Supersonic Flight

Yesterday, Today, and Tomorrow

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History of Supersonic Flight

Start of Supersonic Flight

- First supersonic flight achieved by Chuck Yeager in the Bell X-1 in 1947
- Concorde (1976-2003) and Tupolev Tu-144 were the first commercial supersonic transport aircraft

Why Supersonic Flight?

Reduced Travel Times

Technological Advancements

High demand for reduced travel time among business travelers and affluent customers

> Developments contribute to advances beyond supersonic aviation

Economic Growth

Increased efficiency Increased efficiency can enhance global business and contribute to economic dynamism

Recent Developments in Supersonic Flight

Who are the big players



AERION

N/S/

Boom Supersonic



- Overture, a commercial SST aimed at reducing travel time by half
- Focus on Sustainable Aviation Fuel (SAF) to reduce environmental impact
- Prototype XB-1 Baby Boom has completed several key tests

Aerion Supersonic

AERION

- AS2 business jet
 - Designed for Mach 1.4 speeds
 - Emphasis on reducing sonic boom with "boomless cruise" technology
 - Collaboration with NASA and Boeing on supersonic technology

NASA

NVSV

- <u>X-59 QueSST</u>, an experimental aircraft to demonstrate quiet supersonic technology
 - Aims to reduce sonic booms to a soft thump, paving the way for overland supersonic flight
 - First flight anticipated in 2024

Technical Challenges and Solutions

Sonic Boom

Challenge

 Major barrier for overland supersonic flights

Mitigation

 Advances in shaping the aircraft to mitigate noise (e.g., X-59 QueSST's design)

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Technical Challenges and Solutions

Environmental Concerns

Challenge

• Atmospheric and environmental impact

Mitigation

 Development of sustainable aviation fuels (SAF) to lower carbon footprint

Technical Challenges and Solutions

Material and Structural Engineering

Challenge

 Structural: weight savings, strength, and aerodynamics requirements • Use of advanced composites and heat-resistant materials

Mitigation

 Improved aerodynamics to enhance efficiency and performance

Aerodynamics and Design Innovations

Optimized Airframes

- Sleek, elongated fuselages to reduce drag
- Delta wings and variable-geometry wings for better control and efficiency

Noise Reduction Techniques

- Shaped sonic boom signatures (e.g., lowboom aircraft designs)
 - Advanced computational fluid dynamics (CFD) to predict and minimize noise

Propulsion Systems for Supersonic Aircraft

Engines

- Current Engines
 - Afterburning turbojets and turbofans for thrust augmentation
 - Mixed-flow turbofans for balanced efficiency and power
- Future Concepts
 - Variable cycle engines adapting to different flight conditions
 - Hybrid-electric propulsion systems to improve fuel efficiency and reduce emissions

Fuel

- Increased use of SAF and potential for hydrogenbased fuels
- Research into synthetic fuels
 that can reduce
 environmental impact

Sustainability and Supersonic Flight

Regulatory and Technological Landscape

Long-Term Goals

- Achieving carbon-neutral operations
- Enhancing the environmental sustainability of aviation

How we'll get there

- Environmental Regulations
 - Active engagement with environmental agencies
 - Compliance with international standards for noise and emissions
- Innovations in Fuel and Energy
 - Increasing adoption of SAF and exploration of alternative fuels
 - Integration of renewable energy sources

Prospects for Commercial Supersonic Flight

Factors to be Considered

Market Potential

- High demand for reduced travel time among business travelers and affluent customers
- Potential to open new routes and reduce congestion in subsonic airspace

Regulatory Landscape

- Ongoing efforts to revise international regulations on supersonic flight over land
- Collaboration between manufacturers, regulators, and environmental agencies



- Balancing development costs with passenger ticket pricing to make supersonic travel viable
- Partnerships with airlines and private operators to ensure market entry

What's on the Horizon?

Expected Developments in the Next 5 Years

- Commercialization of Boom's Overture
 - Prototype development and testing phases leading to commercial service by the late 2020s
- NASA's X-59 QueSST Progress
 - First test flights and data collection to influence regulatory changes.
- Emergence of New Players
 - Potential new entrants in the market exploring business jets and small SSTs
- Advancements in Materials and Propulsion:
 - Breakthroughs in lightweight, durable materials
 - Continued development of efficient, low-emission propulsion systems

Longer Term Outlook

Integration with Subsonic Aviation

- Harmonizing supersonic and subsonic operations in air traffic management
- Collaboration across the aviation industry to ensure seamless integration

Long-Term Vision

- Supersonic flight becoming a standard mode of transportation for specific routes
- Continuous innovation leading to the eventual realization of hypersonic flight (Mach 5+)

Questions?

Thank You