

## Group develops C-5 grease

by Timothy R. Anderl — Air Force Research Laboratory

**2/3/2004 – WRIGHT-PATTERSON AIR FORCE BASE, Ohio (AFPN)** – A low-cost, multipurpose grease developed by Air Force Research Laboratory technicians has received a positive evaluation from Air Force maintainers. The evaluation follows nearly 1,529 airframe hours, which adds up to roughly 11 months of operation, on the C-5 Galaxy aircraft.

Equipment specialists from Dover Air Force Base, Del., who evaluated the grease's performance during a rigorous inspection of the aircraft in December, have recommended the Air Force convert to the new moisture-resistant and high-load carrying grease pending review and approval by the C-5 system program office here. A meeting is scheduled for Feb. 17 in which final approval from the office is expected, said Lois Gschwender, an engineer from the nonstructural materials branch in AFRL's materials and manufacturing directorate.

In September 2002, two C-5 landing gears were greased with the new multipurpose grease, MIL-PRF-32014, and two landing gears, which were packed with the current grease, were identified as control gears. To date, the new grease has acquired 1,529.6 airframe hours, 351 total landings, 299 full-stop landings and 360 gear cycles.

"By incorporating the stable, low-cost, rust-inhibiting grease, the Air Force could solve several challenges related to wear, corrosion and rust in the landing gear assembly of the C-5 aircraft," said Ms. Gschwender. "During testing conducted by the University of Dayton Research Institute on-site contractors at the directorate, the grease demonstrated water washout resistance, high-temperature and high-speed performance. During flight testing, the new grease has proven that it provides superior anti-wear and anti-rust performance and will provide a significant cost advantage (because of) reduced maintenance, part replacement and system failures."

The directorate first began working with grease companies to develop the multipurpose grease in the late 1980s, said Ms. Gschwender. The goal was to find a commercial source of grease to replace the mineral oil-sodium-soap-thickened product used in cruise missile engines. The mineral oil product reacted negatively to air moisture and was bleeding out of bearings while in storage.

"Greases are used in military applications to improve and ensure the performance of moving parts," said Ms. Gschwender. "When compared to liquid lubricant systems, grease systems provide significant advantages in the design of a system. Greases are self-contained, which eliminates the need for pumps, tubing, heat exchangers and other extra hardware that increase the weight and design requirements of a system."



**SOUTHWEST ASIA** – A C-5 Galaxy takes off from an airfield at a forward-deployed location. By using a newly developed grease on the C-5, the Air Force could solve several challenges related to wear, corrosion and rust in the landing gear assembly of the aircraft. (U.S. Air Force photo by Tech. Sgt. Justin D. Pyle)

Because no appropriate greases were commercially available, and only a small volume of grease was needed for the missiles, researchers and contractors designed a unique lubricating grease which was ultimately assigned the MIL-PRF-32014 military specification. The rigorous performance requirements in the specification require the grease composition to include anti-oxidant, anti-wear and anti-rust ingredients.

Following validation testing by several military agencies and by Williams Engine Company, the grease was adopted for the cruise missile with great success, said Ms. Gschwender. When the original supply of grease was used up, still no commercial supply was available because the need for cruise missile grease was very small. AMOCO again custom-made and delivered the second batch of the lubricant to the Air Force in 1994.

David Marosok, a lead C-5 landing gear engineer at Ogden Air Logistics Center, Utah, approached AFRL to solve a dilemma caused by using a very expensive grease (\$5,000 per gallon) that had been recommended by a contractor to solve corrosion and rust problems. This grease had in fact aggravated the problems, Ms. Gschwender said.

It was then determined that a MIL-PRF-32014-qualified grease could offer improvements in the landing gear.

"The C-5 landing gear is regularly exposed to moisture and rain, air, bacterial decontaminants, and other corrosion and wear encouraging phenomena, which at times causes significant problems for operators, and challenges for systems maintainers," Ms. Gschwender said.

While AMOCO was unavailable to manufacture the grease, Nye Lubricants, Fairhaven, Massachusetts...commercialized a qualifying grease called Rheolube 374A.

"MIL-PRF-32014 is expected to cost less than \$100 per gallon and to provide the desired improvement in performance over both the original grease and the contractor recommended grease," Ms. Gschwender said.

**Nye Lubricants, Inc.**

Ph: 508.996.6721    Fx: 508.997.5285

E-mail: [techhelp@nyelubricants.com](mailto:techhelp@nyelubricants.com)

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