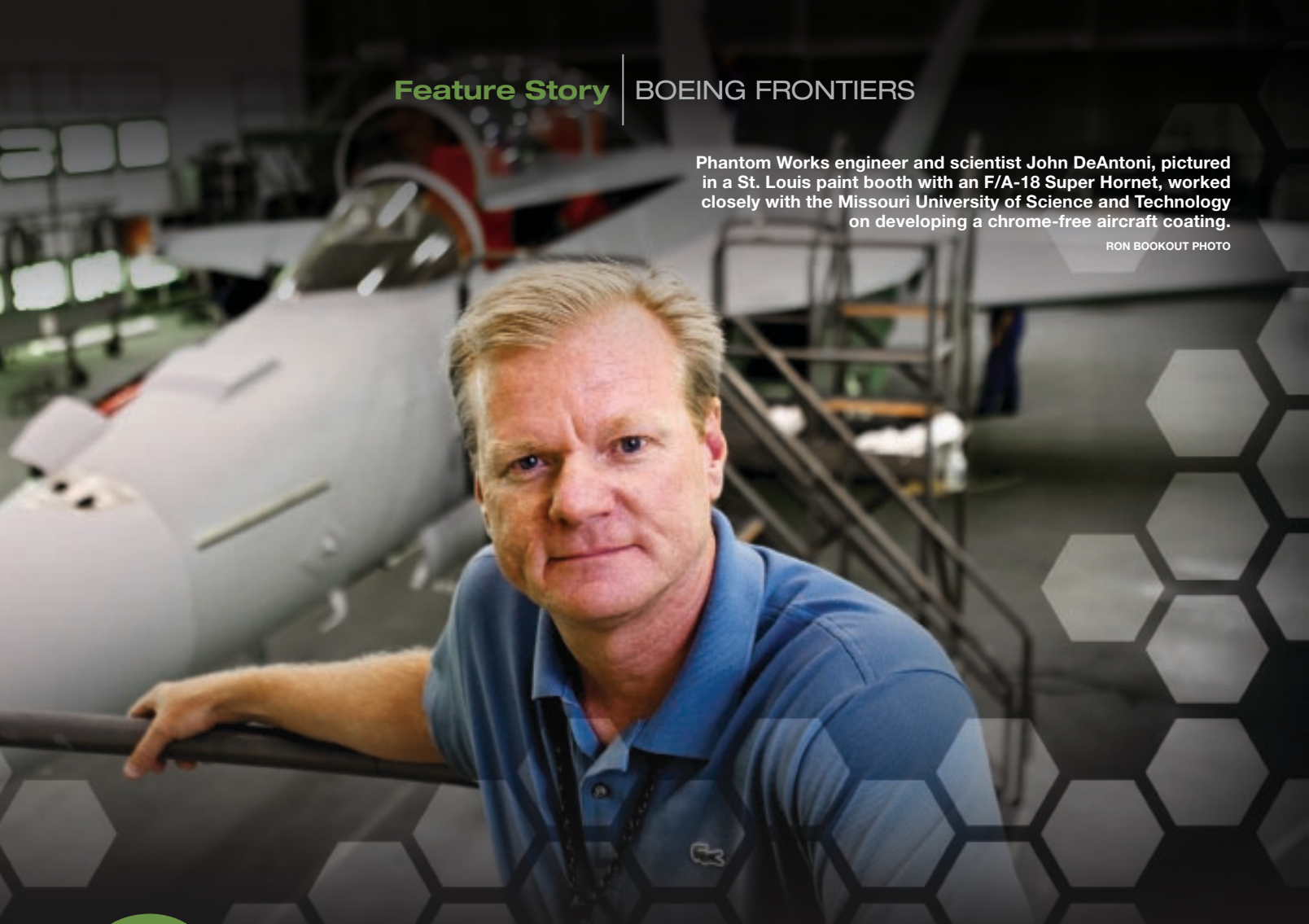


Phantom Works engineer and scientist John DeAntoni, pictured in a St. Louis paint booth with an F/A-18 Super Hornet, worked closely with the Missouri University of Science and Technology on developing a chrome-free aircraft coating.

RON BOOKOUT PHOTO

Greener paint for planes

Researchers develop a way of removing chrome from paints that are applied to military aircraft and vehicles—and saving time and costs

By Daryl Stephenson

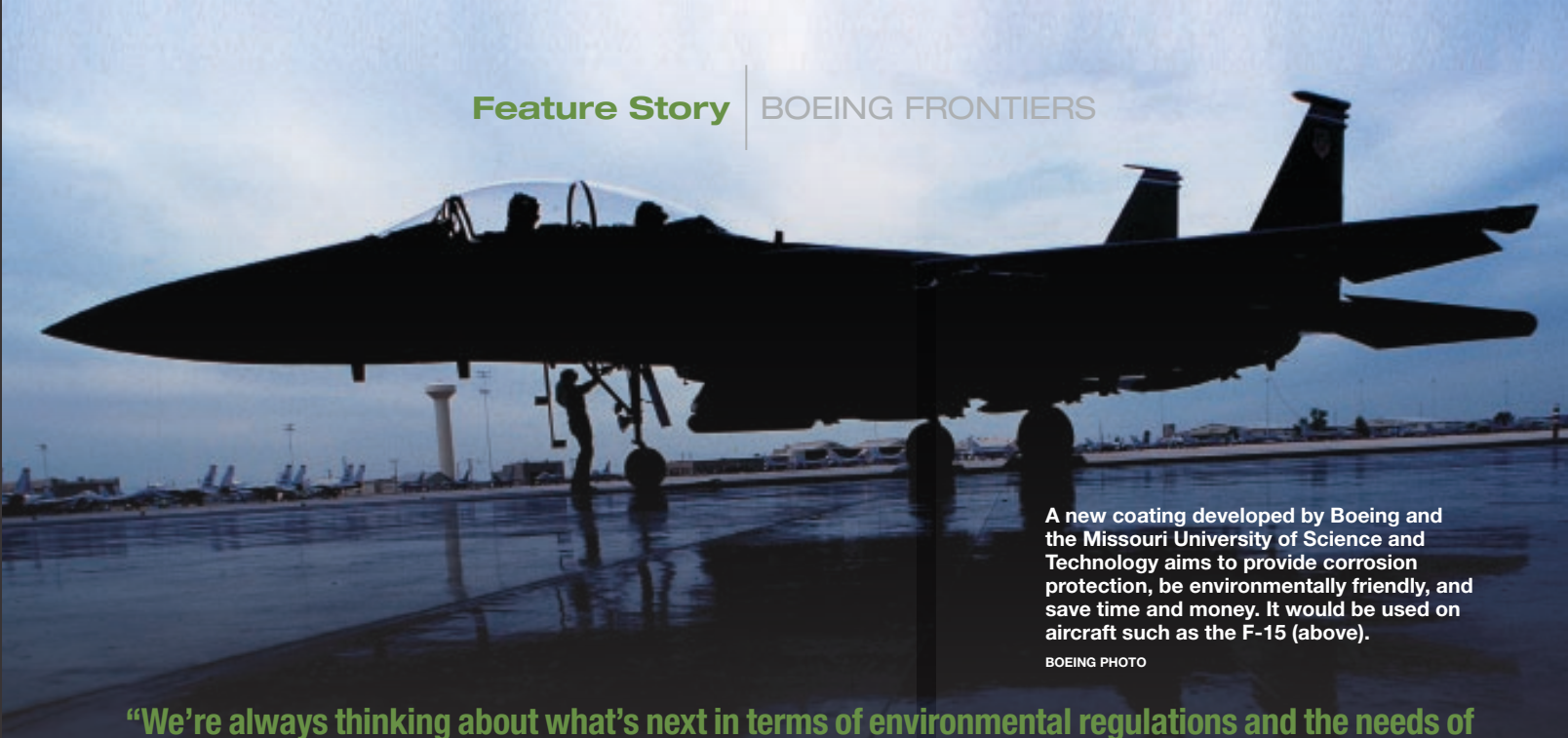
Military aircraft and vehicles need to be protected from corrosion. Current coating systems—primers and topcoats—do a pretty good job. But there's one problem. A lot of these coatings contain chromate compounds, or chrome, that require stringent protective measures for safe use by workers who apply and remove them.

Researchers at Boeing and Missouri University of Science and Technology have been working together to come up with a better system—one that provides the corrosion protection the U.S. Department of Defense wants but is also safer and more environmentally friendly and saves time and money.

They believe they've found a big part of the answer under a three-year program called the Environmentally Benign Coating System for Department of Defense Substrates that's funded by the DoD's Strategic Environmental Research and Development Program.

Their solution combines rare-earth cerium oxide conversion coating processes developed by Missouri S&T with ultraviolet-light-curable multifunctional topcoats developed by Boeing Phantom Works, Cleveland-based Light Curable Coatings and Wayne Pigment Corp., based in Milwaukee.

The new coating system "has a lot of benefits," said John DeAntoni, a Boeing Phantom Works engineer/scientist in Environmental Assurance in St. Louis who's worked closely with Missouri S&T on the project. "We've taken the chromates out of the pretreatment process and replaced them with a cerium-based conversion coating. And we're replacing the current process of applying a primer and topcoat and wait-



A new coating developed by Boeing and the Missouri University of Science and Technology aims to provide corrosion protection, be environmentally friendly, and save time and money. It would be used on aircraft such as the F-15 (above).

BOEING PHOTO

"We're always thinking about what's next in terms of environmental regulations and the needs of our customer. And that's why we've looked at a comprehensive solution that'll work over time."

– John DeAntoni, engineer/scientist in Environmental Assurance, Boeing Phantom Works

ing hours for them to dry with application of a single, chrome-free coating that dries in seconds because it's being cured with ultraviolet light."

The Missouri S&T–Boeing program, which began in 2006, has progressed to the point that it's being seriously considered for an additional three-year demonstration/validation (dem/val) program that would start in 2009, DeAntoni said.

"Usually, you don't get this kind of interest until after you finish your initial program and you know you've been successful," he said. "But we were about halfway through when we were asked to submit a proposal for dem/val. And that was because we had showed so much promise."

REQUIREMENTS SPARK NEEDS

Boeing and Missouri S&T, formerly known as the University of Missouri at Rolla, have been working together on development of new coating systems for military aircraft for several years. The university, through support from Boeing and the U.S. Air Force, previously developed chromate-free corrosion inhibitor technology that was later licensed by Deft Industrial Finishes. Deft currently supplies a chromate-free primer to the U.S. Air Force for application on F-15s.

Commercial Airplanes also is taking steps to deal with chromium in paint by replacing chromates in its conversion coat, which lies under an airplane's decorative paint schemes, for all commercial models. "We are close to testing a nonchromated primer on airframes," said Randy Jahren, Associate Technical Fellow with the Paints and Coatings Group, Materials & Process Technology. After the primer is accepted, BCA will offer a fully nonchromated coating system.

What sparked the effort between Missouri S&T and Boeing, DeAntoni said, were requirements from the U.S. Occupational Safety and Health Administration that decreased the acceptable exposure limit of humans to hexavalent chromium. The final standard requires employers to institute effective engineering and work-practice controls as the primary means to reduce and maintain employee exposures to hexavalent chromium. (Hexavalent chromium compounds contain the element chromium in its +6 oxidation state.)

The new regulations accelerated the need to find replacements for chromate compounds. "What we heard from the Defense Department was that their biggest environmental driver was the chromium in the primer they were using," DeAntoni said. "So we've been working hard to get the chromates out of the primer."

CURE FOR LONG DRYING TIME

The current coating system for aluminum aircraft has three main components. There's a chromated metal pretreatment conversion coating that provides some corrosion protection and improves paint adhesion. Then a primer containing hexavalent chromate compounds is applied to provide the majority of the corrosion protection. That's followed by application of a polyurethane topcoat.

Application of chromate-based coatings requires strict safety procedures, as well as the right equipment and facilities, to prevent potentially severe respiratory problems for workers. Those requirements mean that in depot maintenance, the dry-to-fly time of the current coatings can be as long as 72 hours for aircraft like the F-15. "That has a huge impact on the warfighter," DeAntoni said.

The new cerium-based conversion coating developed by Missouri S&T can be applied or removed without presenting a health hazard to workers, he said. And Boeing Phantom Works has replaced the process of applying a chromated primer and a polyurethane topcoat with application of one chrome-free coating that cures rapidly with ultraviolet light.

The result is a coating system that meets Defense Department goals for pollution reduction and prevention and enables the services to maintain a high level of readiness.

"Through internal strategic planning, we're always thinking about what's next in terms of environmental regulations and the needs of our customer," DeAntoni said. "And that's why we've looked at a comprehensive solution that'll work over time." ■

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