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JSWAG in the Fall

The next fall JSWAG is scheduled for Nov. 2-5 in Virginia Beach. All interested members of the armed services are invited to attend. Come prepared to share your gripes and wiring related concerns. Visit www.navair.navy.mil/jswag for more information.

MAL Code Survey

Please take a moment to help NAVAIR in facilitating honest, constructive feedback by taking the Aircraft Wiring 'W' Malfunction Codes Update Survey. Comments are needed from aviation maintenance professionals in the Navy and Marine Corps. Visit www.blackbeltsurvey.com/survey/1344347/default.cfm for more information.

Newsletter Contacts

JSWAG Coordinator
jswag@navy.mil

Jim Jenkins -- Editor
301-866-2146
james.jenkins@wyle.com

New wire stripper, insulation headed for maintainer toolbox

NAVAIR is working to bring maintenance professionals two new wiring solutions that are expected to save time and money during maintenance intervals.

The Wiring Systems Branch of the Propulsion and Power Engineering Division used the Small Business Innovative Research program to find companies willing to develop new wire strippers and new wire insulation to improve an aircraft's overall wiring health.

The SBIR program is a highly competitive, three-phased award system and is the primary vehicle through which NAVAIR funds small companies to perform innovative research and development projects. There are many benefits that go along with the SBIR program. It stimulates technological innovation, fosters and encourages minority and disadvantaged business participation, increases private sector commercialization innovations and transitions SBIR technology into Naval aviation systems helping to keep the war fighters on the cutting edge. These SBIR wire insulation and stripper projects are focused on helping the aviation electronics technicians and aviation electrician's mates of the Navy have less tools to carry, and are sponsored by the Joint Strike Fighter program and the Aircraft Ground Support Equipment program.

According to NAVAIR, wiring system problems are one of two leading causes of aircraft downtime or non-mission readiness.

Many factors can lead to wiring related issues causing aircraft downtime. Maintenance professionals can have an immediate impact on the elimination of maintenance induced wiring failures. Currently the Navy and Marine Corps maintenance professional carries a suitcase filled with up to 11 different wire strippers because of the many different types of wire insulation he may come across in the performance

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of his job. Some platforms also resort to providing up to five blade set types that must be interchanged on a single handle depending on wire type. The chance for maintainers to grab the wrong wire stripper is greater than if they only had one or two to choose from.

This maintenance induced damage can cause too little insulation being removed and not having a proper connection for a signal to pass through, or the strip being too great and causing some conductor to be removed. The latter could result in too much current passing through the wire resulting in heat build-up, and possible fire.

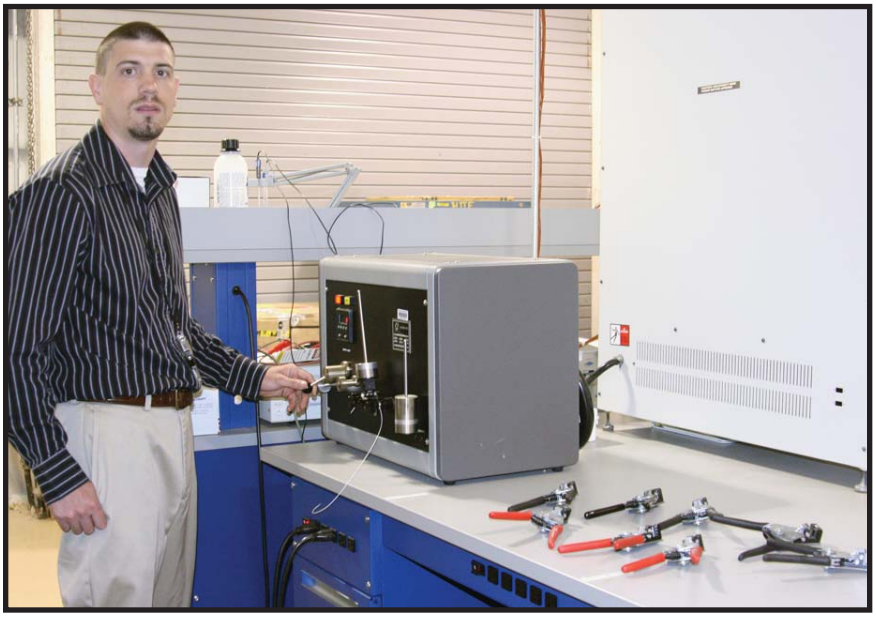
"Because there's contact between the blade and the wire conductor, there is always risk of damage to the wire itself," said Brian Vetter, Technology Development lead engineer for the Wiring Systems Branch. "This probability increases as the current mechanically designed tools age."

NAVAIR is looking to eliminate these failure possibilities completely and go to a non-contact wire strip method. After approximately a dozen companies initially competed in phase 1, NAVAIR down selected to three companies for the initial demonstration phase and recently chose one company to produce a prototype.

The type of wire stripper NAVAIR chose uses an infrared laser diode to remove the insulation.

"The beam the diode produces completely ablates the insulation," Vetter said. "However, metallic structures are reflective to the device's particular wavelength so there is no damage to the conductor."

There are no moving parts within the optical apparatus, but the beam is focused around the wire in such a way that it removes the insulation completely around the wire with no movement whatsoever. Strip time for the laser device is two to three seconds with the gauge of the wire not making a



Brian Vetter, Technology Development lead engineer for the Wiring Systems Branch, hooks a sample wire to the abrasion test machine at the Propulsion Systems Evaluation Facility. At left are various wire strippers currently in use in the Fleet.

Photo by Jim Jenkins

difference at all. Insulation type does matter a little, Vetter said.

The four most prevalent type insulations NAVAIR is testing for are DuPont Tefzel ethylenetetrafluroethtylene (ETFE), Teflon jacketed wire insulation, one with a polyimide material sandwiched between Teflon layers and polyalkene insulation.

The wire stripper will be battery operated and is going to be safe to operate on, in and around fueled aircraft. Also, to handle the different gauges of wire, the device is designed to have a drill-like chuck that will grab the wire securely once the user pushes the wire inside the device for stripping.

"There's still one year of development left," Vetter said. "We are hoping to refine the product once we get the battery requirements set. As of now, the new device will handle 12 to 26 gauge wire, all the standard wire gauges the current wire strippers handle."

Insulation

NAVAIR also needs a stronger wire insulation that won't become brittle through aging and prolonged exposure to extreme temperature fluctuations. More durable wire insulation will be less prone to wire chafing and provide a greater degree of resistance to chemical degradation, arc tracking and maintenance induced failures. Sponsors of this topic are the Joint Strike Fighter, PMA-275 V-22 and PMA-261 H-53.

The objective of this SBIR project is to develop the next

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generation electrical wire insulation that is light weight, have low flammability, have low smoke toxicity, have low smoke density, have high cut through, be less susceptible to abrasion, not be able to experience hydrolysis, be able to withstand temperatures greater than 500 degrees Fahrenheit, have high dielectric properties, have good strip ability, have good marking contrast and be of very low cost.

"What we're using now, as the newest insulation type approved for aircraft use, is about 20 years old," Vetter said. "There have been substantial developments in polymer chemistry since then, so what we did was study the issue to see if that advancement in technology meets our need."

After initially down selecting to three companies, NAVAIR engineers performed testing on material samples. After testing, NAVAIR chose two of those companies to provide a prototype of their solution. Vetter said that NAVAIR chose two companies because the two solutions were so radically different, but appeared to be feasible.

One solution is liquid crystal polymer (LCP) that was originally created for use as a tube-launched, optically-tracked, wire-guided material in submarines. The LCP is used as a sheath to shield the fiber optic wire as it is launched through the water. Knowledge of its current use helped NAVAIR engineers realize that the LCP material is highly resistant to abrasion. Other electrical tests proved favorable as well, and seeing that the material is also proven capable of being extruded onto a fiber optic cable, doing the same on a copper cable isn't radically different. For phase 2, NAVAIR expects the company to optimize the LCP to be a more flexible materiel. Vetter said that if they are successful LCP should be a long-lasting durable product.

The second material is based on existing composite wire made out of Teflon and polyimide coatings. Instead of using a pure polyimide sheath, the company dissolved the polyimide material, added new materials to it and reformed it into wire insulation. Having a polyimide base, the end product will still be lightweight and be a good electrical insulator like polyimide always has been. This new material will have other properties that include reducing the hydrolysis affect, reduced arc tracking possibilities and making it more flexible. The company uses a method called dip-coating to help the flexibility issues. While the polyimide material is in a semi-liquid state, a machine will dip the copper cable over and over until the desired thickness is achieved. The company has partnered with a wire manufacturer and has made a few full-scale production runs already. Vetter said that this solution has the potential for commercial success as well as possible military use.

"Both companies have demonstrated that they can put their materials on wire," Vetter said. "Now they have to tailor the electrical and physical properties for what we need to safely operate in the Navy environment."

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