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Thursday

2014 SERDP Project-of-the-Year Award for Weapons Systems and Platforms



Hazardous solvents and cadmium plating for the maintenance and overhaul of military weapons systems have been primary environmental concerns of the DoD for many years. Both of these areas have a common obstacle for implementation of any potential alternative— [hydrogen embrittlement](#), which can lead to fracturing of high strength steel.

High strength materials are sensitive to hydrogen embrittlement, and the source of the hydrogen can be the fabrication process, maintenance practice, or the natural corrosion cycle. Historically, the various aerospace defense contractors have each tested hydrogen embrittlement in their own manner, which has led to a national standard incorporating many approved test geometries and somewhat ambiguous procedures. The standard method is a pass/fail test, and the ambiguous procedures lead to conflicting test results and perceived risk and roadblocks to implementation of proposed alternative chemicals and coatings.

In this SERDP-funded project, Mr. Scott Grendahl of the U.S. Army Research Laboratory and his team used a three-phase design of experiments approach to investigate the hydrogen re-embrittlement effects of common aviation maintenance chemicals and coatings. Both material and geometry were examined to uncover the best constraints for a novel test method. While traditional testing uses a pass/fail approach, the newly developed method employs load monitoring cells over a range of material strength, hydrogen emitting environment, and applied load, allowing prospective solvent replacement chemicals and cadmium replacement coatings to be finely delineated in terms of performance. The team also developed a modeling-based tool for predicting time to failure under any combination of parameters.

A major benefit of this research will be the removal of implementation hurdles related

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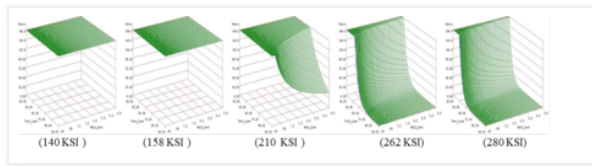
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to hydrogen embrittlement for alternative chemicals and coatings, easing the restriction in the aviation community on the use of alternatives and expanding their applications on high strength steel. The results from this project also led to refining the language of the [ASTM Standard](#)



Results from the specimen geometry life prediction models for AMS-6415 steel. The x and y axes are applied load and NaCl concentration, respectively, while the z (vertical) axis represents time to failure. Flat portions indicate no failure within 168 hours.

For this instrumental work, Mr. Grendahl and his project team received the 2014 SERDP Project-of-the-Year Award for Weapons Systems and Platforms. [Project Overview](#)

Project Team

Mr. Scott Grendahl, U.S. Army Research Laboratory

Mr. Hoang Nguyen, Bowhead Science and Technology LLC
Boeing Research & Technology

Dr. Shuying Zhu

Dr. Stephen P. Jones

Ed A. Babcock

Dr. Joseph H. Osborne

Stephen P. Gaydos

Mr. Chad Hogan, U.S. Air Force

Mr. Richard Green, Green Specialty Service Inc.

Mr. David Kelly, Asko Processing Inc.

Information provided courtesy of <https://www.serdp-estcp.org>

Posted by Ted Kelly at 8:00 PM

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