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Featured Projects

Sensor Data Help Air Force Improve Aircraft Cleaning Cycles

By Ben Craig

Patrick Air Force Base (AFB), located just south of the alluring coastal city of Cape Canaveral in sunny Florida, is home to six C-130 search-and-rescue aircraft and nine H-60 Black Hawk helicopters. While it is warm and enjoyable to tourists, the state's ocean climate and salt-laden atmosphere can devastate the base's fleet if it is not cared for properly.

"Working on Patrick AFB is like being on an aircraft carrier in the middle of the ocean," said Chief M. Sgt. Tim Tomasko, the Fabrication Flight Chief in charge of aircraft maintenance. "We're below sea level on the Atlantic Ocean, a thousand yards off the beach and another thousand yards from a river. In this area the afternoon salt spray that coats the electrical transformers has to be hosed off frequently or the electrical components will short out." (See "Beating Corrosion is Vital at Patrick Air Force Base".)

The Air Force MH-60 (top) and C-130J aircraft will benefit from the Wash-Rinse Optimization Program. Photos courtesy of U.S. Air Force.

At Patrick AFB and other bases, washing and rinsing aircraft is a necessary part of maintenance and rust prevention. Doing required maintenance, though, means grounding the planes and helicopters so they can be serviced. Reducing the frequency of the wash-and-rinse cycles makes more aircraft available for missions, but less washing often increases the plane's propensity to corrode.

The Air Force has always recognized that optimizing the wash-and-rinse cycle is highly beneficial. In harsh environments such as Patrick AFB, the maintenance crew rinses the planes every day and after each flight, and they wash them every 30 days, Sergeant Tomasko said. "Here, if you leave an aircraft outside, in three days it will have corrosion on it from the sand and salt spray."

Using Sensors to Improve Wash-and-Rinse Schedules

The Air Force recently installed sensors to assess the cumulative environmental exposure to specific areas on aircraft that live in benign and severe environments in terms of atmospheric corrosion (see "Sensor Technology Helps Crews Maintain C-130s"). The sensors allow maintenance crews to optimize wash-and-rinse schedules for the entire fleet. The Service has also initiated a program to use the sensor data to improve the designated wash-and-rinse schedule for individual aircraft.

"This project allows a program based on 1970s technology to be supplanted by one based on current technology," said Richard Kinzie, who retired recently as chief engineer of the Air Force Corrosion Prevention and Control Office. "The goal is to eliminate actions with minimum benefit, while altering the type and frequency of actions to achieve an increased reduction in corrosion."

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Richard Kinzie, retired chief engineer of the Air Force Corrosion Prevention and Control Office.

The Office of the Secretary of Defense (OSD) will provide funding for the program. Kinzie said the project's return on investment is relatively high, which they attribute to the anticipated reduction in aircraft wash cycles. According to the Air Force project plan, such benefits should save taxpayers millions of dollars annually and many days of additional airframe availability.

Much of the early work on this project was dedicated to how the sensors can be installed on military aircraft in operational environments. With the success on the project's current phase, the focus has shifted. Once funding is in place, the program will evaluate data from sensors measuring aircraft areas exposed to a relatively benign environment in terms of atmospheric corrosion, a severe environment similar to the extremes of Patrick AFB, and the mild atmosphere of Mansfield AFB, Ohio.

The program will also investigate the effect of extending wash cycles on aircraft in the more benign environments, as well as the effect of rinsing and other corrosion prevention methods such as corrosion prevention compounds in reducing the severity of the harsh environments.

"This portion of the project will provide some indication of the relative benefits of these mitigation activities and their frequencies," Kinzie said.

Kinzie explained that finding the appropriate wash and rinse cycle for aircraft in harsher environments will diminish corrosion, while extending time between wash cycles for aircraft exposed to less corrosive environments will result in a tremendous cost savings. "This optimized wash and rinse program would allow for reductions in corrosion in more severe environments, while eliminating the need for these actions in more benign environments where there may be little cost benefit."

Accumulating Decades of Data on How the Environment Affects Aircraft

Beginning in the 1970s, the Air Force developed an environmental severity index (ESI) through laboratory and field testing in order to determine wash frequency and rinse requirements for a specific aircraft. Then in the late 1990s, the Service tested various metals and alloys aboard ships and aircraft to accumulate actual corrosion measurements. These measurements illuminated the corrosive nature of the environments affecting various systems, and led to the prediction of corrosion rates for actual systems.

Throughout decades of performing these studies, the Air Force has compiled large databases that serve to describe environmental severity at various locations. Currently, Air Force geographical locations are assigned to one of three categories according to their environmental severity in terms of corrosion. They include "mild," "moderate," or "severe." The wash frequency for specific aircraft is determined based on these categories, in conjunction with other operating parameters, such as low-level flights above seawater.

Although the geographical categorization, field testing, and the ESI were steps in the right direction, Kinzie said, the full potential of reducing maintenance costs had not yet been achieved. "While the ESIs have been established, there has been no optimization of the wash and rinse cycles," he explained.

Cynthia Greenwood contributed to this article.