



## Braycote™ Grease retains tribological properties for 17 years in controlled storage

Braycote™ greases that are in mechanisms in controlled storage retain their tribological properties for an extended period of time. Testing on aged and separated Braycote™ grease obtained from several sources showed no detrimental effect on lubricity. Additionally, Thermal Gravimetric Analysis testing demonstrated no significant decrease in performance due to static, controlled storage. Tribological action, heat, or other forces are required to effect the performance of Braycote™ grease.

### Applicability

Braycote™ 601 grease on space flight and ground system mechanisms

### Background

A scheduled inspection of the Rudder/Speed Brake actuators on Space Shuttle orbiter OV-103 revealed fretting corrosion, micro-pitting, wear and discoloration of the lubricant Braycote™ 601. A decision was made to replace the actuators with the existing spares, a single ship set which had been in controlled storage for the past 17 years. Data did not exist on the lubricity of Braycote™ 601 grease after extended storage.

### Data and Analysis

Testing and analysis were undertaken to investigate two key issues:

**Issue 1: Oil separation of grease into its component oil and thickener is known to occur in storage. Its effect on lubricity is not known.**

**Results:** Lubricity testing was performed on aged grease, and grease that exhibited oil separation obtained from several sources, including grease that had been removed from the OV-103 actuators. Three test protocols were used: (1) Falex Block on Ring; (2) Spiral Orbit Tribometer (SOT); and (3) Wedeven Associates Machine (WAM) testing. In all cases, no detrimental effect on lubricity was observed due to storage and/or grease that experienced oil separation.

**Issue 2: Chemical reactions involving the grease and the gear/housing material, 9310 steel, could lead to formation of Lewis acids, resulting in corrosion, pitting, and cracking. The degree to which the chemical reactions were occurring in the actuators was unknown.**

**Results:** Investigations into potential chemical reactions of the grease with the actuator steel were addressed in three ways: (1) an extensive literature review; (2) WAM testing to duplicate the conditions observed in the used actuators; and (3) Thermodynamic analysis, using Thermal Gravimetric Analysis (TGA), to bound the amount of degradation/mass loss that might occur during 17 years of controlled storage. The literature review revealed that absent tribological action, i.e., no stress on the



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White Braycote™ grease on top of a used actuator gear. The discoloration present on the gear surfaces is normal for Braycote™ grease in contact with steel.

lubricant, no significant mass loss should occur below 190°C. The WAM testing was successful in duplicating the fretting corrosion and micropitting effects observed on OV-103 by high frequency low amplitude wear testing, thus reinforcing the results reported in the literature for similar material/lubricant combinations. The TGA testing and thermodynamic analysis predicted no significant corrosive effects from static, controlled storage for 17 years.

### References

Orbiter Rudder Speed Brake Actuator Braycote™ Grease Independent Technical Assessment/Inspection (ITA/I) Report, NESCRP04-03/03-003-E, May 2004

This work was led by Dr. Paul Munafa, Marshall Space Flight Center

For further information contact the NESCR at [www.nesc.gov](http://www.nesc.gov)

