



Titanium Nitride Coating Extending The Life of Marine Corps' CH-53 Engines

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A revolutionary technique to protect CH-53E engine airfoils is enabling the Marine Corps to extend flight hours of its heavy-lift aircraft and reduce the cost of overhauling the Super Stallion, according to a Naval Aviation System Command (NAVAIR) official.

During Desert Storm, Marines discovered that the harsh conditions in Iraq and the Middle East were taking their toll on heavy lift helicopters, Col. Paul Croisetiere, program manager for the CH-53, told Defense Daily in a recent interview.

"Without any mitigation in place we'd get about 150 hours from the engines," he said. "The engines would swallow unfiltered air and all the particulate matter, sand and dust, would erode the leading edge of the compressor blades and cause the engines to get to a low power condition."

Maintenance crews would have to take off and replace the blades at the depot and then get the aircraft back out to the squadrons, Croisetiere added.

Marines change out the CH-53E engines whenever they get down to an 82 percent operating efficiency, a former Marine official familiar with the coating technology told Defense Daily.

The CH-53E uses three General Electric [GE] T64-GE-416 turboshaft engines, according to the Marine Corps. Technologists from NAVAIR began looking around to see what was available to counter the damage done to the engines by the austere conditions in the Middle East. NAVAIR personnel eventually came across Titanium Nitride, a coating used by the Russians when they were operating in Afghanistan in the late 1970s and early 1980s, Croisetiere said.

A Canadian entrepreneur actually found the material while he was touring a Russian factory.

"He saw these gold plated compressor blades, small airfoils, and started asking about it," Croisetiere added.

One thing lead to another and eventually the technology came to Canada. Now it is being applied onto American made compressor blades by MDS-PRAD in Prince Edward Island, he said.

The end result of the effort, Croisetiere said, is that the Marine Corps now has engines operating in the harsh desert environment in Iraq with well over 1,000 hours on them, almost a 10-fold increase. Every time a CH-53 engine is brought back to

the depot to have all its worn parts replaced, it costs approximately \$600,000, Croisetiére noted.

"We are seeing a significant cost savings through [the use of the Titanium Nitride coating] and the fleet is benefiting; they are not removing and replacing engines all the time."

The former Marine official pointed out that having to replace worn parts on each of the three CH-53 engines could cost almost \$2 million per aircraft. Add in the cost of spare engines that may be needed, and the costs begin to really add up, he said. By using the coated blades, the service could be saving as much as \$8 million per CH-53E per year, the former Marine official said.

"Those are very rough figures, but we are seeing at least a five-time improvement of time-on-wing with the engines with the coated blades," he said. Additionally, the coatings have enabled the Marine Corps to improve CH-53E readiness, the former official said. "You can have 10 to 12 aircraft up per day instead of six to seven."

The Marine Corps is just buying airfoils with the Titanium Nitride coating, Stony MacAdams, H-53 assistant program manager, told Defense Daily. The Navy approved the change to allow for the coating in June 2003.

Three months later, General Electric delivered the first airfoils to the Marine Corps, MacAdams added. Besides cutting down on maintenance, the coating is an enabler, MacAdams said.

"This becomes an enabler for operations in that austere, sand-laden environment. The maintenance part is critical, you can't be conducting operations on the backs of our maintainers, but you also have to look at it from the perspective that it becomes critical to operations," he said. "It is an enabler, otherwise you would be pulling engines off of aircraft every other month, and that would be a tremendous impact on the fleet."

Croisetiére added the Marine Corps has data that demonstrates that in the last year, the maintenance man hours, per flight hour metric has dropped significantly.

"We have seen two specific metrics reduced in the last year and we know this Titanium Nitride technology has been a major contributor to their reduction. One is maintenance man hour per flight hour and the other is total program cost," Croisetiére said.

While it cost about \$30,000 to put the coating on, the Marine Corps is just on the cusp of starting to see a cost savings because of the affordability benefits the capability provides, he added.

"That's why I think this is one of the coolest stories in all of DoD. It is a Russian technology used by a U.S. engine manufacturer, made in Canada, and operating heavy-lift helicopters that are deployed throughout the world today," Croisetiére added. "And not only providing a significant operational capability or improvement for it, but providing an affordable solution for the taxpayer as well."

There are currently only a few engines in the entire Department of Defense inventory using the coating, Croisetiere said. Those are GE's T-64, the AE 1107C Liberty engine built by Rolls-Royce for the Bell Helicopter Textron [TXT]-Boeing [BA] V-22 Osprey, and in one case GE's T700, designed for the Sikorsky [UTX]-built UH-60A Black Hawk, he explained.

The former Marine official said it's time to put the coating on any platform that flies in corrosive environments.

"You are talking about billions of dollars in savings. This is a significant transformational technology."

However, Croisetiere acknowledged that the coating won't work on all engine blades.

"The design of the blades does not allow it." Nonetheless, Croisetiere and the former Marine official are both at a loss to explain why there hasn't been inquiries from the other services.

"GE, much to their credit, is looking for ways to put it on other engines in the stable of engines they produce," Croisetiere said. "Surprisingly, there has not been a lot of inquiries from other services or other people who fly different helicopters in the same parts of the world or operational area that we do."

"The question Congress ought to be asking is why isn't everyone doing this," the former Marine Corps official said. "The savings here are blatant. This is a great news story."