

Transition

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.

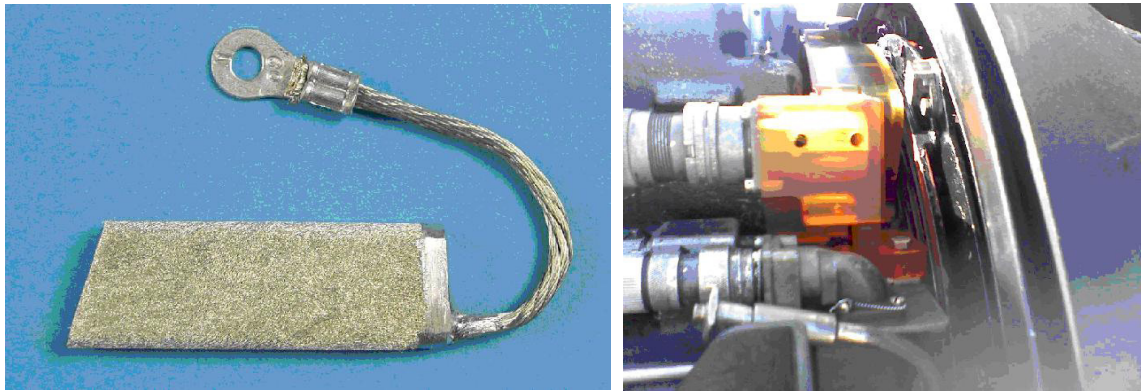
SBIR Topic Number:
N03-007

SBIR Title:
Improved Propeller
De-Icing Systems

Contract Number:
FA8501-07-C-0014
(Air Force Phase II)

SBIR Company Name:
Defense Holdings, Inc.
Arlington, VA

Technical Project Office:
Warner Robins Air
Logistics Center,
Robins AFB, GA



Left: De-icing metal fiber brush. Right: Metal fiber brush holder and brushes undergoing ground testing on a C-130 engine test cell at NYANG 109th MXG/MXQ.

Improved Propeller De-Icing Systems

- The Air Force needed an improved alternative to the use of carbon brushes in propeller de-icing systems in the C-130 aircraft fleet
- Defense Holdings, Inc. (DHi) uses patented metal fiber brushes which have much higher current carrying capability and much lower resistances than carbon brushes
- Transitioning from carbon brushes to metal fiber brushes will result in cost savings in spare parts as well as fewer maintenance inspections and increased operational availability of the platform
- As a result of the SBIR program, DHi expanded the metal fiber brush application into critical flight safety de-icing systems for fixed wing aircraft applications for the Navy and the Air Force as well as power and data applications for rotor aircraft for the Army

Commercialization Pilot
Program Series

EN09-014

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Air Force Requirement

Propeller de-icing systems use carbon “brushes” sliding across a rotating slip ring to transfer electrical power from the engine to the rotating propeller blades. This electricity is applied to heater elements in the blades to shed ice accumulation. These carbon brushes exhibit significant wear resulting in large amounts of carbon dust that greatly increases the potential for short circuits and fires on the engine mount during flight.

To preclude the fire danger, maintenance personnel must inspect and clean the brushes every 15 days. This cleaning and inspection process is a very dirty and time consuming job and negatively impacts the operational availability of the aircraft.

SBIR Technology

The 330th Aircraft Sustainment Wing at Robins AFB, Georgia, sponsored the development of metal fiber brushes as a means to reduce the C-130 aircraft maintenance burden. Metal fiber brush technology was proven through development and testing under a U.S. Navy SBIR program. Capitalizing upon the earlier Navy SBIR results, the Air Force Commercialization Pilot Program (CPP) provided supplemental SBIR funding to advance this Phase II Air Force SBIR project.

Defense Holdings uses patented metal fiber brushes to replace carbon brushes in severe slip ring applications. These metal fiber brushes contain thousands of fine metal fibers about the diameter of a human hair. The fibers make contact with the slip ring on their tips allowing each fiber to carry current. The shape of the brush is maintained by a special outer wrap.

Metal fiber brushes have much higher current carrying capability and much lower resistances than carbon brushes generating much less heat loss across the slip ring. Because they are very soft and flexible, they do not cause wear on the slip rings. In every field application, DHI’s metal fiber brushes have exhibited at least twice the service life of carbon brushes in side-by-side testing.

Transition Impact

Replacement of carbon brushes with metal fiber brushes on the C-130 propeller de-icing slip ring will reduce the operating cost of the de-icing system since far fewer

brushes will be required. Also, the requirement to conduct maintenance inspections of the brushes every 15 days will be reduced due to decreased brush wear rates, thereby saving labor costs. Cleaning a slip ring system with metal fiber brushes is also easier due to the nature of the debris, together with other benefits including overall system reliability.

Transitioning from carbon brushes to metal fiber brushes will result in 2-to-1 cost savings in spare parts alone. Further cost savings are realized when accounting for the labor savings associated with fewer inspections and for the increased operational availability of the platform. The technology can be transitioned to any propeller de-icing system, any slip ring system operating in severe environments, or any system requiring significant performance attributes where carbon brushes are not satisfying the requirement. Metal fiber brushes are currently deployed in the U.S. Navy submarine fleet in critical nuclear propulsion plant components on three separate submarine classes.

Company Impact

The SBIR program allowed DHI to develop this technology, initially in partnership with a university, for critical submarine nuclear power plant components. The program has also allowed DHI to expand the application into critical flight safety de-icing systems for fixed wing aircraft applications for the U.S. Navy and the U.S. Air Force as well as power and data applications for rotor aircraft for the U.S. Army.

Commercial applications being pursued as a result of the SBIR program include de-icing systems for fixed wing aircraft, high power and high data rate slip ring applications for future helicopter platforms, wind turbine applications, and other high performance electrical machines currently under development such as homopolar motors, industrial grade machinery and equipment.



SBIR/STTR

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