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Air-Wing Toolbox: New Antenna Gaskets Eliminate Corrosion and Precipitation Static

By Thomas Doughty

Engineers from the Naval Air Systems Command (NAVAIR) have identified a new, environmentally friendly, and conductive gasket that guards against moisture intrusion and subsequent corrosion. This product does so while providing improved electrical bonding between aircraft aluminum substrate, mounting base of aircraft antennas, and static-discharger mounts.

Corrosion maintenance on aircraft surfaces and attaching hardware is a frequent and costly problem. Attach points such as static-wick mounts and blade antenna mating surfaces are just a few examples of areas that are corrosion prone and that seriously degrade the performance of electronic equipment, especially communication systems. These problems acutely degrade mission capability and require frequent troubleshooting and hardware replacement.

A new commercial-off-the-shelf-technology (COTS), produced by Aviation Devices and Electronic Components (AvDecT), is a conductive gasket, consisting of a cured polyurethane gel that encapsulates an aluminum wire mesh, which has been identified to provide improved electrical bonding between aircraft aluminum substrate and the mounting base of aircraft antennas and static discharger mounts. The focus of this technology is to seal and protect mating areas against moisture and subsequent corrosion while at the same time provide a mechanism for electrical bonding and grounding. The gasket is designed so that once the mounting screws are installed and torqued, compression squeezes some of the polyurethane gel to the outside edge of the antenna mount providing a small perimeter seal, thus eliminating the need for additional polysulfide sealing. That sealant is required each time a technician removes and replaces an antenna or static wick mount. The polysulfide sealant (MIL-PRF-81733) contains hexavalent chrome as a corrosion inhibitor and is used around the perimeter at the base of the antenna or static wick mount to prevent moisture intrusion. These technicians are being exposed to carcinogens that are embedded within the polysulfide sealant, and the excess sealant is a hazardous material that must be disposed of properly. The installation process is a labor-intensive procedure that severely impacts aircraft availability and operational readiness. With approximately 4,000 aircraft in the fleet, the use of the AvDECT conductive gasket will eliminate the

requirement for using chromated polysulfide sealants, thus saving thousands of dollars in labor, material and disposal costs. Additional benefits include the elimination of airborne communication precipitation static (P-static) discrepancies caused by corrosion.

The NAVAIR Aerospace Materials Division AIR 4.9.7 successfully tested the gasket for temperature resistance, fluid compatibility, corrosion, and lightning strikes. The gasket material survived exposure to aircraft fluids and maintained it's electrical performance (2.5 milliohms or less) throughout all conditions, including corrosion testing. Following these tests, AIR 4.9.7 was granted approval to conduct field evaluations of the gasket material on the EA-6B, which is prone to P-static gripes, and the H-60s.

VAQ-131 was one of two operational squadrons selected to conduct a lead the fleet "at-sea" demonstration of the AvDecT conductive gasket technology. All aircraft antennas and static dischargers on two EA-6B Prowlers were outfitted with the gasket before the squadron's deployment. During the deployment, the two aircraft outfitted with the gaskets, flew a combined 759 flight-hours, half of these hours were combat missions over Iraq. AIR 4.9.7 engineers were confident that the conductive gaskets would significantly reduce P-static issues. The two Prowlers outfitted with the conductive gaskets did not experience a single P-static discrepancy during the entire deployment. Two of the squadron's Prowlers that did not have this technology installed experienced moderate to severe P-static gripes and temporary losses of communication between the aircraft and ship.

The post deployment inspection of the antennas and static dischargers on the two Prowlers outfitted with the gasket showed minimal peripheral corrosion on antenna mounting, static wick bases, and aircraft aluminum surfaces where AvDECT gaskets were utilized. Squadron maintainers and NavAir engineers considered the evaluation a success.

HS-7 did a concurrent at-sea demonstration of the AvDECT gaskets. The AvDECT conductive gasket was used on the upper and lower UHF/VHF antennas, and the team decided to waive the 28-day corrosion inspections of these antennas. Flight clearance was granted, the gaskets were installed, and the squadron embarked aboard the USS *Harry S. Truman*. The aircraft flew a total of 546.5 hours during its deployment.

Mr. Josh Honaker, the H-60 Avionics Engineer, at NADEP Cherry Point NC, stated in his technical report that "Post deployment inspection of the antennas outfitted with the AvDECT gasket revealed that they were in immaculate condition, considering the amount of time they were exposed to saltwater without an inspection, or any type of preventive maintenance treatment." The gasket sealing materials were easily removed with little effort and all antenna mounting surfaces and aircraft structure mounting surfaces that were sealed with AvDECT were free from visible corrosion. Honaker added, "AvDECT gaskets provided complete base metal protection and the aircraft experienced no notable system discrepancies or degradation to any of the systems that were involved in the evaluation."

Mr. Honaker recommended the current inspection requirement for the upper and lower UHF/VHF antennas be extended to a 364-day inspection, instead of the 28-day requirement currently established in the H-60 MRCs.

More recently, another conductive-gasket demonstration was done on one aircraft assigned to VFA-136. Six antennas that the wing identified as corrosion prone were tested. It took maintainers 14.25 man-hours just to remove the antennas because of the sealant and corrosion that existed. The conductive gaskets then were installed on the antennas and mounted on the aircraft, requiring approximately 10 minutes each to install. The squadron deployed aboard the USS George Washington. During the deployment, this aircraft logged 367.9 flight hours.

Post-deployment inspections showed that all six antennas were corrosion free. The antennas easily were removed, requiring no force or pressure to remove them from the aircraft. Antennas mounted on the underside of the aircraft dislodged within a minute or two after the mounting screws were removed. The average time to remove one antenna was 5 minutes. It took less time to remove all the antennas than just one of them before the test.

The overall cost for corrosion is extremely high ($10B in DoD annually), and this problem seriously degrades the operational readiness of aircraft. The AvDecT conductive gaskets have performed exceptionally well in preventing corrosion at mating areas and eliminating P-static. Based upon the successful laboratory and at-sea demonstrations/evaluations, AIR 4.9.7 has authorized the use of the AvDecT technology on all Navy and Marine Corps aircraft. Additionally, IRAC #7 to the NA 16-1-540 Avionic Cleaning and Prevention/Control manual recently has been issued regarding this technology.

The conductive gaskets can be die cut to the footprint of the antenna or static wick mount base. It can also be procured in bulk form. Transition of this technology to the Naval aviation community is made through the concurrence of the applicable platform FST and PMA. The first two platforms to transition to the AvDecT gasket are the EA-6B and H-60 communities.

Tom Doughty is a materials engineer with AIR 4.9.7.

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