Redondo Optics, Inc. is transitioning SBIR technologies from the onset of the Phase I program to the commercial sector. ROI has initiated sales of MOFIS systems to key customers in need of miniature, lightweight, battery power, and wireless communication within diverse markets from energy plants, automotive, transportation, and rotorcraft.

Operational Need and Improvement: The main rotor blades and associated rotating hardware are some of the highest dynamically loaded parts found on rotorcraft. These dynamic parts have historically been hard to instrument without a significant weight penalty and are often inspected at intervals. A system capable of monitoring true strains, as well as damaging impacts during rotorcraft operation, without the usually associated weight penalties would have enormous benefits.

Specifications Required: The system must be of low volume (less than 200 cm³) and weight (no greater than 0.33 kg), and be capable of interrogating an optical fiber containing 15 sensing locations in a single blade, and have no moving parts. The sensor interrogator should also be able to withstand the high vibrations and loads found in a Naval rotor system in which it will be installed. The interrogator must also be able to operate efficiently, drawing no more than 3 watts of power.

Technology Developed: A no-moving-parts, ultra-low power, light weight, and miniature size, multi-channel optical fiber interrogation (MOFIS) structural health monitor system suitable for the in-situ non-intrusive integration to a helicopter composite blade to enable the in-flight distributed multi-point measurement of true-train, temperature, vibration, and impacts associated with excessive loads, fatigue, and structural damage within the composite blades structure.

Warfighter Value: Usage information taken from this system would enable health and usage monitoring (HUM) of the rotor system, allowing maintainers to be alerted when components are about to show signs of degradation, resulting in increased safety and reduction in unnecessary maintenance. Additionally, faster maintenance turnaround would translate into improved aircraft availability and lower life cycle costs.

Projected Business Model: Projected Business Model: The integrated engineering design of the MOFIS SHM system is made for low cost, pick-and-place, large-scale production using well established manufacturing practices used in the communications industry. Redondo Optics automated manufacturing facilities currently have the capability of pilot production at levels of 100 MOFIS units per month. If larger production quantities are required, ROI has established outsource manufacturing lines with production foundries used by the semiconductor and telecommunication industry to achieve production levels of 10,000 units per year. For Mil-Spec qualification of the MOFIS SHM products, ROI will outsource testing and qualification to independent test qualification laboratories. Flight qualification of the MOFIS system will be conducted with the support of the Navy and the prime contractor manufacturer. The final Mil-Spec and flight qualified MOFIS SHM system will be delivered to a strategic prime contractor for integration to the target helicopter platform.

Company Objectives: This condition based maintenance functionality is in line with current Navy programs like the CH-53K Integrated Hybrid Structural Management Systems (iSHMS), which is an effort aimed at developing rotorcraft airframe and rotor system Structural Health Management (SHM) capabilities. ROI plans to continue its rapid expansion into fiber optic and wireless sensor markets for avionics and aerospace applications, and progressively and strategically working with prime contractors, i.e., Lockheed-Martin, Boeing, BAE, Northrop-Grumman, Airbus, etc., for integration of MOFIS SHM systems in rotorcraft and UAV platforms.

Potential Commercial Applications: ROI's MOFIS system will provide a cost affordable wireless sensor solution for many of the Navy's structural health monitoring applications. Specific Navy applications include SHM monitoring in rotorcraft, all types of aircraft, and naval ship and submarine systems. In the commercial sector MOFIS has applications in renewable energy (wind mills, solar plants, nuclear plants), civil infrastructures, oil and gas, energy exploration, medical, and security.

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