Pratt & Whitney Supersonic Studies

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Concorde issues

- Limited range (2500nm).
- Airport noise – special exemption required, plus afterburner noise – low frequency & "crackle".
- Boom – approx 2.2 lb/sq ft overpressure – - no overland flight

Limited operational flexibility

- Altitude emissions

- Complexity for Mach 2.2 flight
- Small fleet size
- Low utilization

High operating cost

Supersonic Business Jet

- Requirements:
  - 4000nm range
  - meet applicable noise regulations (at least Stage IV)
  - meet airport emissions requirements, possible altitude emissions requirements
  - 2000 hours sustained supersonic operation between removals

- Estimated market:
  - 250-400 aircraft

- Entry Into Service:
  - 2010 to 2013

Small supersonic transport

- A small supersonic transport (24-48 passengers) could meet the overland low boom/no boom criteria.

- Time saved by flying trans-con US at Mach 1.1 vs. 0.85 would be about 1.4 hours (5.1hours vs. 6.5), a 20% reduction.

- Preliminary analysis suggests that a 48-passenger supersonic transport could have seat-mile costs equivalent to a Boeing BBJ configured for 48 passengers. This could make for viable trans-Atlantic operation.

New Regulations

- Airport noise & emissions
  - The “Call for Information” suggests that future Federal regulation will require that a supersonic aircraft have “no greater noise impact on a community than a civil airplane certified to Stage 3 noise levels”. P&W believes that a small supersonic aircraft will have to meet the same noise and emissions requirements as the subsonic commercial aircraft concurrently in production. Our studies assume that we will achieve this performance.

- Altitude emissions
  - Studies performed in support of the Boeing Sonic Cruiser project indicate that combustor technology can be developed to meet likely emissions requirements.

New Regulations, cont.

- Overland flight
  - P&W's preference for a revised FAR Part 91.817 would allow unrestricted overland flight, if operated such that:
  - a) sonic boom overpressure be less than an agreed level, or
  - b) no measurable sonic boom reaches the surface.
  - If neither a) nor b) is not acceptable, provision of corridors for supersonic overflight.

Changes vis-à-vis Concorde

- Reduced Mach no. - current studies looking at M=1.5 to 1.8, compared to 2.2 design point for Concorde:
  - Lower engine inlet temperatures
  - Less complex inlet
  - Lower airframe temperatures

- Technology improvement - supersonic bypass engine:
  - Lower noise
  - Better sfc – Olympus sfc 1.2 lb/lb/hr, new study engine < 1.0 lb/lb/hr

SSBJ Implications

- Range requirements drive pressure ratio and temperature to Military Engine levels.
- Noise regulation limits jet velocity. Can use nozzle design to “shape” exhaust plume.
- Cannot use afterburner for fuel burn and noise reasons.
- Meeting thrust requirements at TO, transonic and top of climb may require a variable nozzle, landing performance requires thrust reverser. FAR25 certification requires duplicate systems. Result is a complex nozzle, weight is an issue.