems Design Laboratory at Georgia Institute of Technology.

Abstract

The increasing growth of air transport around the globe has heightened the need for the mitigation of aviation's environmental impact and noise around airports. Despite the strides made using current technology and techniques, projected growth in the commercial aviation industry requires innovative solutions to address environmental regulations and concerns. Both industry and government entities desire next generation airliners that reduce NOx emissions, fuel burn, and noise. NASA Aeronautics has defined goals related to these metrics as shown in Table 1.

NASA SUBSONIC TRANSPORT SYSTEM LEVEL METRICS

Technology Benefits	Technology Generations (TRL = 5 – 6)		
	Near Term 2015-2025	Mid Term 2025-2035	Far Term Beyond 2035
Noise	22 – 32 dB	32 – 42 dB	42 – 52 dB
LTO NOx Emissions	70 – 75 %	80%	> 80%
Cruise NOx Emissions	65 – 70 %	80%	> 80%
Aircraft Fuel/Energy Consumption	40 – 50 %	50 – 60 %	60 – 80 %

Through a rigorous design process and extensive research, the team determined that the blended wing body aircraft best meets and exceeds the established requirements in all four categories. The rise in air traffic over the next coming years highlights the need for a new generation of aircraft to fulfil the market gap presented by the 210PAX range. A greater concern for the environment with regards to NOx emissions and noise requires bold and innovative designs in next generation aircraft. Conventional tube and wing configurations have been the staple of the industry for decades, but these challenges presented by NASA make it difficult for these conventional designs to meet.

While these designs could utilize numerous promising technological advances to meet some requirements for noise and emissions, the implementation of these technologies carries inherent risk and uncertainty. The team recommends that future aircraft require a configuration change to meet and exceed aggressive requirements. A blended wing body design not only has an aesthetic appeal, but also provides benefits to noise reduction, and fuel efficiency which both address the most pressing concerns regarding future aircraft.

Currently, there are no commercial blended wing body transports, but there has been significant research done on key areas regarding the aerodynamics and structure of the blended wing body. Utilizing this research, the team believes that the findings and proposals give merit to the implementation of this design. One of the most significant challenges regarding any new configuration of aircraft is its implementation into current fleets. A blended wing body provides challenges with airport operations, and through case study analysis with current aircraft, the team has determined that this design will be able to be integrated into future airliner fleets without issue. The team's blended wing body design provides a bold, new aircraft for potential commercial airliners to add to their fleets and meet aggressive environmental and noise goals established by NASA.

Metric	Target	Baseline Boeing 767	Optimized BWB
Noise Margin	32	7.578	49
LTO NOx Emissions	80%	24%	80%
Mission NOx	1538	1922	1536
Aircraft Fuel/Energy Consumption	0.3014	0.6028	0.482