RX17-19

CMAS & Thermal Barrier Coatings

1. **Research Title:** Physical degradation of Air Plasma Sprayed (APS) thermal barrier coatings exposed to desert dusts like those of Southwest Asia
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:**
Materials Engineering/Chemical Engineering/Mechanical Engineering/
Electrical Engineering (BS or MS)
4. **Objectives:** The student research associate, under the supervision of AFRL CCEL materials engineers, will be the lead agent collecting and analyzing the data related to hot erosion degradation of super alloys in turbine engines for condition-based maintenance (CBM+). Enabling CBM+ of turbine engine components has the potential to save hundreds of millions of dollars annually across all of DoD and federal aviation in general.
5. **Description:** The recent Masters work performed by an AFIT student (Capt. Opie) demonstrated the presence of a large gap in the understanding of the mechanics, chemistry, and kinetics of desert dust attack on air plasma sprayed zirconia thermal barrier coatings found in many hot section locations in turbine engines. Air Plasma Spray (APS) use has also been expanding into other mechanically demanding and hotter locations without a good understanding of how that material will behave. Several doctoral level programs are immediately suggested from this work. There is a strong need to examine how APS influences the accumulation and melting behavior of desert dusts that form calcium-magnesium-alumino-silicate (CMAS) glass. There is a strong need to examine how APS is attacked by real desert dusts that form CMAS glass. The lack of understanding has also prevented the development of truly predictive models of CMAS attack on real engine components. The lack of robust predictive models has restricted the ability to use condition-based maintenance and replacement logistics as a substitute for time-based replacement. Enabling condition-based maintenance of turbine engine components has the potential to save hundreds of millions of dollars annually across all of DoD and federal aviation in general. This study would be a key program to making condition-based maintenance of turbine engine components possible.
6. **Research Classification/Restrictions:** Work performed at university campus as well as on/off site at WPAFB; some facets of work will be restricted to DoD and DoD contractors only.
7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided

[X] **DAGSI** (Wright State University, AFIT, Ohio State University, University of Dayton, Miami University, Ohio University, University of Cincinnati) NOTE: Topics submitted to DAGSI must be approved for public release.