

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

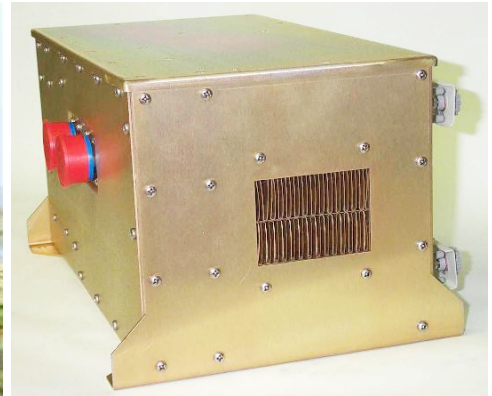
SBIR Topic Number:
AF03-173

SBIR Title:
Aero Propulsion and
Power Technology

Contract Number:
FA8650-04-C-2486

SBIR Company Name:
Innovative Power
Solutions, LLC
Eatontown, NJ

Technical Project Office:
AFRL Propulsion
Directorate, Wright-
Patterson AFB, OH



Left: Global Hawk unmanned aerial vehicle. Right: Starter/generator control unit developed by Innovative Power Solutions, LLC.

Electric Starter/Generator Meets In-Flight Restart Needs

- The Air Force needs innovative solutions which provide major improvements in aero propulsion and power technology applications
- Under a SBIR project, Innovative Power Solutions, LLC (IPS) worked with AFRL to develop a brushless starter/generator (BS/G) that combined both start and power generation functions, thus eliminating traditional air turbine or other dedicated engine start systems
- The BS/G tests demonstrated that this technology could meet the Global Hawk's operational in-flight restart needs
- Bombardier Aerospace selected IPS's advanced BS/G system as the engine starter generator solution for the next-generation Learjet 85 aircraft; the BS/G will start the PW307 engine and provide 625 Amps, 28 Vdc electric power

Commercialization Pilot
Program Series

AFRL/RZ 08-0572

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Air Force Requirement

The Air Force needs innovative solutions which provide major improvements in aero propulsion and power technology applications. One such need was for the Global Hawk unmanned aerial vehicle (UAV) to have an operational in-flight restart capability for its Rolls Royce AE3007 engine. Since an auxiliary power unit was not installed on board, the AE3007 engine could only be started on the ground. Hence, the ability to start the engine in the air would contribute significantly to the Global Hawk's survivability in case of a flame out. Furthermore, if the starter could also start the engine on the ground, the ground-based air turbine starter could be eliminated, resulting in significant weight and cost savings.

SBIR Technology

Under an Air Force SBIR project, Innovative Power Solutions, LLC (IPS) developed a brushless starter/generator (BS/G), capable of starting the AE3007 engine. The IPS BS/G system combines both start and power generation functions, thus eliminating traditional air turbine or other dedicated engine start systems.



Brushless Starter/Generator (B/SG)

The IPS Model SGA2-400-2 BS/G is designed to start turbine engines requiring up to 70 lb-ft starting torque at 2,500 rpm. Moreover, the start cycle is tailored to the specific engine requirements, reducing engine exhaust gas temperatures, thereby significantly increasing engine life.

This technology is also replacing the current Brush Type S/G used on many smaller engines serving the business jet market.

A combination of starter/generator control unit (S/GCU) soft start capabilities and the use of grease-lubricated hybrid bearings results in extended bearing life. The BS/G is air cooled

via a custom designed, efficient axial flow fan which cools the BS/G during both start and generator modes. At altitude, ram air assist is used to maintain the BS/G temperature.

Transition Impact

In 2005, an AFRL-led team, which included IPS and other aircraft industry members, completed demonstration tests simulating altitude operation of a 28 VDC starter/generator (S/G) mounted onto an AE3007H engine at the Arnold Engineering Development Center. The S/G successfully completed its planned test set of in-flight engine restarts at multiple simulated altitude/Mach points. The generator is capable of providing 625 Amps, 28 Vdc output for utility power on the aircraft. The tests accomplished the AFRL goals, enabling transition of the S/G technology to the Global Hawk Systems Group (GHSg) to develop and meet the Global Hawk's operational in-flight restart needs.

Bombardier Aerospace announced in May 2008 that its all-composite, next-generation Learjet 85 aircraft will be powered by Pratt & Whitney Canada (P&WC) PW307B engines. Further, Bombardier Aerospace selected IPS's advanced BS/G system as the starter generator solution for the new midsize jet. The BS/G system has undergone comprehensive evaluations at P&WC on the PW307B engine, demonstrating superior engine start performance under various environmental and input power conditions.

Company Impact

Eli Liebermann, President of IPS, commented "This Air Force SBIR project has mutually benefited the Air Force and IPS. Our BS/G System offers superior efficiency and reliability as well as reduced complexity, maintenance requirements, and weight – all of which contribute to significantly lower life cycle costs and enhanced operational capabilities."

IPS designs and produces innovative, high quality, cost effective power generating systems as well as power conversion, conditioning, and management products, serving both the military and commercial aerospace and ground vehicle markets.



SBIR/STTR

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