(Friday, 02 May 2025, VFS Open Forum)

Ospreys To Receive Unbreakable Gearboxes – A Theory Questioning Sense

Several papers inform about the seemingly final decision taken to remedy problems of the V-22 Osprey. (See link below.) Unfortunately, explanations lack consistence in the sense of both flight energetics and mechanical engineering.

BREAKING DEFENSE

AIR WARFARE, NAVAL WARFARE

V-22 will fly with restrictions until 2026

"We had some learning in the middle," said V-22 Program Manager Marine Corps Col. Robert Hurst, "and that learning in the middle took us from the summer of '25 to start in the spring of '26."

By MICHAEL MARROW on April 30, 2025 at 4:30 PM

U.S. Marines refuel an MV-22 Osprey at the Kilimanjaro International Airport in Tanzania, as part of a troop transport flight during Exercise Cutlass Express 2025 Feb. 12, 2025. (U.S. Navy video by Mass Communication Specialist Seaman

MODERN DAY MARINE 2025 — The troubled V-22 Osprey will not resume full flight operations until 2026, according to the aircraft's program manager, as officials roll out an upgrade to the tiltrotor's gearbox that they hope will address safety concerns.

In a briefing held at the Modern Day Marine conference in Washington today, Marine Corps Col. Robert Hurst said an effort to upgrade the tri-variant V-22's proprotor gearbox — consisting of internal components made with triple-melted steel — should start delivering in January. Following the fix, officials can then gradually implement the aircraft's full mission profile, with the goal of having an "unrestricted" operational fleet by the end of next year, Hurst said.

In an effort to keep the Osprey flying until the mid-2050s, officials are also exploring other improvements. One effort will redesign the aircraft's flight control computer with a modern processor, which Hurst explained will bring it up to speed with modern standards after originally being coded in the 1990s. A second effort, known as the Renewed V-22 Aircraft Modernization Plan (ReVAMP), is a larger study of the platform that is expected to wrap up around the fall.

And finally, the V-22 Enhanced Cockpit Technology Replacement (VeCToR) will "replac[e] hardware inside the cockpit," Hurst said, with the aim of resolving obsolescence issues. VeCToR will be competitive, Hurst added, with a sources sought notice expected to be released to industry "in the next month or two."

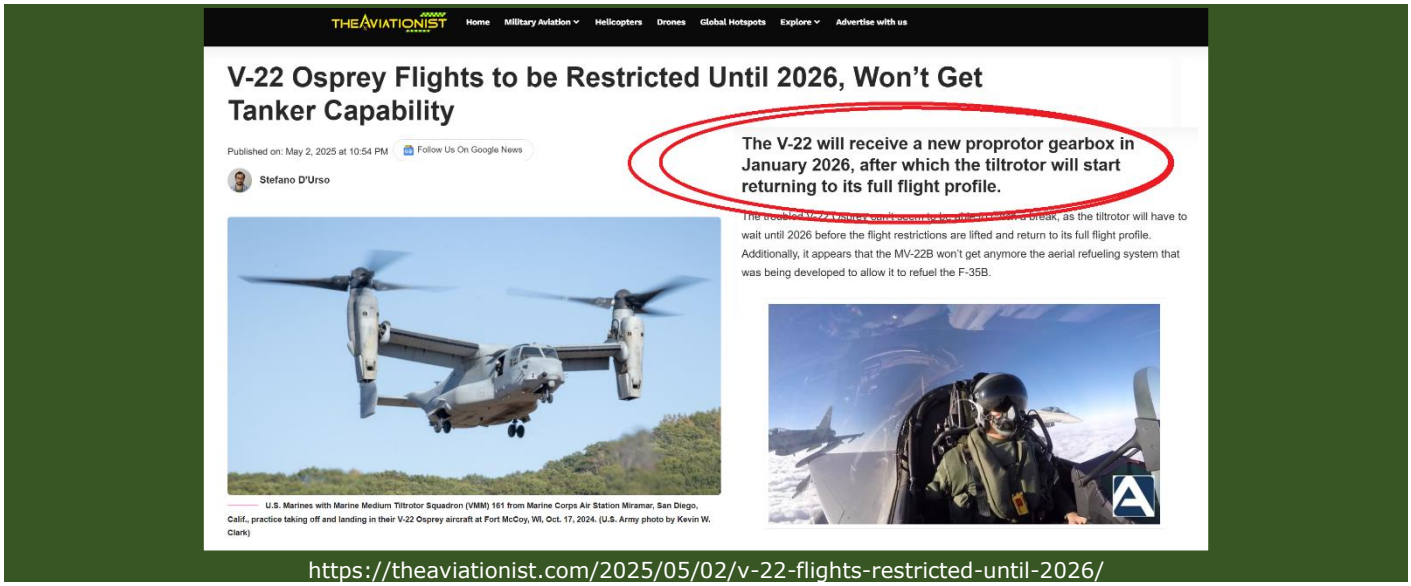
UPDATED 5/1/25 at 3:50 PM ET with comment from Bell Boeing.

https://breakingdefense.com/2025/04/v-22-will-fly-with-restrictions-until-2026/

The only case in which this action (i.e. reinforcing the gearboxes) could be considered the right one is when there is a 100% certainty the actual strength of the gearboxes is a (negative) mismatch for the strength of their mechanical environment.

The nature of this environment makes the issue real critical. Because here we must speak about the turboshaft engine, and the proprotor. These parts are those directly preceding and following the gearbox in the drive chain. With a super-strong gearbox, when the extreme mechanical loads happen again (remember: the V-22s have VRS quite regularly!), the parts which will become prone to breakdown next are just these: the engine and the proprotor.

To put it more dramatically: the V-22s will have a time bomb installed in the drive chain.



https://theaviationist.com/2025/05/02/v-22-flights-restricted-until-2026/

(Sunday, 04 May 2025, The Aviationist)

Reinforced gearboxes will send a message of encouragement to pilots to fly "harder" (or maybe just longer) in critical regimes, those mixed with VRS – the vortex ring state happening frequently to V-22s in regimes of vertical takeoff and landing, and hover. Chances are the extreme mechanical loads caused by VRS will grow both in frequency and in intensity.

Also, with the gearboxes now unbreakable, other parts of the drive chain become vulnerable to the extreme vibrations very much characteristic for the V-22 Ospreys. These parts are typically the proprotors (blades!) and the two turboshaft engines.

This means bigger trouble may happen to the V-22s following the planned gearbox project. As a means to really enhance safety of flight the critical VRS occurrences shall rather be addressed.

It is known proprotor blade stall, and the very low level of propeller efficiency (10% and below!) are to blame for the VRS. In other words, own engine power is feeding those destructive vortices. However, improvement of rotor blade design – application of so called adaptive blades – could help. Adaptive blades cause no VRS, or vibrations either. Flying the Ospreys becomes less stressful (no vibrations, less noise) and more efficient. (Propeller efficiency goes up to the nominal 70-90% level.)

It is known, blades can be upgraded to the adaptive design without requiring major changes to the existing drive system. In contrast to the option of swapping gearboxes, an upgrade to the adaptive rotor blades offers a real solution.

(Tuesday, 06 May 2025, The Aviationist)

Possibly, these days flying a V-22 is like driving a top level car with some very bad tires mounted. Driver may feel the whole car is trash, unsafe and needs to be disposed of entirely. But, just put on the right tires, and the car becomes unrecognizable. Unrecognizably fine!

Blades used for proprotors of the V-22s today, correspond to the stone age of aviation. Stiff body of these blades normally allow a narrow speed range only. (Width of the range less than about 0.3 Mach – even with maximal pitch control enabled.) When pressed for higher or lower speeds, blades will stall heavily, and propeller efficiency goes down terribly. (Operation may happen well below 10% efficiency!)

Tiltrotor technology has been extremely demanding on rotors and propellers. Traditional blades limit and do not allow use of this modern technology to its full capacity.

Noise and vibrations that have been a well-known plague to the operation of the V-22s are products of the imperfections of the proprotor blades only. So is the VRS that notoriously keeps causing mishaps.

The message is: change the tires and keep the car! Or rather: upgrade to adaptive blades and keep the V-22!