Supersonic Landing and Takeoff Noise

Overview of U.S. Notice of Proposed Rulemaking

Presented to:

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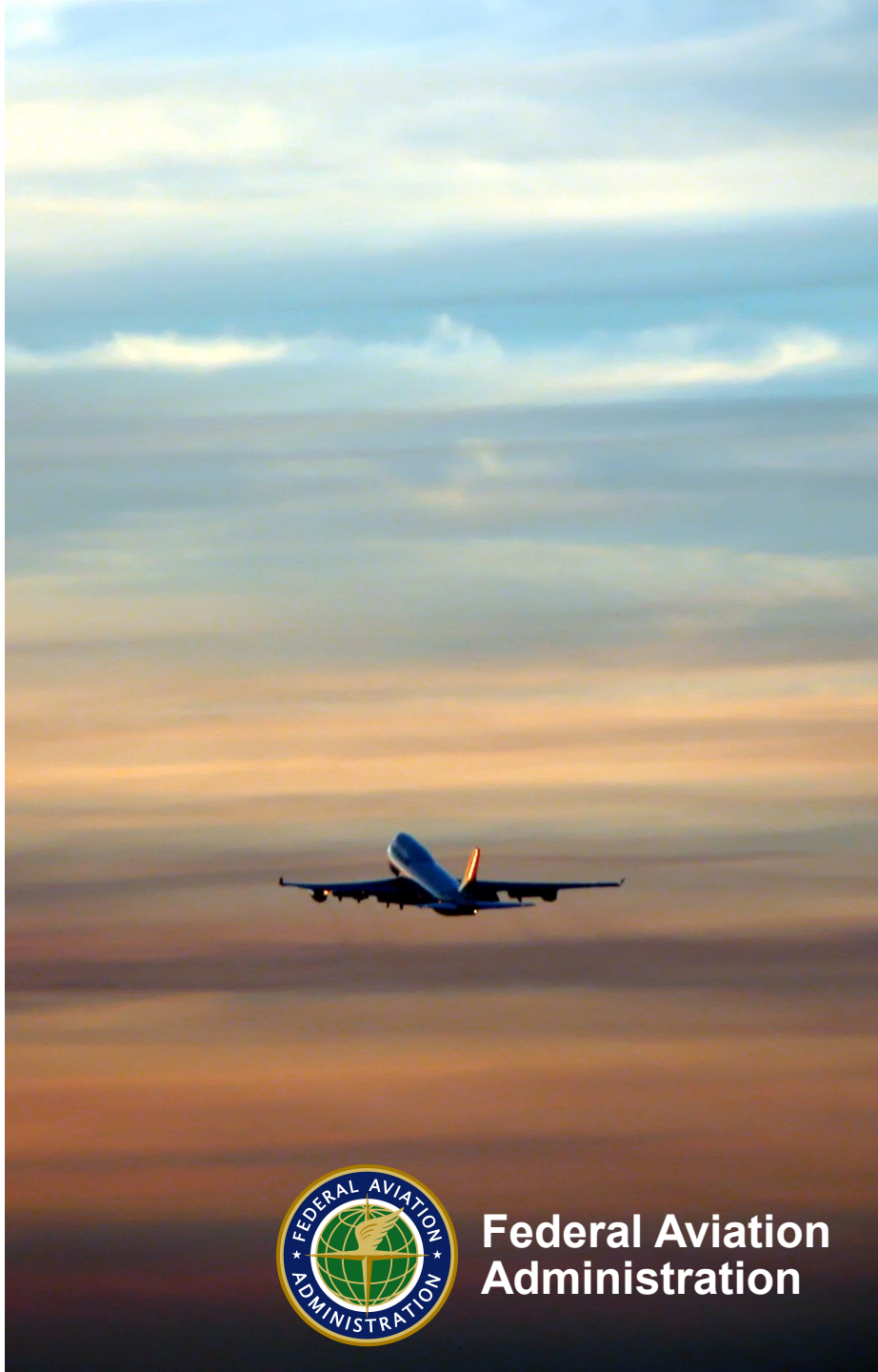

U.S. Rulemaking Process

- **What is the U.S. Rulemaking Process?**
  - The U.S. Rulemaking Process is designed to allow the public & stakeholders (both domestic and international) an opportunity to review and comment on proposed legislation.
  - The process consists of a proposed rule (what we call a Notice of Proposed Rulemaking – NPRM) followed by a comment period, and then a final rule.
  - Typically, the final rule is published within 18 months after the end of the comment period, however each Agency has discretion on timing.
- **What are the process details of this NPRM?**
  - While FAA published the draft NPRM on FAA.gov, we did so to meet our legislative target.
  - The NPRM was officially posted on the U.S. Federal Register on April 13, 2020. The comment period for this rule will be 90 days.
  - The comment period started at time of publication and will end on July 13, 2020.
  - We welcome comments from all stakeholders – including our international colleagues in CAEP.

Overview (1 of 2)

- **What does this rule propose to do?**
  - This rule would set U.S. noise certification standards for new supersonic airplanes.
  - These noise certification standards would apply to noise levels during landing and takeoff (when the airplane is operated at subsonic speeds).
  - The rule would not change the existing prohibition on supersonic flight (Mach 1 or greater) over land in the United States, or otherwise address sonic boom.

- **Why is it necessary?**
  - Existing FAA noise certification standards do not cover supersonic airplanes other than the Concorde.
  - A noise certification standard will allow manufacturers to receive FAA Type Certification for new supersonic airplanes that are currently under development.
  - Setting a noise certification standard will provide the regulatory certainty needed make critical design decisions and make substantial investments in airframe and engine programs.

Overview (2 of 2)

- **Why are we doing this now?**
  - Several U.S. aerospace manufacturers are developing the next generation of supersonic airplanes for entry-into-service in the mid to late 2020s.
  - In the FAA Reauthorization Act of 2018, Congress directed FAA to develop and issue a Notice of Proposed Rulemaking to set a noise certification requirement for supersonic airplanes by March 31, 2020.

- **Key Takeaway**
  - This rule will enable innovation in supersonic aviation by filling a gap in existing noise certification requirements, removing uncertainty, and providing a necessary requirement for certification of new supersonic aircraft.
    - NOTE: Noise certification is just one element of the FAA type certification. New supersonic aircraft will need to go through a thorough application process to receive type certification.
  - The NPRM process is a chance to comment on the proposal and provide feedback prior to FAA finalizing a rule.

Supersonic Noise & Certification Background (1 of 2)

- **Two types of noise –** There are two types of regulated noise from supersonic aircraft:
  - 1) landing and takeoff (LTO) noise; and
  - 2) sonic boom generated during cruise flight at supersonic speeds.
- **LTO noise**
  - During landing and takeoff, supersonic aircraft operate at subsonic speeds. FAA is required to regulate LTO noise by setting noise certification requirements.
  - There are two principal elements of a LTO noise certification standard:

1) **Noise Level –** LTO noise certification standards set both individual noise levels for three measurement points (known as "lateral," "flyover," and "approach") and a cumulative noise level for each aircraft type

2) **Reference Procedures –** In addition to the noise levels, FAA requires that manufacturers follow a precise set of "reference procedures" (*i.e.*, specific requirements for how the plane is flown) when measuring noise. These reference procedures are indicative of how the plane will be flown in normal operations.

Supersonic Noise & Certification Background (2 of 2)

- **Unique design characteristics of supersonic aircraft**
  - Supersonic aircraft have unique design characteristics, such as a low-drag dart-like aerodynamic shape and engine design, that are necessary for achieving efficient supersonic flight at cruise altitude, and have implications for subsonic landing and takeoff performance and noise.
  - These characteristics make supersonic aircraft sufficiently distinct from today's subsonic aircraft to merit an independent analysis and a unique cumulative noise level for LTO noise certification.
- **Sonic Boom**
  - At cruise altitude, supersonic aircraft generate a sonic boom when flying faster than Mach 1. Concerns regarding sonic boom from the Concorde led to a ban on supersonic flight over land in the United States.
  - **This rulemaking does not address sonic boom**, and it is anticipated that the first generation of new supersonic aircraft will only operate at supersonic speeds over water.

Key Elements of Proposed Rule (1 of 2)

- **Weight and speed**
  - The proposed rule applies to new supersonic aircraft that have a maximum takeoff weight of 150,000 pounds [~68 Tonne] (or less) and a maximum operating cruise speed of Mach 1.8.
- **LTO Noise Level**
  - The proposal sets a proposed cumulative LTO noise level for new supersonic aircraft (SSL1).
    - Noise level based on extensive collaboration with NASA and data collection from industry projects
    - SSL1 is a level that is economically reasonable, technologically practicable, and appropriate for the applicable aircraft, while reducing noise to the greatest extent possible while allowing the airplane to operate safely.
  - This creates a new level and limit for supersonic aircraft, but uses the same ‘measuring stick’ as subsonic – EPNdB.

Key Elements of Proposed Rule (2 of 2)

- **Reference procedure changes –**
  - The proposal includes changes to some elements of the existing reference procedures used to measure aircraft LTO noise levels during certification
  - These changes taking into account operational characteristics of supersonic aircraft, as well as technology advances
  - Allows for flexibility in takeoff reference speeds, but requires FAA approval
  - Allows for the use of Variable Noise Reduction Systems (VNRS)
    - If used for certification, requires the use of VNRS during normal operation
    - Requires the applicant to provide a way for the flight crew to verify that the VNRS is operating correctly before takeoff
    - Requires the applicant to demonstrate that ending Programmed Lapse Rate (PLR) does not produce a noise impact on the ground that exceeds the level at the certification measurement points

Regulatory Evaluation (1 of 2)

- **Supersonic aircraft potentially qualifying for type certification**

  Based on data by aircraft developers and likely producers,

  – Two supersonic airplanes *could* qualify for type certification as a result of this proposal and potentially begin production by 2025 assuming these airplanes would meet all existing requirements for certification.

  – A production of 25 airplanes per certificate for 50 total airplanes per year, a production period of ten years, and airplane life of 20 years *could* be realized (likely upper bound).

  – Fifty percent or more of production would be sold to foreign operators based on current market indicators.

  – Therefore, the potential life cycle of the first U.S. civil supersonic fleet results in deliveries to U.S. operators of 25 airplanes per year (*same to foreign operators*) until the U.S. operating fleet reaches a potential peak of 250 airplanes in 2034.

Regulatory Evaluation (2 of 2)

- **Incremental change of proposed LTO cycle noise limits**
  - The impact of the incremental change in the certificated noise level resulting from the proposed LTO cycle noise limits is low.
  - The FAA looked at the noise level of airplanes in the future subsonic fleet and the noise levels of the 2- and 3-engine supersonic airplanes that would be covered under this proposed rule using the potential peak of 250 airplanes in 2034 previously discussed.
  - The anticipated certification noise levels of the 2-engine supersonic airplane is in the 57th percentile of the subsonic fleet, and the anticipated certification noise level of the 3-engine supersonic airplane is in the 74th percentile of the subsonic fleet.
  - In addition, the number of supersonic airplanes expected to be certificated is small and would represent less than three percent of the combined subsonic and supersonic U.S. fleet in 2034.