

CARGO

Helicopters

Product Improvement Update

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The primary objective in the Cargo Helicopters Product Improvements Sustainment Division is to enhance the performance of the CH-47 Aircraft by leveraging new and improved technologies into the Chinook aircraft and aircraft systems.

We are responsible for performing the non-recurring engineering (NRE) development, test and qualification efforts, the NRE logistics efforts, and also the planned recurring fielding efforts, as required, for each project we manage.

These products are intended to be common to all CH-47 Chinook models and are intended to provide enhanced maintainability, lower operations and support (O&S) costs and, ultimately, to reduce the maintenance burden on the Soldier.

The product improvements to the engine inlet air cleaner described below have been incorporated onto the CH-47D platform and will become integral to the new CH-47F model, currently in production.

Engine Air Particle Separator

Don't leave home without 'em. The engine air particle separator, or EAPS, is made up of over 3,000 approximately 3/4-inch diameter vortex generator tubes which centrifugally expels sand and dirt, water, salt water and other foreign object damage (FOD) contaminates overboard, allowing only clean, uncontaminated air to reach the engine.

This self-cleaning device is virtually maintenance-free.



PHOTO COURTESY OF SGT ROBERT ROSE

Work on the "Short Can" EAPS included mountain test flights at Fort Carson, Colo., to confirm no adverse effects on T55-GA-714A engine performance when operating at or above 10,000 feet mean sea level – important for crews like this CH-47 flying a mission in Afghanistan.

Heeding the requests of pilots and maintainers in the field, the Cargo Helicopters Project Management Office has incorporated several major modifications to the EAPS and the cross shaft fairing seals to significantly improve their performance.

The EAPS Can has been shortened by 2-inches to create the new "Short Can EAPS," thereby allowing ready unimpeded access to the engine compartment for periodic inspections and routine maintenance without having to disconnect the air cleaner.

The entire engine cowling is now fully operational with the Short Can EAPS installed, thus saving Soldiers precious time and effort in the field.

In addition, to further enhance FOD protection, a screen has been mounted internal to the EAPS assembly.

The new molded cross shaft fairing seal design prevents air leakage around the canister and eliminates any

ingestion of foreign objects such as rocks, stones, sand and other debris.

The new positive lock latches attach the units securely, facilitate removal and installation and will now eliminate the need for tools.

These forward and aft locking mechanisms hold the cross shaft fairing cover seal against the canister and prevent the seal from "walking" away from the can.

Flight Tests Validate Improvements

The "Short Can" flight test in September 2005 at Fort Carson, Colo., demonstrated successful results wherein no adverse effects were noted with the operation or performance of the T55-GA-714A engines.

As the CH-47D test aircraft operated for over 100 hours in various environments, including mountain flights at or above 10,000 feet mean sea level, to Hurricane Katrina relief in



PHOTO COURTESY BOEING HELICOPTERS

The EAPS system installed ahead of the engines on the new production CH-47F model cargo helicopter.

New Orleans at sea level, the engines performed within all parameters that are established by the required performance planning card criteria set forth by Army Regulations.

With the Short Can installed, the engines met or exceeded all power limits called for in the aircraft performance charts. Additionally, both engines passed the Power Assurance Test (which is performed on every flight prior to departure to determine engine condition from a predetermined set of parameters developed from the results of the maximum power check) and maintained power assur-

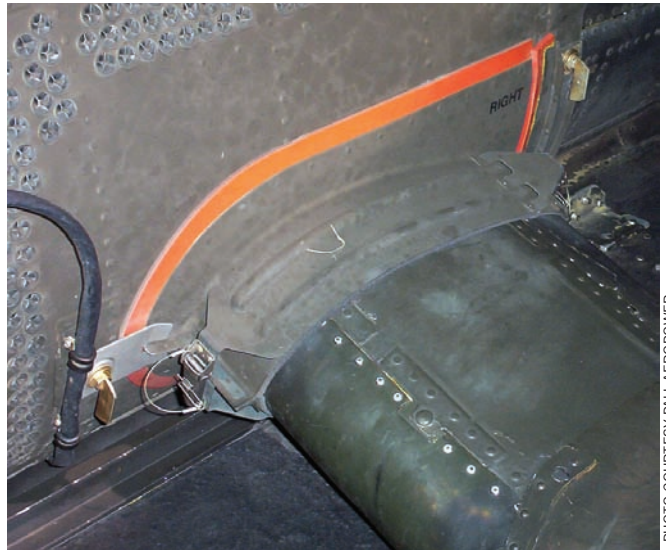


PHOTO COURTESY PALL AEROPower

The improved cross shaft fairing seal installation with its "no tools required" attachments, coming from the engine area to the aft pylon and transmission.

ance during the entire flight test without any change in computation.

The EAPS will save engines and substantially lower the O&S costs to operating units. In addition to protecting the engine against sand and dirt, icing, bird strikes and other FOD sources, the EAPS defends against the negative

effects of salt spray and its potential for engine corrosion, fouling or power loss. Even though the EAPS has been designated as mission equipment, the full time operation of the EAPS would serve to protect the engine, given the aircraft are routinely required to operate outside their mission profiles in unforeseeable adverse conditions.

Flight operations in icing conditions with EAPS installed have been demonstrated at the Army Aviation Technical Test Center at Fort Rucker, Ala., with no loss of power or restricted air flow. Currently, with the All Weather Screens installed, the rear by-pass screens have to be removed in icing conditions which could result in ice ingestion and compressor blade damage.

Bottom Line Performance

The perception in operational units is that EAPS power losses will limit or reduce the weight of available loads. The most significant loss would be during the hover and take off phase. The calculated or projected power penalty averages 2 to 3 percent torque at a hover which equates to approximately 900 pounds.

This calculated torque penalty affects performance planning for continuous power and all other power settings in the following manner: the predicted torque value for continuous power would be 2 to 3 percent less with a power turbine inlet temperature (PTIT) of 815 degrees for the 714A engine.

The engine still has more torque available, but the PTIT may be slightly higher than the temperature limit for that power range. The only time the EAPS power penalty affects the engine is when predicted power required is at the top of the selected power range temperature limit. It is possible that with an engine that exceeds minimum production specifications, no penalty will be realized. The power requirements during cruise flight and destination

hover are normally significantly less, therefore EAPS power losses are normally not a contributing factor.

Over time, operating without EAPS will result in engine degradation from unfiltered air, which will more than offset the disadvantages of EAPS usage.

Because EAPS reduces compressor erosion and power turbine glassing, the engine will not suffer from environmental degradation and will maintain its designed efficiency over a longer period of time – resulting in less on-wing maintenance and repair time.

As demonstrated by the on-wing testing at Fort Carson, no power loss was detected on the engines during any phase of flight.

Summary

Near term, the plan is to recover Long Can EAPS assemblies from the field and convert them to Short Can configurations and, along with new production units, the Short Can EAPS will ultimately be made available to all requesting units.

Future product improvements on the horizon for the EAPS may take advantage of advanced materials technology to generate lighter assemblies.

In the meantime, the new improved EAPS will serve as the optimum device for engine inlet air filtration and engine protection for cargo helicopters.



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