A2.02 Electric and Intelligent Propulsion Technologies for Environmentally Harmonious Aircraft

Lead Center: GRC

Electric aircraft propulsion and power systems have the potential to completely eliminate harmful emissions from aircraft while at the same time improving energy efficiency. Major strides have been achieved in the development of fuel cells, especially in the automotive field. NASA is pursuing the application of fuel cell technology for both aircraft power and propulsion. There are still major technical advances required to make a commercially viable electric aircraft a reality, but this goal now appears to be achievable, possibly even in the nearer term. To achieve the realization of environmentally harmonious 21st century air vehicles, innovations are needed to enable highly efficient, low cost, power dense (weight and volume) electric aircraft propulsion and power systems.

Technical areas of interest in electric aircraft propulsion and power include, but are not limited to, fuel cells, power management, power conditioning, power distribution, actuators, motors and drive systems, sensors and fuel storage (especially hydrogen). Highly integrated dual function components and systems that have the potential to reduce overall vehicle and subsystem weight are of special interest (e.g., power conductors that are integrated into the airframe structure, motors directly integrated into the fan/propeller structure). Synergistic use of onboard cryogenic hydrogen fuel is also of interest. Both component and system level technologies are solicited. Proposals must show improvements to the state-of-the-art and viable application to aircraft.

Implementation of intelligent propulsion concepts requires advancements in the area of robust control synthesis techniques and automated diagnostics, and development of advanced enabling technologies such as nanoelectronics, smart sensors, and actuators. Attention will also need to be paid to integration of the active component control and diagnostics technologies with the control of the overall propulsion system. This will require moving from the current analog control systems to distributed control architectures.

Intelligent propulsion technologies that address electric, turbine, jet and/or hybrid aerospace propulsion systems are of interest. Proposals focusing on development of advanced diagnostics, health monitoring and control concepts, smart sensors, electronics and actuators for enabling self-diagnosis and prognosis, and self-reconfiguration capabilities are being sought. Concepts of special interest include those that integrate distributed sensing with actuation and control logic for micro-level control of parameters (such as propulsion system internal flows that impact performance and environment). Novel instrumentation approaches that provide valuable information for development and validation of technologies for self-diagnosis, prognosis, and reconfiguration are also of interest.