NASA SBIR 2005 Phase I Solicitation

A2.01 Noise Breakthrough Turbine-Based Propulsion Technologies

Lead Center: GRC

Future subsonic and supersonic aircraft may be required to achieve reduced noise levels up to 20 effective perceived noise levels (EPNdB) below FAR 36 Stage 3 certification levels without significant impacts to performance. The main emphasis of this subtopic is on high-risk, breakthrough technologies in order to reduce the technical risk associated with the development and deployment of new technologies in future commercial products. Subsonic noise reduction to date has predominantly been achieved via higher-bypass-ratio engines. With current practices, the nacelle diameter limit has physically been reached and engine noise is now comparable to airframe noise on approach. Engine noise reduction concepts proposed for subsonic applications must be compatible with low noise propulsion/airframe integration designs and continuous descent approach, low noise guidance flight procedures. Innovative noise reduction concepts need to be identified that provide economical alternatives to conventional propulsion systems.

Integrated, advanced propulsion systems with intelligent controls technologies will enable supersonic vehicles (up to Mach 2) having acceptable takeoff/landing noise and increased efficiency. Studies suggest that gas turbine engines with increased thrust-to-weight, bypass ratios, and decreased thrust specific fuel consumption are required to support quiet supersonic aircraft. NASA is interested in the development of advanced gas turbine engine concepts and key enabling technologies that can dramatically reduce the landing/take-off noise to an acceptable level, and which have the potential to dramatically improve the sustained cruise performance of a supersonic aircraft. Concepts proposed for supersonic applications must not adversely impact the airframe configurations to reduce sonic boom intensity, especially with regard to the formation of shaped waves and the human response to shaped waves.

Specific areas of interest include but are not limited to the following:

**Subsonic Propulsion System Technologies**

- Innovative source identification techniques for fan, jet, combustor, or turbine noise;
- Advanced turbine engine cycles to achieve effective very high-bypass-ratio with smaller diameter engines;
- Innovative technologies for reduction of fan, jet, combustor, or turbine noise; and
- Advanced sound attenuating liners, including active and passive control.

**Supersonic Propulsion System Technologies**

- Advanced turbine engine cycle concepts to achieve low takeoff/landing noise and high supersonic cruise
efficiency, including high pressure, high bypass multiple spool cycles, inter-stage turbine burning, variable
cycle engines;

- Advanced propulsion system technologies, including advanced integrated airframe-propulsion control
methodologies, adaptive flow control technologies, smart structures for nozzles and inlets, inlet
technologies for weight/ performance/ operability/ stability; and

- High temperature materials such as monolithic ceramics and nano materials, evaporatively cooled turbine
blades, and counter rotating stages enable more compact engine cores, greater thermal efficiency, and
higher thrust to weight ratios.

Proposals must show improvements to the state-of-the art and viable application to aircraft.