RESPONSE TO THE NASA ADVANCED AIR VEHICLES STUDENT COMPETITION 2016-2017 REQUEST FOR PROPOSAL

Prime Flux Presents

FINAL REPORT – JULY 12, 2017
FACULTY ADVISOR: DR. PRADEEP RAJ
TEAM LEAD: MATTHEW HAIN

PRIMEFLUX

AOE
AEROSPACE & OCEAN ENGINEERING
AT VIRGINIA TECH

I. Team Members

Team Members From Left to Right	Level of Study	Responsibilities
Christian Breed	Undergraduate	Aerodynamics/ Propulsion Analysis
David Cattano	Undergraduate	Interior Layout/Airport Ops
Brady Marston	Undergraduate	Interior Layout/Airport Ops
Matthew Hain	Undergraduate	Team Lead/Structures
Kevin Angell	Undergraduate	Aerodynamic Analysis
Jordan Hancock	Undergraduate	Structures/Production Analysis
Jungwon Lee	Undergraduate	Airfoil Analysis/ Sonic Boom Analysis
Sehoon Chung	Undergraduate	Airfoil Analysis/ Sonic Boom Analysis

II. Executive Summary

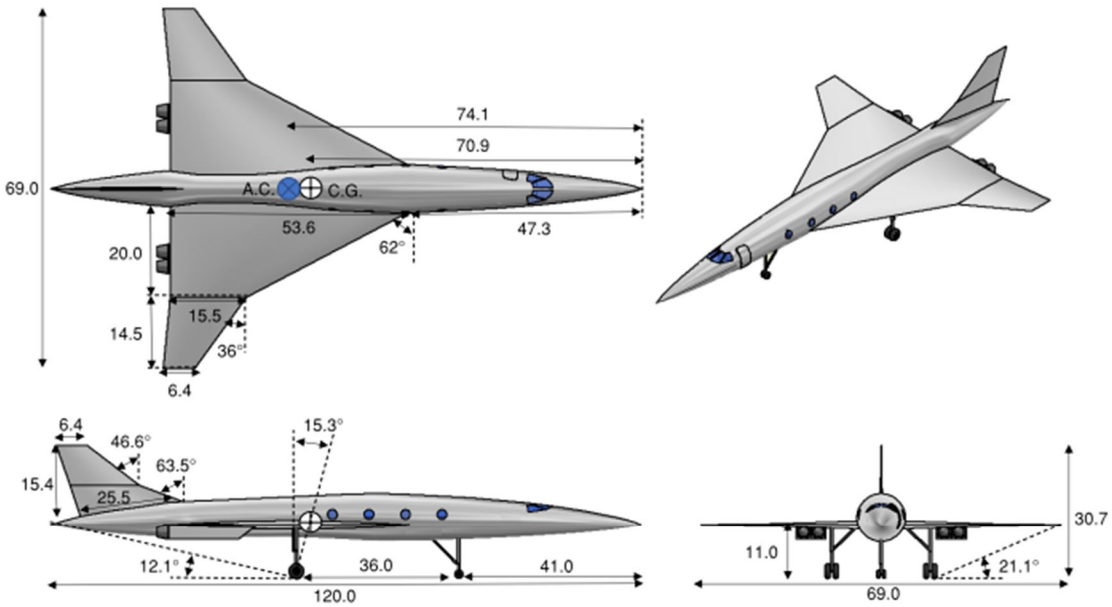
Prime Flux, A Virginia Tech design team of 8 undergraduate students, is proud to present the Nimbus, a modern Supersonic Business Jet, designed in response to the National Aeronautics and Space Administration's Advanced Air Vehicles 2016-2017 Student Competition Request For Proposal. The Nimbus meets or exceeds NASA's performance and environmental goals for service entry in 2025 as depicted in Table 1 and Table 2. Additionally, the Nimbus is fully compliant with FAR Part 25 and Chapters 14 and 16 of the ICAO.

The Nimbus will cruise at Mach 1.6, 70% faster than the fastest business jets like the G650 and G450, while offering the same or better amenities, comparable costs, and the range to service most major air routes. The Nimbus can operate in and out of 5890 ft runways allowing use of all major international and many regional airports. The Nimbus is designed for interoperability with existing fleet infrastructure. Its similar size and weight relative to current generation business jets allows it to utilize the same storage and maintenance facilities, and while its composite structure requires only limited additional accommodations compared to a conventional metal structure.

The Nimbus utilizes a cranked delta wing in order to provide enhanced subsonic handling while still maintaining efficient supersonic cruise relative to traditional delta wing designs. Four military-grade General Electric F414-EPE turbofan engines power the aircraft providing sufficient thrust to takeoff, climb, and cruise without the use of afterburners while simultaneously satisfying ETOPs requirements for transoceanic flights. The 120 ft, 93100 lbs aircraft's airframe uses mostly composite construction saving weight, maintenance costs, and increasing fuel efficiency while affording each of its 20 passengers a spacious 109 ft^3 of cabin space on par with competitor aircraft like the G650. FAA approved synthetic vision affords the pilot all-weather visibility day or night, improving safety, while also allowing takeoff and landing without a mechanically articulated 'droop nose.'

The Nimbus addresses the dual problems of sonic boom mitigation and airport noise reduction through a combination of shape, specialized components and modern operating procedures. Sonic boom mitigation is achieved through the use of boom-mitigating hull shaping techniques and current off-the-shelf technology like the NASA-Gulfstream Quiet Spike. Airport noise reduction is achieved through a combination of engine cutback and the use of corrugated exhaust nozzles.

We at Prime Flux are confident that the Nimbus represents the best SSBJ to meet NASA's needs. We look forward to taking to the sky in 2025 and redefining executive travel for years to come.



*All Dimensions in feet

Overall Length	120 ft	Wing Area	1700 ft^2
Wing Span	69 ft	Aspect Ratio	2.81
Overall Height (gear down)	30.7 ft	Vertical Tail Area	217 ft^2
Overall Height (gear up)	23.1 ft	Total Wetted Area	5590 ft^2
Cabin Length	54 ft	Total Wetted Volume	5396 ft^3
Cabin Volume	2380 ft^3	Estimated TOGW	93100 lbs
Passenger Capacity	20	Available Thrust (non-AB)	61630 lbf

Figure 1. Nimbus 3-view with isometric view. All dimensions in feet unless otherwise noted.

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