U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Compatibility of Changes to Type Design Installed on Aircraft

Date: 12/09/16 **AC No:** 20-188

Initiated By: AIR-100

1 **PURPOSE.**

Federal Aviation Administration (FAA) Order 8110.4C, *Type Certification*, paragraph 4-19(f)(2), requires the Limitations and Conditions section of a multiple STC to include the statement:

> "The installer must determine whether this design change is compatible with previously approved modifications."

This advisory circular (AC) provides engineering guidance to installers on determining the compatibility of the installation of approved changes to type design where previously approved changes to type design are installed on aircraft. Previously approved changes include other major or minor changes to type design approved under Title 14 of the Code of Federal Regulations (14 CFR) part 21, *Certification Procedures for Products and Parts*. Alterations or repairs to aircraft approved pursuant to part 43, *Maintenance, Preventive Maintenance, Rebuilding, and Alteration* should also be considered. Although this AC focuses on the installation of changes to type design approved via supplemental type certificate (STC) or amended type certificate where previously approved changes exist, the principles and guidance are applicable to alterations approved in a manner other than STC or amended type certificate where previously approved changes exist.

2 **AUDIENCE.**

This AC affects persons and organizations who own, operate, or maintain aircraft.

3 **EFFECTIVE DATE.**

This AC is effective 12/07/2016.

4 COMPATIBLE INSTALLATIONS.

4.1 Compatibility is ensuring that changes to type design approved separately do not create a safety issue if installed together.

4.2 The following, although not an all-inclusive list, provides examples of combinations of installations which have the potential to create compatibility issues; for example, the installation of:

- Any combination of installations that create a non-compliance to the certification basis for the aircraft,
- Autopilots on aircraft with other modifications that alter flight characteristics, including the lift, drag, weight, and thrust of aircraft (do not discount the effect of the combination of modifications which individually increase the drag of aircraft),
- Navigation and communication equipment,
- Multiple accessories mounted on the skid tubes of helicopters,
- Changes to or the introduction of new operating limitations or procedures. This would include multiple flight manual supplements affecting the same or interconnecting systems,
- Multiple modifications to the same structure (the superposition of stresses, changes in stiffness, or changes to safe life, fail safe, or damage tolerance characteristics should be considered),
- Any combination of weight, speed, or type design configuration changes,
- Any software changes in interdependent systems,
- Modifications to light-emitting or reflecting characteristics (internal and/or external) of aircraft with night vision imaging system (NVIS) lighting systems,
- Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment with previously installed GPS antennas or upgrades of Global Positioning System (GPS) antennas/navigators that may affect ADS-B Out function (performance),
- Highly integrated avionics components (e.g., one multi-function display (MFD) and one primary-function display (PFD) where interconnectivity was changed, added, or removed),
- Modifications to items that affect ditching certification (e.g., replacement windows with different construction or push-out window STCs, changes to waterline location, or the installation or relocation of equipment, such as valves, below the waterline),
- Equipment where use under normal operation could damage other equipment in close proximity (e.g., heat from a searchlight mounted next to skid-mounted float bags on helicopters),
- Any modification near attitude and heading reference system (AHRS) magnetic field sensors (flux valves, etc.),

- Multiple modifications to the same primary structure that include the use of blind fasteners,
- Multiple changes affecting ice protection system operation,
- De-icing boots with structural changes that could impinge on the ability of the boots to expand,
- Multiple flammable fluid lines/tubing/hoses that utilize new types of materials,
- Multiple installations that may affect the ability to inspect the aircraft or aircraft systems as required,
- Multiple changes to the interior aircraft configuration (seats, emergency lighting, etc.) which may affect egress and occupant protection,
- Multiple modifications installing equipment that applies electrical loads on the same aircraft electrical generating system, or
- Multiple modifications installing equipment that requires an assessment of electromagnetic compatibility.

4.3 Type certificate holders and supplemental type certificate holders may be able to provide technical information to help identify a compatibility issue. Other resources include aircraft type clubs, FAA designees, or holders of an FAA Organization Designation Authorization (ODA).

4.4 An additional consideration is the compatibility of the certification basis of multiple installations. The differences in the certification basis of multiple installations that are installed with similar areas affected by the change (reference AC 21.101) may create a compatibility issue. For example, installation of a structural change that includes damage tolerance in the certification basis with a different structural change that has fail safe requirements in the certification basis.

5 GUIDANCE FOR THE OWNER OR OPERATOR.

5.1 When requesting an installation of a change to type design on aircraft, the owner or operator should ensure that a compatibility determination is made. It is also important for the owner or operator to consider the impact on returning aircraft to service if the installation is determined to be non-compatible.

5.2 It is recommended that the owner or operator discuss the compatibility of an intended installation of a change to type design with the installer prior to starting the installation on the aircraft. Waiting until the installation on an aircraft has started or until the aircraft with the installation is presented for return to service may result in an aircraft that is ineligible for return to service. If the installer determines that the new installation is not compatible, then the aircraft may not be approved for return to service until the issue is resolved.

5.3 The aircraft owner or operator should provide aircraft records to the installer to determine if there are other installed changes to type design that may present compatibility issues with proposed installations.

5.4 The owner or operator should obtain resolution of all non-compatible aircraft installations.

6 INSTALLER RESPONSIBILITIES.

6.1 Persons installing a change to type design should assess functional and operational compatibility with previous changes to type design to ensure changes will not introduce adverse characteristics, such as physical interference, or impact on the operation of other previous alterations.

6.2 When the compatibility assessment exceeds installer capability, the installer should enlist necessary engineering support (e.g. the STC holder or appropriately rated Designated Engineering Representative) to make that determination.

6.3 The installer should notify the owner or operator of any identified compatibility issues.

6.4 A compatibility assessment of installed changes to type design should be conducted whenever an aircraft is converted for operation into a different role or when a change in its basic configuration has occurred; for example, changing from a:

- Cargo to passenger configuration,
- Landplane to seaplane configuration, or
- Normal utility to restricted category, etc.

6.5 When compatibility assessments include a modification that allows for multiple optional configurations, the compatibility should be assessed for each combination of possible configurations with the other modifications.

6.6 Compatibility determination is expected, as defined in the Note on page 2 of FAA Form 337, Major Repair and Alteration.

7 RESOLVING NON-COMPATIBLE MODIFICATIONS.

7.1 Non-compatible installations may require substantiation data, additional alterations to aircraft, additional changes to type design, changes to aircraft limitations, or changes to the flight manual to establish compatibility. All type design data and flight manual changes require FAA approval.

Note: Although the installer may determine an installation is not compatible with previously installed changes to type design, it is not the installer's responsibility to develop any necessary design changes or data to resolve non-compatible designs.

7.2 If alterations are required to establish compatibility, then the Major Alteration Job Aid should be consulted to determine the type of approval needed for the data.

7.3 Data necessary to establish compatibility may need FAA approval or may need to be acceptable to the FAA. Reference AC 43-210A, *Standardized Procedures for Obtaining Approval of Data Used in the Performance of Major Repairs and Major Alterations,* and AC 43.13-1B, *Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair,* for more information about obtaining approved and acceptable data.

7.4 A person or organization that provides technical information related to compatibility should specify which changes to type design the information addresses and whether the data is approved by the FAA.

7.5 When operating limitations inherent to specific installations are conflicting, the issue must be evaluated to determine the appropriate operating limitations. The development of a new flight manual supplement may be required to prescribe the operating envelope applicable to the aircraft configured with multiple changes to type design installed. In all cases, new operating limitations must be FAA approved.

7.6 Once the non-compatibility of designs is resolved, the installer is responsible to determine that the new installation, in combination with any necessary design changes, is compatible with previous installations.

8 WHERE TO FIND THIS AC.

8.1 You may find this AC at http://www.faa.gov/regulations_policies/advisory_circulars.

8.2 If you have any suggestions for improvements or changes, you may use the template provided at the end of this AC.

Richard E. Jennings
Acting Manager, Design, Manufacturing, &
Airworthiness Division
Aircraft Certification Service

Appendix A. Definitions

All definitions are provided solely for the context of this advisory circular.

Installer. An installer is anyone who replaces or adds articles, parts, or materials used in the alteration of any aircraft that has a United States airworthiness certificate or is responsible to ensure airworthiness prior to returning an altered aircraft to service.

Modification. A modification is a change to type design installed on the aircraft.

Type Club. A type club is an organized group of people with a common interest in a particular aircraft type or brand of aircraft. Information is a type club's primary resource to members and a type club often provides technical expertise for aircraft models that no longer have an active design approval holder supporting continued operational safety. In some cases, a type club may even be the design approval holder of the aircraft itself.

Appendix B. Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by (1) complete the form online at https://ksn2.faa.gov/avs/dfs/Pages/Home.aspx or (2) emailing this form to 9-AWA-AVS-AIR-DMO@faa.gov

Subject: AC 20-188 Date: _____

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:

☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

☐ Other comments:

☐ I would like to discuss the above. Please contact me.

Submitted by: _____ Date: _____