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A Boeing-led team has developed technology that could significantly reduce the toxic paints and solvents used to clean them from military airplanes. Known as the Joint Strike Fighter Paintless Airplane Program (JPAP), the effort also holds the potential of dramatically reducing the cost of maintaining military aircraft.

"This is very promising research," said Ted Ytsma, Boeing JPAP team leader. "It is environmentally friendly, highly durable, will cut maintenance costs and improve supportability of the military fleet."

JPAP is being conducted under a technology maturation contract awarded in 1996 by the Joint Strike Fighter Program Office. Under the contract, Boeing and 3M are demonstrating the feasibility of replacing paint with a patented class of materials known as appliques; thin polymer films backed by pressure-sensitive adhesive.

The JPAP program originated as one aspect of the Joint Strike Fighter program's emphasis on affordability. Specifically, JPAP is aimed at greatly reducing the support costs of in-service aircraft. Painting, stripping and repainting airplanes contributes significantly to the costs of maintaining military aircraft.

One of the most significant aspects of painting airplanes is the environmental cost associated with hazardous materials. Up to 90 percent of all hazardous materials associated with aircraft stem from the paint/strip/repaint operations.

"As we progressed with the research, we began to discover other potential benefits of JPAP as well," Ytsma said. "We learned that JPAP offers the services a way to control a phenomenon called 'weight growth'."

He explained that some fighters carry as much as 800 pounds of paint accumulated from repeated repainting of the plane. Such weight can seriously degrade the aircraft performance.

"We also found that applique work can be done concurrently with other types of maintenance instead of in separate facilities at a different time, as is the case with paint."

Ytsma said JPAP's primary objective is to quantify the reduction in aircraft support costs associated with estimating the total life-cycle costs for fleet use of appliques and comparing them to paint. Other JPAP objectives include demonstrating the suitability of appliques for maritime and carrier environments, and for supersonic aircraft. To accomplish these objectives, Boeing and 3M performed a series of materials, environmental, wind tunnel and flight tests. The materials and environmental exposure tests were designed to expand the state-of-the-art for appliques to include total paint coating replacements.

Wind tunnel tests helped determine failure mechanisms and establish peel strength requirements. The flight tests were broken into a series of progressively more difficult demonstrations beginning with a small patch of appliques placed on the surfaces of a Boeing T-33 chase plane. As testing progressed, larger areas and more aggressive flight conditions were tested first with "patch tests" on an F-18 drop tank, then on panel-sized sample tests on the same F-18.

In September 1996, most surfaces of an F18-B were covered with an applique, and in October a one-year flight test began. Material flight-qualification testing, T-33 flight tests and development of application, cutting and removal techniques were conducted at the Boeing Developmental Center in Seattle. All F-18 flight-testing is being performed at the Naval Air Station Patuxent River, Md., in combination with JPAP partners Naval Air Systems Command and Naval Air Warfare Center Aircraft Division.

"Based on the results of the testing to date, this technology has great potential for cutting maintenance and environmental costs for our customers," Ytsma said.

"It would be worthwhile if it addressed only one of those major concerns. The fact that it so strongly improves both makes it a real success."

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