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Abstract: Corrosion is a large and growing problem in the US Army. While there has been significant activity in the area of corrosion prevention, very little effort has taken place the area of corrosion detection. This paper/discussion will review the Structural Health Monitoring (SHM) corrosion work currently on-going by the US Army Aviation & Missile Research, Development, & Engineering Center (AMRDEC), Diagnostics and Prognostics Laboratory (DPL) located on Redstone Arsenal, Huntsville, AL. The focus of DPL activities is to examine various techniques to enhance the diagnostic capability of US Army aviation, ground, and missile systems and provide futuristic platform-health based upon condition indicators. An area of focus for the DPL is structural health monitoring that is of critical high value/high maintenance items of our aviation fleet. This work involves detecting and localizing corrosion on various air and rotorcraft parts. Many of these applications are currently displayed as a technology demonstration in the DPL.

Two laboratory demonstrations were developed revealing the importance of optimizing sensor locations by comparing the results of two design groups: one of an optimized sensor constellation design and the other a heuristic design by a subject matter expert (SME) using twice as many sensors as the optimized design. This key design characterization is demonstrated on two very different parts: a helicopter main landing gear drag beam tested in free-free boundary conditions and a helicopter roof strap tested with many and complex boundary conditions. The drag beam demonstration detects a simulated mass removal, such as pitting or corrosion, while the roof strap demonstration detects simulated cracking and bolt loosening.

A third demonstration involves the correlation between optimized structural health monitoring system output and corrosion propagation. The objective is to detect and correlate pitting, cracking and oxidization damage growth of metallic structures. The correlation between the damage metric and corrosion were demonstrated using steel plates coupons subjected to a salt fog chamber.