Helicopter Dynamic Components Project

Presented at:
HCAT Meeting
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25th Replacement of Hard Chrome and Cadmium Plating Program Review Meeting, March 15-17, 2005, Greensboro, NC. Sponsored by SERDP/ESTCP.

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Contracts with Sikorsky, Boeing Philadelphia and Bell Helicopter

- *Contracts awarded to Sikorsky (H60); Boeing (H46/H47) and Bell (UH-1/AH-1) in 2003*

OEMs Performed Following Tasks:

- *Conducted analysis of helicopter dynamic components onto which hard chrome is applied by OEM or in repair*
- *Identified materials and rig tests that would be required to qualify HVOF coatings as replacement for chrome on their components*
- *Submitted reports on results of analysis and designation of required tests*
- *Participated in stakeholders meeting to complete Joint Test Protocol and discuss potential component rig tests*

Stakeholders Meeting

- *Meeting held 17-18 March 2004 in Baltimore*
- *25 attendees representing three OEMs, NAVAIR, NADEP Cherry Point, Army AMCOM, Army Research Lab, HCAT, Hill AFB, NAVFAC, thermal spray experts*
- *OEMs made presentations related to hard chrome usage on their helicopters, material test requirements, and component test requirements*
- *NADEP Cherry Point made presentation on scheduled component testing*
- *Extensive discussion on materials testing that makes up Joint Test Protocol*

Development of Materials JTP

- Base Materials
  - 4340 steel (200-220 ksi strength)
  - PH13-8Mo stainless steel
  - 9310 carburized steel
  - Aluminum 7075-T73 alloy
- Coatings
  - WC/17Co and WC/10Co4Cr
  - Tribaloy 400
  - WC/17Co plus T400 bond layer for Al alloy only
- Axial high-cycle fatigue testing, load control, both tension/tension and fully reversed stress
- Crevice corrosion testing only since ASTM B117 has proven to be unreliable (using Sikorsky-designed crevice corrosion test)

Development of Materials JTP

- *Fretting fatigue (combination of high cycle, short-stroke sliding wear with alternating stress); United Technologies test rig will be utilized*
- *ASTM F519 environmental embrittlement testing*
- *Fluid compatibility weight loss tests (for fluids not already evaluated in landing gear and actuator projects)*

Component Testing Being Considered

- *H1 brake disk adapter flange and tail rotor control tube (Bell)*
- *H-47 transmission test (Army)*
- *H-60 dummy gearbox test (Sikorsky)*
- *H-60 tail takeoff flange, rotor flange sleeve and swash plate guide for lead-the-fleet flight testing (Sikorsky and NAVAIR)*

Component Testing in HDC Project

- H-46 generator gears coated with HVOF WC/Co and subjected to 200-hour endurance test at Boeing; no problems encountered
- Two additional gears coated with WC/Co for 900-hour lead-the-fleet flight test
- Flight clearance has been obtained from NAVAIR
- Gears in production shop at Cherry Point awaiting installation; once installed, will be inspected every 100 hours