Compatible **Modifications**

As more complex modifications become the norm, the interactions between different systems also become more complex. Before modifying, make sure you know whether your mods will work together.

Modifications are generally approved independently of each other, with the assumption that the installation modifies a 'stock-standard' aircraft.

Installers sometimes do not fully take into account the interaction and compatibility of their modification with other systems, unless the installation documentation explicitly refers to it.

The installer of any modification, whether through a supplemental type certificate (STC) or not, should always consider compatibility.

"This good practice is applicable to any modifications on an aircraft," notes CAA Airworthiness Engineer, Alessio Caldara.

Avionics

Avionics modifications are increasingly popular, but the interaction between devices needs careful consideration.

GNSS antennas can, for example, affect the performance of ADS-B Out equipment.

An autopilot system can be affected by modifications that change flight characteristics like lift, drag, weight, or thrust.

Electrical load analysis is also essential.

"The electrical load drawn by avionics also needs to be considered," says Alessio, "because adding additional systems may reduce the amount of power available in an emergency."

For issues such as wiring separation and chafing, the OEM's recommendations for Electrical Wiring Interconnect System (EWIS) must also be considered.

It's not just hardware interoperability that can cause problems. Software updates on one system may also unintentionally impact on another, or a software upgrade might be necessary to ensure compatibility.

Unintended consequences

Sometimes the compatibility issues are less than obvious.

Think of the heat generated by a searchlight that you may have installed next to float bags on a helicopter, or a structural change that stops de-icing boots from expanding.

Even two systems that are totally unrelated may be causing harm to each other.

"These problems are not unique to New Zealand," says Alessio. "In 2016, the FAA released its AC 20-188 *Compatibility of Changes to Type Design Installed on Aircraft,* which provides engineering guidance to installers around compatibility."

Responsibilities

The owner or operator of an aircraft should always ensure that a compatibility determination is made when they request a modification.

That is best discussed before the installation, because the work could result in an aircraft that isn't able to be returned to service.

Installers need to assess the functional and operational compatibility of the modification. If that's outside their ability, they need to seek engineering support from a third party like the STC holder, or a Part 146 Aircraft Design Organisation.

Compatibility assessments should also be made for every optional configuration offered by your mods, or when an aircraft is converted for operation in different roles.

"The Acceptable Technical Data can be used for installation on your aircraft only after the modification has been declared compatible with the present aircraft configuration," says Alessio.

Non-compatible installations may require additional design changes, changes to aircraft limitations, or changes to the flight manual. ■

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