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 (AvDec™), 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 AvDEC™ 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 AvDec™ 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 AvDEC™ gaskets were utilized. Squadron maintainers and NavAir engineers considered the evaluation a success.

HS-7 did a concurrent at-sea demonstration of the AvDEC™ gaskets. The AvDEC™ 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 AvDEC™ 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 AvDEC™ were free from visible corrosion. Honaker added, "AvDEC™ 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

Flight, Flight-Related, and Ground Class A Mishaps 10/01/2006 to 12/13/2006

Date	Type Aircraft	Command
11/30/2006	FA-18C	VMFAT-101
Hornet crashed after experiencing hydraulic problems.		
12/03/2006	CH-46E	HMM-165
Helo landed in water. Four fatalities.		
12/07/2006	MV-22B	VMMT-204
Aircraft landed on taxiway after experiencing left nacelle fire. No injuries.		
12/11/2006	CH-53E	HMH-465
Aircraft rolled over on its side while landing. One passenger fatality.		

Class B Mishaps

Date	Type Aircraft	Command
10/13/2006	TH-6B	NTPS PAX RIVER
Aircraft crashed during emergency landing.		
10/13/2006	FA-18F	VFA-122
Lighting struck Hornet during return to base.		
10/20/2006	SH-60F	DP COMNAVAIRPAC
Sonar transducer lost at sea while conducting ASW training on SCORE.		
11/07/2006	TAV-8B	VMAT-203
Aircraft nose gear failed to retract. No injuries.		
11/18/2006	FA-18D	VMFA (AW)-242
Left engine fire during PMCF. No injuries.		

Printed as a supplement to *Mech* from
Naval Safety Center Data
Cdr. Ed Hobbs
For questions or comments, call Dan Steber
(757) 444-3520 Ext. 7247 (DSN 564)

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 AvDec™ conductive gaskets have performed exceptionally well in preventing corrosion at mating areas and

Intergranular and exfoliation corrosion found on an antenna base plate and aircraft skin.

Application of the AvDEC™ conductive gasket and protective gel on an antenna base allows the gel to squeeze out around the antenna base.

Antenna	Unit Cost ($K)	Removal Time (MH)	Time Savings (MH)	Replacement Rate/Deployment Average
Integrated	$143.0	0.75 MH pre deployment	0.68	2.5
		0.07 MH post deployment		
GPS	$1.6	8.0 MH pre deployment	7.83	1.0
		0.17 MH post deployment		
U/VHF	$4.9	3.5 MH pre deployment	3.42	5.0
		0.08 MH post deployment		
TACTS	$1.1	1.0 MH pre deployment	0.9	2.0
		0.10 MH post deployment		
IFF	$3.0	1.0 MH pre deployment	0.92	1.0
		0.08 MH post deployment		
Total	$153.60	14.25 MH pre deployment	13.75	
		0.5 MH post deployment		

This chart contains specific data regarding the demonstration and performance of the AvDec™ conductive gaskets with VFA-136.

eliminating P-static. Based upon the successful laboratory and at-sea demonstrations/evaluations, AIR 4.9.7 has authorized the use of the AvDec™ 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 AvDec™ gasket are the EA-6B and H-60 communities.

Tom Doughty is a materials engineer with AIR 4.9.7.

The author wishes to thank AEC Jan Hamillton, and AMCS Darrell McWhorter CSFWL, Mr. Allen Giannerini NATEC Detachment Oceana, AMCS Ron Price COMVAQWING, and the men and women of VAQ-131, HS-7 and VFA-136 for their support during the demonstration and evaluation of this technology.