Status of Blended Wing Body Commercialization Activities

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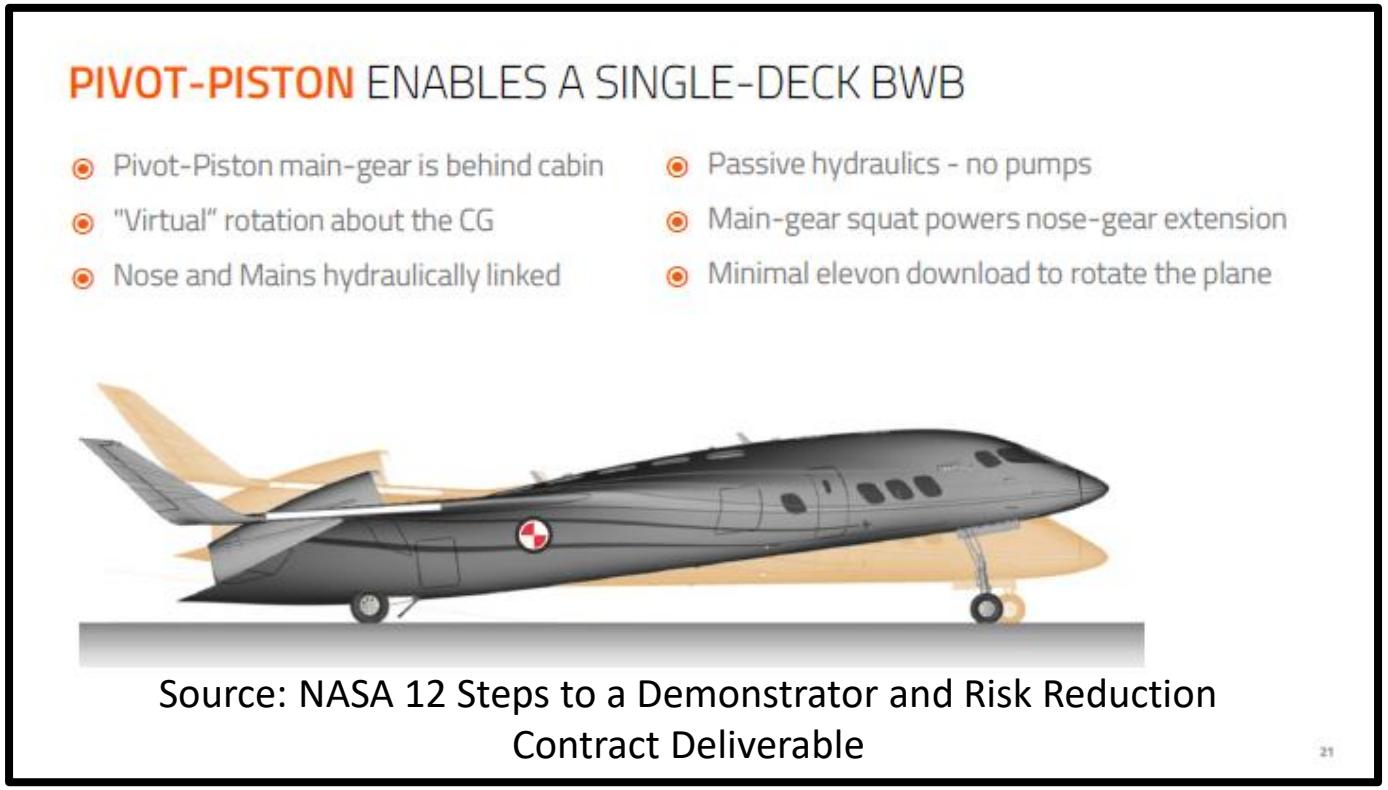
Blended Wing Body Developments 1984 - 2022

Source: NASA Armstrong

Source: NASA Langley

Damage Arresting Composites Technology Maturation Plan Technical Paper Released in 2022



Source: NASA 12 Steps to a Demonstrator and Risk Reduction Contract Deliverable

Current status: Design has been further simplified from hydraulic to mechanical approach and is being readied for flight in 2023

DoD BWB Project
2022 to 2027

- Problem to be solved
  - Reduce fuel used across the DoD with BWB across the fleet ($1B/year savings)
- How are we solving it
  - Seeking BWB designs with 30 percent better efficiency than B767/A330 aircrafts
- Why Defense Innovations Unit
  - History of fielding and scaling commercial technology across the military at speed
- Why is this different/disruptive
  - Early focus on digital designs will accelerate prototype build, flight test and production
- What is the end goal
  - Accelerate widespread adoption of BWB designs in the commercial and military space

Status: Two contracts awarded in December 2022. Digital conceptual design review April 2023.
Next steps to be announced by June 2023

DoD BWB Project
2022 to 2027

- Conceptual Design Review Deliverables
  - Conceptual Design of Full-Scale Prototype (scale of A330/B767 aircraft)
    - And technical relationship to Production Aircraft
  - Manufacturing Plan (Prototype and Production Aircraft)
  - Commercialization Plan
  - Partnership Plan (Prototype and Production Aircraft)
  - Technology Maturation Plan
  - Public/Private Investment Plan (Prototype and Production Aircraft)
  - Management Plan
  - Risk and Risk Reduction Plan (Prototype and Production Aircraft)
  - Risk infused cost and schedule estimates

Other transaction authority procurement mechanism allows smooth transition to next phases in June 2023

Public Facing BWB Activities – a few examples

Commercialization Activities

- Natilus Autonomous Freight Transports
- JetZero Commercial and Military Transports

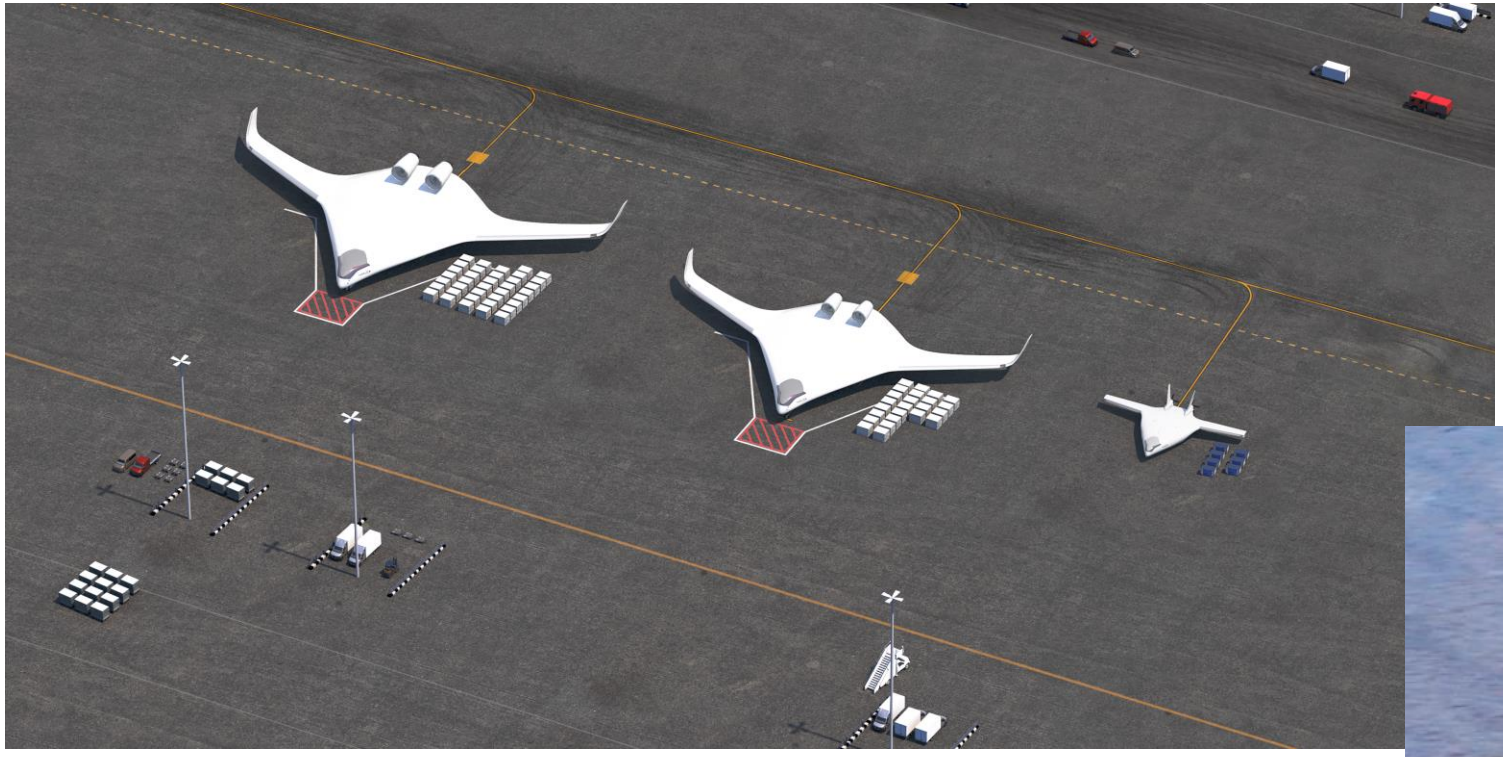
Research/Development Activities

- Northwestern Polytechnical University/AVIC/COMAC
- Bombardier eco-Jet Business Jet

Path to Zero Carbon Emissions

- JetZero

Natilus Autonomous Freighter
Image Source: https://natilus.co/media-kit



Nautilus:

- Founded in 2016 by former Piper lead aerodynamicist Aleksey Matyushev
- Will fly a full-scale prototype of its Blended-Wing-Body (BWB) concept in 2024

- Natilus has designed and developed a blended-wing, autonomous global air freight system
- Goal: Offer freight services at a fraction of the cost of today's freight transport, while reducing negative impacts on the environment

JetZero Middle of the Market Commercial Airliner

JetZero “Middle of the Market” Commercial Airliner Concept Images developed under recent NASA and DoD Contracts

JetZero's Path to Zero Carbon Emissions

Concept Description

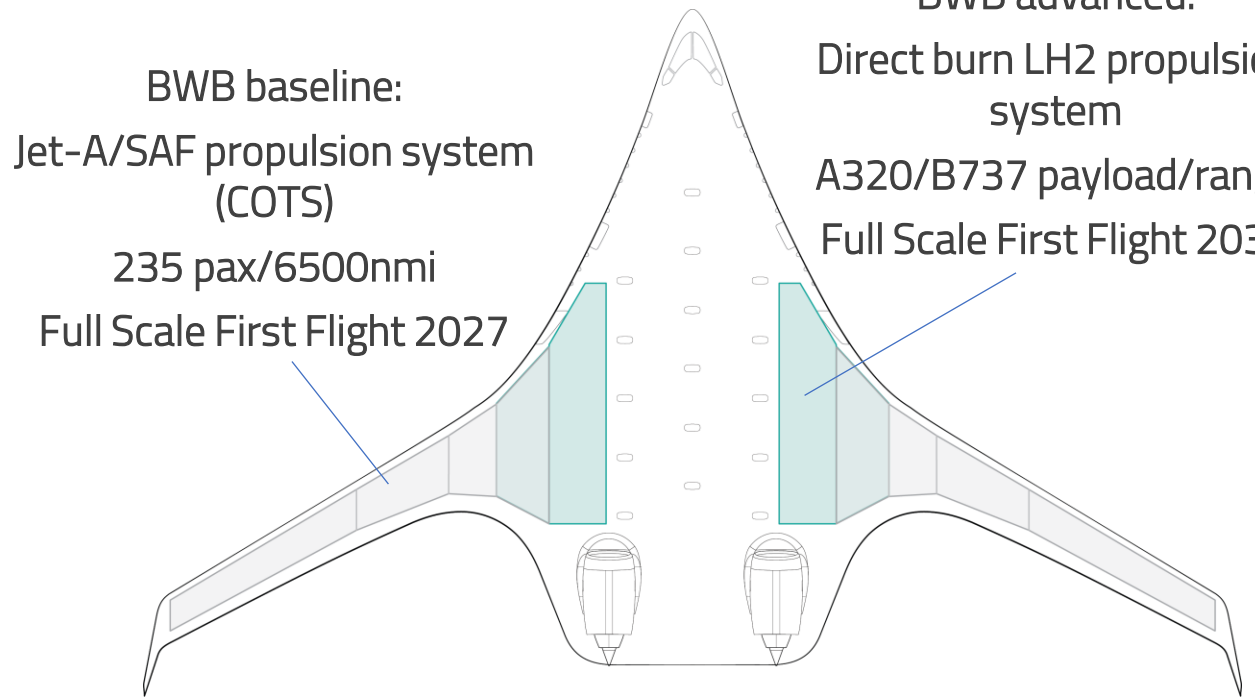
Flight demonstrate blended wing body (advanced) with direct burn LH2-based propulsion system by 2030

Key Innovations

- Damage arresting SRI composite center body
- Direct burn LH2-based propulsion system w/LH2 Cryo-Tankage and Delivery Systems
  - Liquid hydrogen combustion
  - Water vapor recovery

Relevance to Market

- In flight learning for advanced propulsion system integration with novel airframe configuration
- Potential impact on family of regional, single aisle, and twin aisle passenger, cargo & tanker products
- Potential path to zero carbon emissions and low water vapor emissions



JetZero's Path to Zero Emissions by 2035
Plans/images developed under recent NASA and DoD Contracts

Summary and Discussion

BWB designs have been matured via NASA and DoD and other global research initiatives

Entities are now commercializing BWB aircraft for various market segments

At least one entity has a “family” of BWB aircraft in development with innovative single-deck designs featuring a novel landing gear system

Emerging BWB aircraft designs are ideally suited for transition to hydrogen economy