Advanced Rotor Blade Erosion Protection System

ONR Program Code 35

September 2012

At a Glance

What is it?

- The Advanced Rotor Blade Erosion Protection System FNC product will develop and deliver an advanced rotor blade leading edge erosion-resistant material system.

How does it work?

- This FNC will conduct the analysis, development, risk reduction and demonstration of advanced rotor blade leading edge erosion-resistant material systems.
- Various materials will undergo sand/rain erosion testing and analysis. Materials will also be evaluated for thermal conductivity, structural characteristics, manufacturability and repairability.

What will it accomplish?

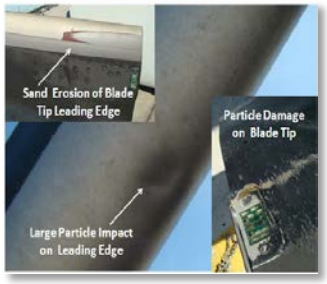
- Increase prop rotor blade mean time between removal as measured by the ability of the protection system to prevent blade removal from sand/rain erosion or damage caused by other environmental effects.
- In addition, the protection system will reduce any maintenance burden by reducing the mean time between repair.

Points of Contact

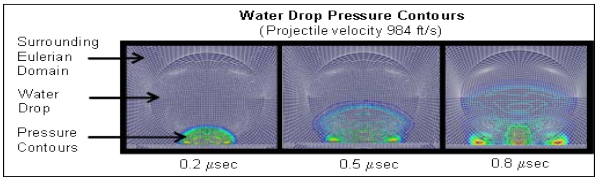
Miss Malinda Pagett, ONR Code 352
malinda.pagett@navy.mil

Dr. David Shifler, ONR Code 332
david.shifler@navy.mil

About 71% by weight of the mixture are coarser than 30-mesh. A large number of them are actually larger than 1" in length. These are more like gravels or pebbles with very sharp edges.



Rain: Water hammer pressure/ shock waves



The harsh environments of current operational theaters have significantly increased the impact damage and erosion of prop rotor blades. The erosion degradation of rotor blades and subsequent repair/replacement has become a logistics and maintenance burden for the U.S. Armed Forces when deployed in a desert environment.

Current rotor system blade protection methods (tapes and paints) are largely ineffective and have exhibited widespread rain and sand erosion to substrate within short periods of exposure.

The proposed protection system will be evaluated for its mechanical and thermal properties; its resistance to sand/rain erosion and foreign object damage (FOD) impact; its resistance to solvents, oils, fuel, ultraviolet light, and fungus; as well as its repairability. Final maturation of the leading candidate material solution will include icing-ice protection system analysis, aerodynamic performance (blade dynamic) analysis, material qualification, and subscale whirl/sand-rain testing.

Research Challenges and Opportunities:

- Materials research including hybrid ceramic/polymer-matrix composites; tungsten-carbide -cobalt or -nickel (W-C-Co or W-C-Ni); and hard, flexible metal/ceramic nanocomposites
- Rotorcraft aeromechanics

www.onr.navy.mil