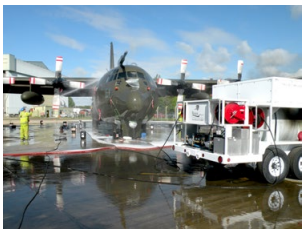
Corrosion in Heavy Equipment, Vehicles, and Aircraft:

Clear Water Rinse Systems Mitigate the Threat of Corrosion

SITUATION



Corrosion is a considerable hazard that severely impacts the U.S. military and nearly every U.S. industry sector. The damaging effects of corrosion are particularly felt in the fields of commercial and military aviation. Aircraft are expensive and carefully crafted investments and the never-ending problem of corrosion can pose fiscal, structural and safety risks in addition to the more indirect problems of lost productivity, litigation and taxes.

FINANCIAL IMPACT OF CORROSION:

The USAF alone spends $1.5 billion dollars annually on vehicles that are affected by corrosion, and the overall corrosion-related cost for U.S. armed forces is $20 billion dollars annually according to the most recent report by the Air Force Corrosion Prevention and Control Office (AFCPCO). According to the House Armed Services Committee, roughly $7 billion of that rust is preventable, which signals an unfilled need for a corrosion mitigating solution.

Despite the massive costs associated with corrosion, it is an often-overlooked threat and does not get the attention it deserves as a serious fiscal drain. The following statistic should help to put the severity of corrosion-related costs into context. From 1980 to 2002, the U.S. experienced over $380 billion dollars in losses as a result of catastrophic natural disasters. In that same span of time, the direct cost of metallic corrosion in the U.S. was over $6 trillion dollars.

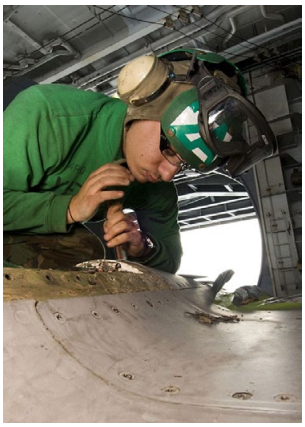
STRUCTURAL DAMAGE OF CORROSION:

Aircraft are commonly utilized for travel and transportation above and around large bodies of water. In many military applications and in some commercial applications, desert environment are also frequently encountered. Operation in these environments causes the build up of dust, salt and other corrosion causing contaminates. Corrosion occurs as the result of a reaction with the environment through the chemical degradation of metals. This process can run rampant in these harsh environments.

Corrosion can have a very direct impact on the day-to-day operations of a fleet of aircraft. Recently, 2,450 U.S. Army helicopters were found to not be mission ready due to corrosion-related faults, and Navy F-14 and F-18 planes experienced a series of landing gear failures due to corroded struts.

The Solution is Clear with Riveer℠

While corrosion is unquestionably the causing factor for many structural failures, those structural failures often superficially appear unrelated to corrosion. It is not as if an entire wing will rust off of a plane. However, the structural integrity of an entire wing can be compromised as the result of corrosion-caused stress concentration points. These concentration points can lead to cracks when salt, dust and other corrosive materials reduce the thickness and structural integrity of aircraft components. More direct harm done by corrosion can be seen in the erosion of electrical connectors and antenna. These components are of upmost importance to the proper functionality of an aircraft.



SAFETY HAZARDS OF CORROSION:

If all of this structural damage is taking place, the safety hazards are going to be severe as well. The structural damage caused by corrosion jeopardizes the safety of those serving in the armed forces, in addition to the passengers and crew of commercial aircraft.

As an example of the safety risk that corrosion poses, from 1989 to 2000, the U.S. Army experienced 46 mishaps, 9 fatalities, and 13 injuries tied directly to corrosion. Corrosion-caused stress concentration points not only pose a risk to the structural integrity of wings as mentioned above, but they also have been known to commonly occur in difficult-to-clean areas of an aircraft's fuselage.

CORROSION IN AGING AIRCRAFT:

As aircraft age, the risk of corrosion-related damages continuously increases. To combat this, corrosion prevention measures must be included as a part of the lifecycle management procedures for all aircraft.

This is a problem that is particularly relevant for the USAF today. The current USAF is the oldest in the history of the branch, with an average plane age of more than 24 years old. This number is only increasing. The average F-15's age is 25 years. This plane was first designed in the 1960's and is now restricted to 1.5 Mach in training exercises even though it was designed to be a 2.5 Mach aircraft. Maneuvering restrictions exist as well due to a potential for cracking in the tail, fuselage and wings of the plane.

HOW TO MITIGATE THE SITUATION

In a report presented to Congress, the US General Accounting Office emphasized the importance of providing a solution to the hazards of corrosion: "Because numerous advances in products and technologies have been found to enhance efforts to prevent and mitigate corrosion, it is critical that [the Department of Defense], as the steward of an enormous investment in military assets, ensure that all appropriate measures are implemented to reduce corrosion costs to the greatest extent possible."

The case is the same for industrial applications. To ensure the safety of employees and to mitigate the large potential costs of corrosion, an effective solution must be implemented. Often, the first line of defense against corrosive damage in aircraft is a clear water rinse system to rinse salt and particulate residue off of planes and helicopters. These rinse systems can clean areas of aircraft that can be difficult to access with manual rinsing. Often times, particularly in corrosive desert conditions, conserving freshwater is a necessity. Because of this, there are rinse systems available that collect and re-use wash water after filtering out corrosive particles.

For the U.S. military, clear water rinse systems are ideal for stopping the advance of corrosion. Clear water rinses are required for all aircraft exposed to salt-water environments in order to meet the requirements of USAF TO 1-1-691. This order states that all aircraft stationed within 1.25 miles of salt water should be rinsed every 15 days at a minimum, and that all aircraft flown at altitudes under 3000 feet over salt water should be rinsed after those flights.

The use of appropriate rinse systems for corrosion prevention protects the safety of workers and saves a tremendous amount of money in prevented damages and indirect costs. Even though these rinses are not a substitute for regular washes, they can be a valuable supplement. Often, a once monthly wash isn't enough to prevent corrosion, which is why TO 1-1-691 was implemented. This is preferable to increased wash frequency, as aircraft washes can take four individuals over three hours to finish. Clear water rinse systems can be automated to rinse a fleet at a rate of less than five minutes per plane.

RIVEER ENVIRONMENTAL

Riveer rinse and filtration systems efficiently and effectively rinse aircraft, collect dirty wash water, remove suspended solids, heavy metals, chemicals, microbes and other contaminates from that water, and then reuse the purified water. Wash water use is cut drastically, and the water that is used is filtered to totally remove corrosive particles. These systems can effectively and economically fight back against corrosion, and have best thoroughly tested in military and commercial applications.

Statistics and information found in this document can be found in the following reports:

ASM Handbook Volume 13C, Corrosion: Environments and Industries (ASM International)

US General Accounting Office Report to Congressional Committees in July of 2003

NACE: "Corrosion Costs and Preventive Strategies in the United States"

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