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Feature

## Services Work to Reduce Maintenance Costs and Raise Helicopter Readiness

By Ben Craig

The U.S. Navy often expresses its air and sea power by launching supersonic-capable aircraft from floating airstrips, more famously known as aircraft carriers. These powerful naval vessels, however, also require multipurpose close-in air support that fighter aircraft cannot provide.

The Navy's fleet of SH-60 Sea Hawk helicopters offers such support. They are critical to many successful missions. The Sea Hawk delivers anti-submarine and anti-surface ship warfare solutions, search-and-rescue, and other means of support such as special operations. Keeping the rotorcraft flying is vital to the safety and operation of naval aircraft carriers, so regular maintenance is crucial.

One longstanding problem for these aviation platforms has been the corrosion of magnesium components, particularly the gearboxes, said Bill Nickerson, a chemist at the Naval Air Systems Command (NAVAIR). "The extremely poor corrosion resistance of magnesium, especially in gearbox assemblies that are used in corrosive operational environments, has led to premature component degradation," said Nickerson. The lightweight, high-strength magnesium alloys are attractive for aerospace applications, but have been a nuisance to maintenance personnel.

Fleet Readiness Centers (FRCs), once known as Naval Air Depots, handle the maintenance of magnesium components, and the Cherry Point FRC specializes in maintaining Navy and Marine helicopters. According to Craig Matzdorf, senior corrosion engineer at NAVAIR, the problem of helicopter gearbox corrosion requires NAVAIR to replace gearboxes prematurely. "Corrosion of magnesium gearboxes causes high scrap rates due to excessive pitting, cracks, or other forms of degradation," Matzdorf said. "Scrapping the parts means we have had to replace the gearboxes with new ones sooner than we planned."

Even if the damage to the gearboxes was not apparent to the unaided eye, the original protective coatings would have to be stripped to allow for further inspection of the part. "We would have to strip all coatings at the depot, and then replace them with inferior ones. This coating re-work was very expensive."



*A destroyer steams along the starboard side of the Nimitz-class aircraft carrier USS Harry S. Truman (CVN 75), not shown, as an SH-60 Seahawk helicopter assigned to Helicopter Squadron Seven conducts plane guard during flight operations over the Atlantic Ocean. Photo by Mass Communication Specialist Seaman Recruit Matthew D. Williams, U.S. Navy.*



*Marines assigned to the 15th Marine Expeditionary Unit 1st Force Reconnaissance Company conduct a hoist rescue from a CH-53E Sea Stallion off the coast of Hawaii, followed by a 750-meter swim. The hoist rescue is one of the many ways the Marines can be stealthily inserted into an objective. Photo by Staff Sgt. T.G. Kessler, U.S. Marine Corps.*

This corrosion problem with magnesium gearboxes has not been exclusive to the Sea Hawk. H-46 and H-53 helicopters have had similar problems. In fact, the problem even extends beyond the Service line. The Army, Marine Corps, and Coast Guard have all shared in the unfortunate scrapping of magnesium gearboxes from their helicopters.

But instead of each Service tackling the problem separately, they decided to integrate their efforts and look for a common solution.

In January 2006, NAVAIR embarked on a joint Service effort involving the Army and the Coast Guard to form a solution that would improve helicopter readiness by reducing the corrosion damage incurred on the magnesium components. "The overall purpose of the project is to reduce the scrap rate and cost to maintain gearboxes for Navy, Marine Corps, and Army helicopters," Matzdorf said.



*The U.S. Coast Guard HH-60 Jay Hawk. Photo courtesy of the U.S. Coast Guard.*

The Joint Service team has investigated new coatings and processes to alleviate the problems of the magnesium gearboxes. The project team has identified best practices for coatings and application processes that will be more resistant to corrosion than the current coatings. They have identified the need for a new nondestructive inspection process that does not require the removal of protective coatings, and have also looked into an alternative procedure for the gearboxes. Finally, the team has established baseline magnesium processes at Cherry Point FRC and the Army's Corpus Christi Depot.

"Ultimately, this project will allow gearboxes to be processed faster at lower cost, and will reduce the inspection and maintenance man-hour burden in the fleet," Matzdorf explained.

Through this effort, which is co-sponsored by the Services and the DoD Corrosion Office, the Army, Navy, Marine Corps, and Coast Guard expect significant cost avoidance through a reduction in maintenance costs. "We originally projected savings based on reduced scrap rates—only one per year for the H-53s main gear box will give about a 10:1 return on investment over 10 years," said Matzdorf. However, since the project is still ongoing, these estimates will have to be better quantified when it is nearly complete. The other benefits, including reduction of coating removal and replacement costs, easier touch-up repair, and reduced inspection burden, are already known.



*The Army's AH-64 Apache Helicopter will benefit from the new magnesium coatings and maintenance processes. Photo courtesy of the U.S. Army.*

Even though best practices are being implemented for helicopter gearboxes, there is a greater effort to reduce corrosion of magnesium components in general. According to Matzdorf, the project team has established a three-pronged effort. "Our first priority is to try and replace it with an alternate material like aluminum or composite. The second is to implement best practices, and our current project focuses mostly on accomplishing this. And the third effort is to come up with a better overall design for minimizing galvanic corrosion. These thrusts are highlighted in the output of a recent NAVAIR Corrosion-Resistant Alloy Workshop, which had representatives from suppliers, manufacturers, and other participating Services."