



U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

DRAFT

AC 23-24

AIRWORTHINESS COMPLIANCE CHECKLISTS FOR COMMON PART 23 SUPPLEMENTAL TYPE CERTIFICATE (STC) PROJECTS

DRAFT

February 28, 2005

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FOREWORD

The Advisory Circular (AC) system became effective in 1962. It provides a single, uniform agency-wide system that the Federal Aviation Administration (FAA) uses to deliver advisory material to FAA customers, industry, the aviation community, and the public. This AC describes one method that may be used to generate compliance checklists. These compliance checklists may be used to fulfill some of the requirements for a Certification Plan as part of a part 23 Supplemental Type Certification project.

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Manager, Small Airplane Directorate
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U.S. Department
of Transportation
**Federal Aviation
Administration**

Advisory Circular

Subject: AIRWORTHINESS
COMPLIANCE CHECKLISTS
FOR COMMON PART 23
SUPPLEMENTAL TYPE
CERTIFICATE (STC) PROJECTS

DRAFT Date: 2/28/05

AC No.: 23-24

Initiated By: ACE-100

Change:

1. What is the purpose of this Advisory Circular (AC)?

This AC provides information to generate compliance checklists for some common Title 14 of the Code of Federal Regulations (14 CFR) part 23 Supplemental Type Certificate (STC) projects. These checklists may be used to fulfill some of the requirements for a Certification Plan for STC projects. The standard compliance checklist provided with this AC shows typical methods of compliance with the regulations and cross-references other related guidance material. Guidance specific to STCs for autopilot, engine, propeller, auxiliary fuel tank, and gross weight changes is included in paragraphs 8 through 15 of this AC. The checklists generated using the information in this AC are meant to complement the guidance in the Guides for Certification of Part 23 Airplanes (ACs 23-8B, 23-16A, 23-17A, and 23-19) and other more project-specific guidance. The checklists may contain complete certification requirements or may be used as a starting place when applying for an STC that may be beyond the scope of the checklists. This AC describes an acceptable means, but not the only means, of compliance with 14 CFR part 23. The material in this AC is neither mandatory nor regulatory in nature and does not constitute a regulation.

2. Who is affected by this AC?

a. Persons applying for STCs for the common changes covered in this AC may use the compliance checklists generated using this AC as a starting point to generate a project-specific compliance checklist for discussions with their geographical Aircraft Certification Office (ACO). The list of ACOs with their addresses and phone numbers may be found on the Internet at www.faa.gov/certification/aircraft/acochart.htm.

b. Federal Aviation Administration (FAA) engineers working on STC projects for the common changes covered in this AC may also use the compliance checklists generated using this AC as a basis for discussions with the persons applying for the STC.

3. What documents does this AC supersede?

This AC does not supersede any existing documents.

4. What other publications are related to this AC?

The publications listed in these paragraphs are a representative selection of documents that are relevant to the certification of part 23 airplanes. A complete list of documents is available at the Internet addresses listed below.

a. Regulations:

In general, this AC covers 14 CFR part 23 regulations in their entirety. Specific regulations that are applicable to the common STC projects referenced in this AC are listed in the compliance checklists in the appendix. The following regulations are also related and are available on the Internet at www.airweb.faa.gov/far.

- 14 CFR part 21, subpart E Supplemental Type Certificates
- 14 CFR part 33 Airworthiness Standards: Aircraft Engines
- 14 CFR part 34 Fuel Venting and Exhaust Emission Requirements for Turbine Engine Powered Airplanes
- 14 CFR part 35 Airworthiness Standards: Propellers
- 14 CFR part 36 Noise Standards: Aircraft Type and Airworthiness Certification

b. FAA Orders and ACs available at no charge:

Copies of the current FAA orders and ACs listed below may be obtained at no charge from:

U.S. Department of Transportation
Subsequent Distribution Office, M-30
Ardmore East Business Center
3341Q 75th Avenue
Landover, MD 20795

Telephone: 301-322-4779

Facsimile: 301-386-5394

These documents are also available on the Internet at www.airweb.faa.gov/orders and www.airweb.faa.gov/ac respectively.

| | |
|-------------------|---|
| FAA Order 8110.4B | Type Certification |
| FAA Order 8110.48 | How to Establish a Certification Basis for Changed Aeronautical Products |
| AC 20-66A | Vibration and Fatigue Evaluation of Airplane Propellers |
| AC 20-119 | Fuel Drain Valves |
| AC 20-122A | Anti-misfueling Devices: Their Availability and Use |
| AC 20-124 | Water Ingestion Testing for Turbine Powered Airplanes |
| AC 20-128A | Design Consideration for Minimizing Hazards Caused by Uncontained Turbine Engine and Auxiliary Power Unit Rotor Failure |
| AC 20-130A | Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors |
| AC 20-135 | Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards, and Criteria |
| AC 20-138A | Airworthiness Approval of Global Navigation Satellite System (GNSS) Equipment |
| AC 20-146 | Methodology for Dynamic Seat Certification by Analysis for Use in Part 23, 25, 27, and 29 Airplanes and Rotorcraft |
| AC 21-40 | Application Guide for Obtaining a Supplemental Type Certificate |
| AC 21.101-1 | Establishing the Certification Basis of Changed Aeronautical Products |
| AC 23-2 | Flammability Tests |
| AC 23-10 | Auxiliary Systems for Reciprocating and Turbine Powered part 23 Airplanes |
| AC 23-14 | Type Certification Basis for Conversion from Reciprocating Engine to Turbine Engine-Powered Part 23 Airplanes |
| AC 23-19 | Airframe Guide for Certification of Part 23 Airplanes |
| AC 23.562-1 | Dynamic Testing of Part 23 Airplane Seat/Restraint Systems and Occupant Protection |
| AC 23.607-1 | Self-Locking Nuts on Bolts Subject to Rotation |
| AC 23.629-1B | Means of Compliance with Section 23.629 "Flutter" |
| AC 23.1309-1C | Equipment, Systems, and Installations in Part 23 Airplanes |
| AC 23-1311-1A | Installation of Electronic Displays in Part 23 Airplanes |
| AC 33-2B | Aircraft Engine Type Certification Handbook |

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|---------------|---|
| AC 33.28-1 | Compliance Criteria for 14 CFR § 33.28, Aircraft Engines, Electrical and Electronic Engine Control Systems |
| AC 33.28-2 | Guidance Material for 14 CFR § 33.28, Reciprocating Engines, Electrical and Electronic Engine Control Systems |
| AC 35.37-1A | Composite Propeller Blade Fatigue Substantiation |
| AC 36-1H | Noise Levels for U.S. Certificated and Foreign Aircraft |
| AC 36-2C | Measured or Estimated (Uncertificated) Airplane Noise Levels |
| AC 36-3H | Estimated Airplane Noise Levels in A-Weighted Decibels |
| AC 36-4C | Noise Standards: Aircraft Type and Airworthiness Certification |
| AC 183.29-1HH | Designated Engineering Representatives |

c. ACs available for purchase:

Copies of the current ACs listed below may be purchased from:

Superintendent of Documents
P.O. Box 371954
Pittsburgh, PA 15250-7954

These documents are also available on the Internet at www.airweb.faa.gov/ac.

| | |
|-----------|--|
| AC 23-8B | Flight Test Guide for Certification of Part 23 Airplanes |
| AC 23-16A | Powerplant Guide for Certification of Part 23 Airplanes and Airships |
| AC 23-17A | Systems and Equipment Guide for Certification of Part 23 Airplanes |
| AC 23-19 | Airframe Guide for Certification of Part 23 Airplanes |

d. Policy Statements:

Copies of the current Policy Statements listed below may be obtained at no charge from:

Small Airplane Directorate Regulations and Policy Branch
901 Locust St., Room 301
Kansas City, MO 64106

These documents are also available on the Internet at www.airweb.faa.gov/policy.

| | |
|----------------------|--|
| PS-ACE100-2001-004 | Guidance for Reviewing Certification Plans to Address Human Factors for Certification of Part 23 Small Airplanes |
| PS-ACE100-2002-007 | Final Policy for Pitot Heat Indication Systems for 14 CFR, Part 23, § 23.1326(b)(1) |
| PS-ACE100-2002-008 | Propeller Testing V_d Versus V_{NE} |
| PS-ACE100-2004-10023 | Final Policy Statement for Flammability of Electrical Wiring Used in Part 23 Aircraft per 14 CFR, part 23, §§ 23.853 and 23.1359 |

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AIRWORTHINESS COMPLIANCE CHECKLISTS FOR COMMON PART 23 SUPPLEMENTAL TYPE CERTIFICATE (STC) PROJECTS

1. How does this Advisory Circular (AC) relate to other Federal Aviation Administration (FAA) ACs and Policy Statements?

a. This AC provides guidance on the applicable sets of regulations for some common STC projects and a standard checklist to use in creating a project-specific checklist. The standard checklist shows the typical methods of compliance with the regulations and cross-references other related guidance material. This AC is organized by topic to address some common STC projects and is to be used in conjunction with other published guidance described in 1.b. and 1.c. below.

b. The Small Airplane Directorate has published Guides for Certification of Part 23 Airplanes covering broad sections of Title 14 of the Code of Federal Regulations (14 CFR) part 23 regulations (i.e. Structures, Systems, Powerplant, and Flight Test). These Guides for Certification of Part 23 Airplanes (i.e. ACs 23-8B, 23-16A, 23-17A, and 23-19) are organized to provide guidance for showing compliance with individual regulations.

c. The Small Airplane Directorate has published ACs and Policy Memoranda that address specific airplane installations (i.e. AC 23-10, AC 23-14, etc). These documents provide guidance for showing compliance with the sets of regulations applicable to specific airplane design changes and installations.

2. What common STC projects does this AC address?

a. Review of databases for STCs and Certification Project Notices (CPNs) initiated since 2002 shows the five most common categories of changes over this time period are:

(1) Automatic Flight Control Systems installations, including autopilot installations with electric trim;

(2) Engine installations, including total engine replacements, horsepower (hp) increases, using different engine mounts, adding Full Authority Digital Engine Controls (FADEC), cowling modifications, and adding turbochargers;

(3) Propeller installations, including spinner changes and new propellers with different diameters, different number of blades, and variable pitch;

(4) Fuel systems installations, including the addition of auxiliary fuel tanks/cells, fuel filters and flow transducers, annunciators, indicators and pumps, and adding tip tanks; and

(5) Airplane gross weight increases.

b. These categories encompass many different potential airplane changes. This AC covers the following specific STC projects. In the future, checklists may be added to this AC to cover other specific STC projects.

- (1) Installation of an autopilot system;
- (2) Installation of a reciprocating engine with increased horsepower;
- (3) Installation of a turbine engine with increased horsepower;
- (4) Installation of turbine engines to replace reciprocating engines;
- (5) Installation of a different propeller (simple);
- (6) Installation of a different propeller (complex);
- (7) Installation of auxiliary fuel tanks; and
- (8) Increase in the airplane gross weight.

3. Where can the common STC project checklists be found?

A standard checklist is provided in Appendix 1. Paragraphs 8 through 15 of this AC list the basic regulations applicable to each of the different common STC projects. This information may be used to generate a checklist for the project as described in paragraphs 5, 6, and 7. The checklists generated from this AC are also available on the Internet at www.faa.gov/certification/aircraft/aceAirworthinessComplianceChecklists.htm in a format that allows the user to fill the forms in on their computer.

4. How were the standard compliance checklist and the lists of applicable regulations for these common STC projects developed?

The baseline compliance checklist and the lists of applicable regulations for each of the common STC projects were developed from checklists used by various ACOs on past and present STC projects and from current guidance.

5. How should the compliance checklists in this AC be used in certification projects?

Order 8110.4B and AC 21-40 describe the STC application process that begins with the applicant submitting a completed FAA Form 8110-12 along with a Certification Plan. A compliance checklist may be used to fulfill some of the requirements for the Certification Plan. The information in this AC may be used as a starting point to generate a project-specific compliance checklist for some common STC projects. This checklist may be submitted as part of the Certification Plan providing applicants and ACO engineers a communication tool to begin the project.

6. Should these checklists be combined into one for projects that cover more than one of these changes?

Yes, the requirements for each of the changes should be combined into a single checklist if the project includes more than one of the changes listed in this AC. For example, adding auxiliary fuel tanks could involve a gross weight increase. In such cases, it is prudent to plan the certification program to show compliance to the applicable rules for these changes at the same time.

7. How should the standard checklist be filled in to generate a checklist specific to a project?

Figures 1 and 2 show the first and second page of the standard compliance checklist from Appendix 1 of this AC. The following paragraphs describe the information to be entered into the checklist with the letters of the paragraphs below corresponding to the circled letters in the figures. Template checklists for each of the common STC projects listed in paragraphs 8 through 15 of this document are available at www.faa.gov/certification/aircraft/aceAirworthinessComplianceChecklists.htm. The regulations shown in the standard and template checklists have not been expanded to show all sub-paragraphs. Where the method of compliance differs between sub-paragraphs of the same regulation, the checklist should be expanded to show the sub-paragraphs and the methods of compliance for each. Figure 3 shows an example of an expanded checklist entry.

- a. When an applicant initially uses the checklist, this field will be blank. The project number will be assigned by the ACO when the application for the STC is accepted.
- b. Enter the name of the originator of the completed checklist.
- c. Enter the date of the latest checklist revision.
- d. Enter the revision level of the latest checklist. The applicant may choose any method to track this, provided it can be used to distinguish different versions. For example, sequential numbering/lettering for each new version of the checklist may be used.
- e. Enter the make of the airplane to receive this STC (for example, Cessna, Piper, etc.).
- f. Enter the complete model number of the airplane to receive this STC, as shown on the Type Certificate Data Sheet (TCDS) (for example, C150, PA-32-260, etc.).
- g. Enter the number of the TCDS for the airplane make and model listed in d and e. The TCDS information may be found on the Internet at www.airweb.faa.gov/TCDS.
- h. Enter the original certification basis of the airplane. It is acceptable to reference the TCDS for the airplane, as it lists the original certification basis.
- i. Enter the proposed certification basis for this STC project. Refer to AC 21-101-1 and FAA Order 8110.4B for guidance in determining the proposed certification basis.
- j. Check the appropriate box to indicate whether the proposed STC is for one serial number only or if it will be for duplication on other aircraft.

k. Enter a brief description of the modification similar to that stated on FAA Form 8110-12 (found in FAA Order 8110.4B). A complete description of the change will appear in the certification plan provided to the ACO as described in FAA Order 8110.4B.

l. Enter the page number and the number of pages.

m. Enter the applicable amendment level of the regulations to be used as the Certification Basis for the STC.

n. Enter the method or combination of methods of compliance that will be used to show compliance with the regulations. An entry should be made in the checklist for each regulation or sub-paragraph as explained in paragraph 7 above. The regulations listed in paragraphs 8 through 15 are considered the minimum required for showing compliance. A determination of applicability to the project must be made for all of the regulations. The standard checklist in Appendix 1 lists typical methods of compliance that have been acceptable for other STC projects in the past. Other combinations of methods may be required depending on the unique features of the project. Verify the appropriateness of the methods listed and modify them to reflect the certification plan for the specific STC project. When determining if additional regulations are required beyond those listed on the checklist, make sure to consider the impact of the airplane changes on areas such as structural integrity, performance, controllability, and human factors. See FAA Policy Statement PS-ACE100-2001-004 for guidance that addresses human factors considerations. Use the following definitions when filling in this column. A more detailed description of the method of compliance (i.e. hand calculations or finite element model analysis) should be included in any compliance plans referenced in the checklist plan column and remarks column described in paragraphs 7.o and 7.q respectively.

(1) Flight Test (FT) – This method of compliance is a test of the airplane by operating it in the air.

(2) Ground Test (GT) – This method of compliance includes component bench testing, testing of simulated airplane systems, and ground testing of the airplane. These tests may be precursors to a flight test.

(3) Analysis (AN) – This method of compliance includes a quantitative or qualitative assessment, as appropriate, of systems or components. An analysis may be a precursor to ground and flight tests as well as the validation of a design. In all cases, for an analysis to be accepted for showing compliance to the regulations, it must be shown to be valid by previous experience or by test.

(4) Design (DE) – This method of compliance encompasses the inherent features of a system or component where compliance with the applicable regulations is shown by inspection of airplane hardware, the drawings, the bill of materials, or other documentation, such as material specifications.

(5) Similarity (SI) – This method of compliance is a comparison between a previously certificated design and the proposed design. The intent is to show that these designs are the same in all aspects that relate to showing compliance with the applicable regulation, such that the proposed design will perform the same or better than the previously certificated design. The

applicant must account for any differences in the regulations if the amendment levels of the regulations are not the same for the two designs.

(6) Not Applicable (N/A) – This denotes that the specific regulation does not apply to the design or modification for this STC; therefore, a showing of compliance is not necessary. Enter the reason the rule is not applicable in the “Applicable Guidance, References, and Remarks” column of the checklist described in paragraph 7.q. below.

o. Enter the plan, drawing, and report numbers that will be used to document the showing of compliance. The items referenced here should contain sufficient detail to show compliance to the rules.

p. Enter the name and designee number of the Designated Engineering Representatives (DERs) who will be finding/recommending compliance with each of the applicable regulations. The FAA encourages applicants to use DERs in their projects. The DERs typically provide their services to applicants for a fee. A directory of DERs is available in AC 183.29-1HH. An updated electronic directory and additional information concerning DERs may be found on the Internet at www.faa.gov/certification/aircraft/av-info/dst/DER_content.htm. The compliance checklist should be coordinated with the DERs for their concurrence before submitting it to the ACO.

q. Enter the applicable guidance to be followed as well as other references and remarks to clarify how compliance will be shown with the applicable regulations. If N/A is entered as a Method of Compliance, enter the reason the rule is not applicable in this column. The checklist in this AC lists the latest revisions of other ACs with applicable guidance in this column. These revisions are current as of the release date of AC 23-24. When creating a project-specific checklist, the latest revisions of these documents should be referenced in this column and may be found on the Internet at www.airweb.faa.gov/AC. Other guidance, in the form of ACs and Policy Statements, may also be applicable and should be referenced as appropriate.

| Type Certificate Compliance Checklist | |
|--|---|
| Project Number: a _____ | Date: c _____ |
| Originator: b _____ | Revision: d _____ |
| <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> e Make: _____ </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> f Model: _____ </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> g TCDS #: _____ </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> Original Certification Basis: h </div> <div style="border: 1px solid black; padding: 2px;"> Proposed Certification Basis: i </div> | Description of Change: One-only STC <input type="checkbox"/> Multiple STC <input type="checkbox"/> j |
| k | |

*Methods of Compliance:
 FT = Flight Test, GT = Ground Test, AN = Analysis, DE = Design, N/A = Not Applicable
 Page ___ of ___ l

Figure 1 – First page of the compliance checklist

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Type Certificate Compliance Checklist

Project Number: a
 Originator: b

Date: c
 Revision: d

| Regulation | Applicable Amendment | Method of Compliance* | Plan, Drawing, Report Number | DER (Name, Number) | Applicable Guidance, References, & Remarks |
|--|----------------------|-----------------------|------------------------------|--------------------|--|
| Title 14 CFR part 23: (CAR 3) | m | n | o | p | q |
| Subpart A -- General | | | | | |
| Section | | | | | |
| 23.1 Applicability. (3.0) | | DE | | | AC 23-8B |
| 23.2 Special retroactive requirements. | | AN, GT | | | |
| 23.3 Airplane categories. (3.20 (less 2nd sent. of (a)(2) and 2nd and 3rd sent. of (b)), 3.20-1, 3.20-2 (1st sent.)) | | DE | | | AC 23-8B |
| Subpart B -- Flight | | | | | |
| GENERAL | | | | | |
| 23.21 Proof of compliance. (3.61, 3.71-1) | | AN, GT, FT | | | AC 23-8B |
| 23.23 Load distribution limits. (3.71) | | DE, AN, FT | | | AC 23-8B |
| 23.25 Weight limits. (3.74, 3.75) | | AN | | | AC 23-8B |
| 23.29 Empty weight and corresponding center of gravity. (3.73 (1st sent.), 3.73-3(b)) | | AN, GT | | | AC 23-8B |

*Methods of Compliance:
 FT = Flight Test, GT = Ground Test, AN = Analysis, DE = Design, N/A = Not Applicable

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Figure 2 – Second page of the compliance checklist

| Regulation | Applicable Amendment | Method of Compliance* | Plan, Drawing, Report Number | DER (Name, Number) | Applicable Guidance, References, & Remarks |
|---------------------------------------|----------------------|-----------------------|------------------------------|--------------------|--|
| 23.1416 Pneumatic de-icer boot system | | AN, DE, GT, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 |
| 23.1416(a) | | AN, GT, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 |
| 23.1416(b) | | GT, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 |
| 23.1416(c) | | DE, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 |
| 23.1419 Ice Protection. (3.712) | | DE, SI, AN, GT, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 |
| 23.1419(a) | | DE, AN, GT, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 The analysis and tests to be conducted must be specified. An exemption may be required for stall speed in icing. |
| 23.1419(b) | | AN, GT, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 The tests to be conducted must be specified, and the actual measurements of the natural icing conditions must be documented |
| 23.1419(c) | | SI, AN | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 |
| 23.1419(d) | | DE, GT, FT | | | AC 23-8B, AC 23-17A, AC 23.1419-2C, AC 20-73, AC 23.143-1 |
| | | | | | |

*Methods of Compliance:
 FT = Flight Test, GT = Ground Test, AN = Analysis, DE = Design, SI = Similarity, N/A = Not Applicable
 Page ___ of ___

Figure 3 – Example of an expanded checklist entry

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8. What are the applicable regulations and guidance for the installation of an autopilot system?

a. This change covers the installation of components associated with an autopilot system including the autopilot mode control and annunciation panel, the autopilot computer, the servos and actuators that drive control surfaces, and the data sources (pressure sensors, attitude data sources, navigation sources, other system interfaces) needed for proper functioning. The certification requirements for these installations are dependent on the type of autopilot system being implemented. AC 23-17A provides additional guidance regarding autopilot installations.

b. There are common certification issues that are related to autopilot installation approvals that need to be addressed, but are not covered in AC 23-17A and other existing guidance. Most of these issues can be related to specific installation aspects and complexity of a particular installation, the interface with existing systems on a particular airplane, and maintenance related issues. These items are dependent on the autopilot design. The following are examples of items that should be considered:

(1) Certification Basis: Advisory Circular 21.101-1 generally classifies autopilot installations as non-significant. Digital autopilot systems frequently are complex enough that this may not be the case. These systems may require additional effort to assure the proper interactions of the software and hardware. Hardware design assurance should also include RTCA/DO-160 testing to make sure the sensors and components being used meet appropriate airworthiness requirements. Other regulations in addition to those listed in paragraph 8.c. below may need to be considered in this case.

(2) System Integration: Current guidance in AC 20.130A and AC 20.138A requires the source of navigation information be annunciated on or near the affected display. For an autopilot installation, the source of navigation data must be clearly annunciated to indicate to the pilot which source is driving the autopilot. This could include a Global Positioning System (GPS) roll steering source, an Instrument Landing System course deviation source, or some other navigation source. The lack of clear annunciation and the subsequent potential for confusion has been a contributing factor to several small airplane accidents. Any new autopilot installation must be integrated with existing navigation systems in a way that is clear to the pilot. The autopilot should be designed to avoid inadvertent mode changes. Also, if a Control Wheel Steering (CWS) function is implemented to allow temporary interrupt of the autopilot for the pilot to reposition the airplane, the CWS switch should not cause inadvertent mode changes.

(3) AFM Limitations on the Autopilot Envelope: Many autopilots are not capable of acceptable control of the airplane in all flight conditions. Frequently, flight manual limitations are used to restrict the use of the autopilot above or below a given airspeed, in certain turbulence conditions, or in certain airplane configurations. Title 14 CFR part 23, § 23.1329 clearly states that the autopilot cannot cause deviations in flight path. This includes the requirement that the autopilot should not be able to drive the airplane into a stalled condition, particularly in icing conditions.

(4) Maintenance Related Issues: The applicant should provide a means to insure proper autopilot rigging with the existing controls system. This would include checking primary and bridled cable tensions to make sure the airplane is rigged properly before and after the installation, and at regular maintenance intervals.

c. The applicable regulations for the installation of an autopilot system should include but are not limited to the following:

(1) Title 14 CFR part 23, subpart B, §§ 23.143, 23.253;

(2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.303, 23.305, 23.307, 23.391, 23.395, 23.397, 23.561;

(3) Title 14 CFR part 23, subpart D, §§ 23.603, 23.605, 23.607, 23.609, 23.611, 23.613, 23.619, 23.625, 23.627, 23.671, 23.672, 23.677, 23.685, 23.689, 23.693, 23.771, 23.777, 23.779, 23.853, 23.867;

(4) Title 14 CFR part 23, subpart F, §§ 23.1301, 23.1307, 23.1309, 23.1311, 23.1321, 23.1322, 23.1325, 23.1329, 23.1335, 23.1351, 23.1357, 23.1359, 23.1365, 23.1367, 23.1381, 23.1431; and

(5) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1529, 23.1541, 23.1555, 23.1581, 23.1583, 23.1585.

9. What are the applicable regulations and guidance for the installation of a reciprocating engine with increased horsepower?

a. This change covers the replacement of a spark ignition reciprocating engine with a different spark ignition reciprocating engine that is able to supply more horsepower. This type of change is done mostly to increase the performance of the airplane in take-off and climb and maintains the airspeed limits of the airplane. These installations may increase the gross weight of the airplane in which case the applicant should refer to the gross weight increase compliance checklist for additional requirements. The impact of the increased horsepower on the noise level should be considered and accounted for per Title 14 CFR part 36. AC 23-19 provides additional guidance regarding modifications involving increased engine power.

b. The need for a limited spin matrix on an STC program is a subjective decision based on the service history of the specific airplane being modified. It is not possible to offer a comprehensive list of when to re-test the spin matrix because of the number of variables to consider. There are instances of airplanes with significant modifications that had little effect on spin recovery, and airplanes with subtle modifications that changed the spin recovery dramatically. If it is determined that the airplane does need to be re-evaluated for spin recovery, then a limited matrix using the middle and edges of the envelope is normally all that is needed to verify the airplane recovers.

c. The following key airplane characteristics and features seem to relate directly to the “stall/spin” or departure accidents, and should indicate the need for more evaluation of the spin characteristics.

(1) **Stall characteristics** - Does the airplane just buffet at full aft control or does it roll off dramatically with no aerodynamic warning? Does the airplane require talented footwork to keep the wings level or could the pilot put their feet on the floor during the stall with little roll-off? An airplane that is resistant to stalling and easy to keep the wings level may not need a spin recovery re-evaluation, but an airplane with poor stall handling qualities and a poor “stall/spin” accident history will need a spin recovery re-evaluation.

(2) **Stick force gradient** - Airplanes with steep stick force gradients are involved in fewer “stall/spin” accidents than airplanes with light force gradients.

(3) **Stall warning** - A stall warning system can reduce the number of “stall/spin” accidents depending on the effectiveness of the system. There are numerous stall warning schemes ranging from the ineffective lights to the very effective stick shakers with warning horns.

d. The following rules-of-thumb have been used with reasonable success since 1972 for airplane changes that increase the power and should be considered when addressing the spin recovery.

(1) Spin tests that are required because of aerodynamic or mass distribution changes will require the use of power (75% Maximum Continuous Power (MCP) / thrust or full throttle, whichever is less) for one full turn into the spin.

(2) Airplanes modified by increasing the installed horsepower (maximum takeoff power) by more than 10% or 25 horsepower, whichever is less, over the original type certificated airplane installed horsepower rating, will require spin testing.

(3) Turbocharged engine installations will be evaluated as follows:

(a) Determine the maximum power available on the original engine at 10,000 feet pressure altitude.

(b) Determine the value of 75% MCP on the new engine.

(c) If the difference between (a) and (b) exceeds either 10% of the original installed horsepower (maximum takeoff power) or 25 horsepower, spin tests will be conducted.

(4) Airplanes modified as described in paragraph 9.d.(2) may accept a de-rated power schedule in lieu of spin testing. The maximum horsepower difference criteria, 10% or 25 horsepower, whichever is less, applies from sea level to the airplane service ceiling. This requires a placard of manifold pressure versus pressure altitude (at rated Revolutions Per Minute (RPM)) corresponding to the maximum allowable horsepower differential between the de-rated engine and the original type certificated engine.

e. Using a limited spin matrix should also be considered if the change to the airplane causes a weight and/or a rotational inertia increase of greater than 10%.

f. The applicable regulations for the installation of a reciprocating engine with increased horsepower should include, but are not limited to, the following:

(1) Title 14 CFR part 23, subpart B, §§ 23.25, 23.33, 23.45, 23.49, 23.65, 23.66, 23.67, 23.75, 23.77, 23.143, 23.145, 23.147, 23.149, 23.155, 23.161, 23.171, 23.175, 23.177, 23.201, 23.203, 23.207, 23.221 (except agricultural and twin engine airplanes), 23.231, 23.233, 23.235, 23.237, 23.239, 23.251, 23.253;

(2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.303, 23.305, 23.307, 23.331, 23.333, 23.335, 23.337, 23.341, 23.361, 23.363, 23.371, 23.479, 23.499, (23.572, 23.573, 23.574, 23.575 as required or if part of original certification basis);

(3) Title 14 CFR part 23, subpart D, §§ 23.601, 23.603, 23.607, 23.609, 23.611, 23.613, 23.619, 23.627, 23.629, 23.735, 23.777, 23.779, 23.781, 23.831, 23.841, 23.863, 23.865, 23.867;

(4) Title 14 CFR part 23, subpart E, §§ 23.901, 23.903, 23.905, 23.907, 23.925, 23.929, 23.933, 23.939, 23.943, 23.951, 23.953, 23.954, 23.955, 23.959, 23.961, 23.991, 23.993, 23.994, 23.995, 23.997, 23.1105, 23.1107, 23.1011, 23.1013, 23.1015, 23.1017, 23.1019, 23.1021, 23.1023, 23.1027, 23.1041, 23.1043, 23.1047, 23.1091, 23.1093, 23.1101, 23.1103, 23.1105, 23.1107, 23.1121, 23.1123, 23.1141, 23.1143, 23.1145, 23.1147, 23.1149, 23.1153, 23.1163, 23.1165, 23.1181, 23.1182, 23.1183, 23.1189, 23.1191, 23.1193, 23.1195, 23.1197, 23.1199, 23.1201, 23.1203;

(5) Title 14 CFR part 23, subpart F, §§ 23.1301, 23.1303, 23.1305, 23.1309, 23.1311, 23.1321, 23.1322, 23.1329, 23.1337, 23.1351, 23.1353, 23.1357, 23.1359, 23.1416, 23.1437, 23.1435, 23.1438;

(6) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1505, 23.1513, 23.1521, 23.1527, 23.1529, 23.1541, 23.1543, 23.1545, 23.1549, 23.1551, 23.1555, 23.1557, 23.1581, 23.1583, 23.1585, 23.1587; and

(7) Title 14 CFR part 36.

10. What are the applicable regulations and guidance for the installation of a turbo-prop engine with increased horsepower?

a. This change covers the replacement of a turbo-prop engine with a different turbo-prop engine that is able to supply more horsepower. This type of change is done mostly to increase the performance of the airplane in take-off, climb, and cruise at altitude. These installations may increase the gross weight of the airplane, in which case, the applicant should refer to the gross weight increase compliance checklist for additional requirements. The impact of the increased horsepower on the noise level should be considered and accounted for per Title 14 CFR part 36. AC 23-19 provides additional guidance regarding modifications involving increased engine power.

b. The need for a limited spin matrix on an STC program is a subjective decision based on the service history of the specific airplane being modified. It is not possible to offer a comprehensive list of when to re-test the spin matrix because of the number of variables to consider. There are instances of airplanes with significant modifications that had little effect on spin recovery, and airplanes with subtle modifications that changed the spin recovery dramatically. If it is determined that the airplane does need to be re-evaluated for spin recovery, then a limited matrix using the middle and edges of the envelope is normally all that is needed to verify the airplane recovers.

c. The following key airplane characteristics and features seem to relate directly to the “stall/spin” or departure accidents, and should indicate the need for more evaluation of the spin characteristics.

(1) **Stall characteristics** - Does the airplane just buffet at full aft control or does it roll off dramatically with no aerodynamic warning? Does the airplane require talented footwork to keep the wings level or could the pilot put their feet on the floor during the stall with little roll-off? An airplane that is resistant to stalling and easy to keep the wings level may not need a spin recovery re-evaluation, but an airplane with poor stall handling qualities and a poor “stall/spin” accident history will need a spin recovery re-evaluation.

(2) **Stick force gradient** - Airplanes with steep stick force gradients are involved in fewer “stall/spin” accidents than airplanes with light force gradients.

(3) **Stall warning** - A stall warning system can reduce the number of “stall/spin” accidents depending on the effectiveness of the system. There are numerous stall warning schemes ranging from the ineffective lights to the very effective stick shakers with warning horns.

d. The following rules-of-thumb have been used with reasonable success since 1972 for airplane changes that increase the power and should be considered when addressing the spin recovery.

(1) Spin tests that are required because of aerodynamic or mass distribution changes will require the use of power (75% MCP or full throttle, whichever is less) for one full turn into the spin.

(2) Airplanes modified by increasing the installed horsepower (maximum takeoff power) by more than 10% or 25 horsepower, whichever is less, over the original type certificated airplane installed horsepower rating, will require spin testing.

(3) Turboprop engine installations will be evaluated as follows:

(d) Determine the maximum power available on the original engine at 10,000 feet pressure altitude.

(e) Determine the value of 75% MCP on the new engine.

(f) If the difference between (a) and (b) exceeds either 10% of the original installed horsepower (maximum takeoff power) or 25 horsepower, spin tests will be conducted.

(4) Airplanes modified as described in paragraph 10.d.(2) may accept a de-rated power schedule in lieu of spin testing. The maximum horsepower difference criteria, 10% or 25 horsepower whichever is less, applies from sea level to the airplane service ceiling. This requires a placard of manifold pressure versus pressure altitude (at rated RPM) corresponding to the maximum allowable horsepower differential between the de-rated engine and the original type certificated engine.

e. Using a limited spin matrix should also be considered if the change to the airplane causes a weight and/or a rotational inertia increase of greater than 10%.

f. The applicable regulations for the installation of a turbo-prop engine with increased horsepower should include, but are not limited to, the following:

(1) Title 14 CFR part 23, subpart B, §§ 23.25, 23.33, 23.45, 23.49, 23.65, 23.66, 23.67, 23.75, 23.77, 23.143, 23.145, 23.147, 23.149, 23.155, 23.161, 23.175, 23.171, 23.177, 23.201, 23.203, 23.207, 23.221 (except agricultural and twin engine airplanes), 23.231, 23.233, 23.235, 23.237, 23.239, 23.251, 23.253;

(2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.303, 23.305, 23.307, 23.331, 23.333, 23.335, 23.337, 23.341, 23.361, 23.363, 23.367, 23.371, 23.479, 23.499, (23.572, 23.573, 23.574, 23.575 as required or if part of original certification basis);

(3) Title 14 CFR part 23, subpart D, §§ 23.601, 23.603, 23.607, 23.609, 23.611, 23.613, 23.619, 23.627, 23.629, 23.735, 23.777, 23.779, 23.781, 23.831, 23.841, 23.863, 23.865, 23.867;

(4) Title 14 CFR part 23, subpart E, §§ 23.901, 23.903, 23.904, 23.905, 23.907, 23.925, 23.929, 23.933, 23.937, 23.939, 23.943, 23.951, 23.953, 23.954, 23.955, 23.959, 23.961, 23.965, 23.973, 23.977, 23.991, 23.993, 23.994, 23.995, 23.997, 23.1011, 23.1013, 23.1015, 23.1017, 23.1019, 23.1021, 23.1023, 23.1027, 23.1041, 23.1043, 23.1045, 23.1091, 23.1093, 23.1103, 23.1105, 23.1107, 23.1111, 23.1121, 23.1123, 23.1141, 23.1143, 23.1145, 23.1149, 23.1153, 23.1155, 23.1163, 23.1165, 23.1181, 23.1182, 23.1183, 23.1189, 23.1191, 23.1193, 23.1195, 23.1197, 23.1199, 23.1201, 23.1203;

(5) Title 14 CFR part 23, subpart F, §§ 23.1301, 23.1303, 23.1305, (23.1307 if necessary to maintain original operating envelope and conditions), 23.1309, 23.1311, 23.1321, 23.1322, 23.1329, 23.1337, 23.1351, 23.1353, 23.1357, 23.1359, 23.1416, 23.1435, 23.1437, 23.1438;

(6) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1505, 23.1513, 23.1521, 23.1527, 23.1529, 23.1541, 23.1543, 23.1545, 23.1549, 23.1551, 23.1555, 23.1557, 23.1581, 23.1583, 23.1585, 23.1587;

(7) Title 14 CFR part 34; and

(8) Title 14 CFR part 36.

11. What are the applicable regulations and guidance for the installation of turbine engines to replace reciprocating engines?

a. This change covers the replacement of reciprocating engines with gas turbine engines (turbopropeller, turbojet, or turbofan). Additional guidance for this may be found in AC 23-14. The impact on the noise levels should be considered and accounted for per Title 14 CFR part 36. Installations that involve the following changes may require additional substantiation and/or additional certification basis requirements that could exceed the scope of this AC.

- (1) primary structure;
- (2) aerodynamics;
- (3) airspeeds;
- (4) mass distribution (may induce whirl mode, flutter, and fatigue life changes);
- (5) maximum weight;
- (6) system changes;
- (7) changes in center of gravity (c.g.) limits; or
- (8) power increases affecting high speed characteristics or airplane handling qualities.

b. Projects such as commuter category or restricted category airplanes will require a more detailed analysis to establish the appropriate certification basis. Installations that increase the gross weight of the airplane should refer to the gross weight increase compliance checklist for additional requirements.

c. The applicable regulations for the installation of a turbine engine to replace a reciprocating engine should include, but are not limited to, the following:

- (1) Title 14 CFR part 23, subpart B, §§ 23.25, 23.33, 23.45, 23.49, 23.65, 23.67, 23.77, 23.145, 23.149, 23.155, 23.161, 23.175, 23.177, 23.201, 23.203, 23.221 (except agricultural and twin engine airplanes), 23.231, 23.233, 23.239, 23.251, 23.253;
- (2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.303, 23.305, 23.307, 23.331, 23.333, 23.337, 23.341, 23.335, 23.361, 23.363, 23.367, 23.371, 23.479, (23.572, 23.573, 23.574, 23.575 as required or if part of original certification basis);
- (3) Title 14 CFR part 23, subpart D, §§ 23.603, 23.627, 23.629, 23.735, 23.777, 23.781, 23.831, 23.863, 23.865;
- (4) Title 14 CFR part 23, subpart E, §§ 23.901, 23.903, 23.904, 23.905, 23.907, 23.925, 23.929, 23.933, 23.937, 23.939, 23.943, 23.951, 23.953, 23.955, 23.959, 23.961, 23.965, 23.973, 23.977, 23.991, 23.993, 23.994, 23.995, 23.997, 23.1011, 23.1013, 23.1015, 23.1017, 23.1019, 23.1021, 23.1023, 23.1027, 23.1041, 23.1043, 23.1045, 23.1091, 23.1093, 23.1103, 23.1111, 23.1121, 23.1123, 23.1141, 23.1143, 23.1145, 23.1149, 23.1153, 23.1155, 23.1163, 23.1165, 23.1181, 23.1182, 23.1183, 23.1189, 23.1191, 23.1193, 23.1203;

(5) Title 14 CFR part 23, subpart F, §§ 23.1301, 23.1303, 23.1305, 23.1307, 23.1309, 23.1321, 23.1322, 23.1329, 23.1337, 23.1351, 23.1353, 23.1357, 23.1359, 23.1435, 23.1438;

(6) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1505, 23.1513, 23.1521, 23.1527, 23.1529, 23.1545, 23.1549, 23.1551, 23.1555, 23.1557, 23.1583, 23.1585, 23.1587;

(7) Title 14 CFR part 34; and

(8) Title 14 CFR part 36.

12. What are the applicable regulations and guidance for the installation of a different propeller (simple)?

a. A simple propeller change consists of replacing an originally certificated propeller with a different propeller that has the same diameter and number of blades as the original propeller. The regulations listed in paragraph 12.b. apply to single engine tractor configuration (Normal Category) airplanes only. The impact on the noise levels should be considered and accounted for per Title 14 CFR part 36. AC 20-66A provides additional guidance regarding propeller installation.

b. The applicable regulations for the installation of a different propeller (simple) should include, but are not limited to, the following:

(1) Title 14 CFR part 23, subpart B, §§ 23.33, 23.53, 23.65, 23.71, 23.75, 23.77, 23.201, 23.251;

(2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.303, 23.305, 23.307, 23.361, 23.363, 23.371, (23.573, 23.574, 23.575 as required or if part of original certification basis);

(3) Title 14 CFR part 23, subpart E, §§ 23.901, 23.905, 23.907, 23.925, 23.1041, 23.1043, 23.1045, 23.1047;

(4) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1521, 23.1529, 23.1541, 23.1549, 23.1559, 23.1581, 23.1583, 23.1585, 23.1587; and

(5) Title 14 CFR part 36.

13. What are the applicable regulations and guidance for the installation of a different propeller (complex)?

a. A complex propeller change consists of replacing an originally certificated propeller with a different propeller that has a different diameter and/or a different number of blades than the original propeller. The regulations listed in paragraph 13.b. apply to single engine (Utility, Acrobatic, or Commuter Category) and twin-engine reciprocating and turbine airplanes only.

The impact on the noise levels should be considered and accounted for per Title 14 CFR part 36. AC 20-66A provides additional guidance regarding propeller installation.

b. The applicable regulations for the installation of a different propeller (complex) should include, but are not limited to, the following:

(1) Title 14 CFR part 23, subpart B, §§ 23.33, 23.45, 23.49, 23.51, 23.53, 23.55, 23.57, 23.59, 23.61, 23.63, 23.65, 23.66, 23.67, 23.69, 23.71, 23.73, 23.75, 23.77, 23.141, 23.143, 23.145, 23.147, 23.149, 23.151, 23.153, 23.155, 23.157, 23.161, 23.171, 23.173, 23.175, 23.177, 23.181, 23.201, 23.203, 23.207, 23.221 (except agricultural and twin engine airplanes), 23.231, 23.233, 23.235, 23.237, 23.239, 23.251, 23.253;

(2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.303, 23.305, 23.307, 23.321, 23.331, 23.333, 23.335, 23.337, 23.341, 23.347, 23.349, 23.351, 23.361, 23.363, 23.367, 23.371, 23.391, 23.393, 23.395, 23.397, 23.399, 23.405, 23.407, 23.409, 23.415, 23.421, 23.423, 23.425, 23.427, 23.441, 23.443, 23.445, 23.455, 23.459, 23.571, (23.573, 23.574, 23.575 as required or if part of original certification basis);

(3) Title 14 CFR part 23, subpart D, §§ 23.629, 23.671, 23.672, 23.673, 23.675, 23.677, 23.679, 23.681, 23.683, 23.685, 23.687, 23.689, 23.691, 23.693, 23.697, 23.699, 23.701, 23.703, 23.721, 23.723, 23.725, 23.726, 23.727, 23.729, 23.731, 23.733, 23.735, 23.737, 23.745, 23.751, 23.753, 23.755, 23.757, 23.771, 23.773, 23.775, 23.777, 23.779, 23.781, 23.783, 23.785, 23.787, 23.791, 23.803, 23.805, 23.807, 23.811, 23.812, 23.813, 23.815, 23.831, 23.841, 23.843, 23.851, 23.853, 23.855, 23.859, 23.863, 23.865, 23.867, 23.871;

(4) Title 14 CFR part 23, subpart E, §§ 23.901, 23.905, 23.907, 23.925, 23.929, 23.933, 23.934, 23.937, 23.939, 23.943, 23.1027, 23.1041, 23.1043, 23.1045, 23.1047, 23.1091, 23.1093, 23.1121, 23.1149, 23.1153, 23.1155;

(5) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1505, 23.1507, 23.1511, 23.1513, 23.1519, 23.1521, 23.1529, 23.1541, 23.1543, 23.1545, 23.1549, 23.1555, 23.1559, 23.1583, 23.1585, 23.1587; and

(6) Title 14 CFR part 36.

14. What are the applicable regulations and guidance for the installation of auxiliary fuel tanks?

a. AC 23-10 provides additional guidance and criteria for the installation of auxiliary fuel tanks. These installations may increase the gross weight of the airplane in which case the applicant should refer to the gross weight increase compliance checklist for additional requirements.

b. Performing spin recovery tests with a limited spin matrix should be considered if the change to the airplane causes a weight and/or a rotational inertia increase of greater than 10%.

c. The applicable regulations for the installation of auxiliary fuel tanks should include, but are not limited to, the following:

(1) Title 14 CFR part 23, subpart B, §§ 23.23, 23.25, 23.29, 23.147, 23.251, 23.157, 23.177, 23.181, 23.201, 23.203, 23.221 (except agricultural and twin engine airplanes);

(2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.303, 23.305, 23.307, 23.321, 23.331, 23.333, 23.335, 23.337, 23.341, 23.343, 23.471, 23.473, 23.479, 23.485, 23.561, 23.571, 23.572, (23.573, 23.574, 23.575 as required or if part of original certification basis);

(3) Title 14 CFR part 23, subpart D, §§ 23.601, 23.603, 23.605, 23.607, 23.609, 23.611, 23.613, 23.619, 23.623, 23.625, 23.627, 23.629, 23.777, 23.787, 23.843, 23.853, 23.863, 23.867;

(4) Title 14 CFR part 23, subpart E, §§ 23.901, 23.903, 23.951, 23.953, 23.954, 23.955, 23.957, 23.959, 23.961, 23.963, 23.965, 23.967, 23.969, 23.971, 23.973, 23.975, 23.977, 23.991, 23.993, 23.994, 23.995, 23.997, 23.999, 23.1001, 23.1011, 23.1183, 23.1189;

(5) Title 14 CFR part 23, subpart F, §§ 23.1301, 23.1305, 23.1309, 23.1337, 23.1351, 23.1357;

(6) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1505, 23.1507, 23.1511, 23.1513, 23.1519, 23.1521, 23.1522, 23.1523, 23.1524, 23.1525, 23.1527, 23.1529, 23.1541, 23.1543, 23.1549, 23.1553, 23.1555, 23.1557, 23.1581, 23.1583, 23.1585, 23.1589; and

(7) Title 14 CFR part 36 if the auxiliary tanks are externally mounted or there is a change to the airplane performance.

15. What are the applicable regulations and guidance to increase the airplane gross weight?

a. Many changes may cause an increase in the airplane gross weight. In many cases, due to changes in the operational requirements of an owner/operator, the need arises to modify and substantiate the structure for an increase in maximum takeoff weight, in maximum landing weight, or in maximum zero fuel weight.

b. An increase in maximum gross weight is in general a large effort, as it requires a complete review of all aspects of the aircraft design. When an airplane is initially designed, the manufacturer determines the gross weight through a process of compromise with the desired performance features. Once the gross weight is fixed, the details of the aircraft are designed around that weight. This means that the basic loads for the aircraft are determined using that

weight, then the control surfaces and wing area are sized for those loads, and the size of the primary structure is determined using the same loads. Most manufacturers over estimate the weight by a small percentage to allow for future growth and unforeseen weight increases. This margin may be used in some cases to allow a small gross weight increase without changing the primary structure, but the applicant must be familiar with all the analysis to determine how much margin exists in the design. It must be kept in mind that this margin may exist to mitigate fatigue and airframe longevity. Gross weight changes that do not involve using this margin in the airframe will require a complete re-analysis of the airplane to determine the effect on basic loads, performance, and primary structural strength.

c. A common misconception is that since an airplane has operated over gross weight and seems to fly fine, the airplane is good for that weight, and should be granted an approval for increased gross weight. The nature of aircraft design is that many airplanes have the capability to takeoff and fly well in excess of their allowable gross weight under the right conditions. However, the airplane will no longer be able to perform in its entire certificated performance envelope. This results in a lower service ceiling, decreased takeoff and climb performance, increased landing distance, a decreased ability to withstand the design g-loads without deformation, and a decrease in fatigue life of the airframe that could result in early structural cracking and possible failure. In the end, this airplane no longer meets the requirements of 14 CFR part 23, and is less safe than the original design even though it seems to fly fine.

d. The applicable regulations to increase the airplane gross weight should include, but are not limited to, the following:

(1) Title 14 CFR part 23, subpart B, §§ 23.21, 23.23, 23.25, 23.29, 23.45, 23.49, 23.51, 23.53, 23.55, 23.59, 23.63, 23.65, 23.66, 23.67, 23.69, 23.71, 23.73, 23.75, 23.77, 23.141, 23.143, 23.145, 23.147, 23.149, 23.151, 23.153, 23.155, 23.157, 23.161, 23.171, 23.173, 23.175, 23.177, 23.181, 23.201, 23.203, 23.207, 23.221 (except agricultural and twin engine airplanes), 23.231, 23.233, 23.235, 23.237, 23.239, 23.251, 23.253;

(2) Title 14 CFR part 23, subpart C, §§ 23.301, 23.302, 23.303, 23.305, 23.307, 23.321, 23.331, 23.333, 23.335, 23.337, 23.341, 23.343, 23.345, 23.347, 23.349, 23.351, 23.369, 23.373, 23.391, 23.395, 23.397, 23.399, 23.405, 23.407, 23.409, 23.415, 23.421, 23.423, 23.425, 23.427, 23.441, 23.443, 23.445, 23.455, 23.459, 23.471, 23.473, 23.479, 23.481, 23.483, 23.485, 23.493, 23.497, 23.499, 23.505, 23.507, 23.509, 23.511, 23.521, 23.523, 23.525, 23.527, 23.529, 23.531, 23.533, 23.535, 23.537, 23.561, 23.562, 23.571, 23.572, 23.573, 23.574, 23.575;

(3) Title 14 CFR part 23, subpart D, §§ 23.601, 23.603, 23.605, 23.607, 23.609, 23.611, 23.613, 23.619, 23.621, 23.623, 23.625, 23.627, 23.629, 23.641, 23.651, 23.657, 23.671, 23.672, 23.673, 23.677, 23.681, 23.683, 23.687, 23.689, 23.691, 23.693, 23.721, 23.723, 23.725, 23.726, 23.727, 23.731, 23.733, 23.735, (23.737 if part of type design), 23.751, 23.753, 23.755, 23.757;

(4) Title 14 CFR part 23, subpart G, §§ 23.1501, 23.1505, 23.1507, 23.1511, 23.1513, 23.1519, 23.1521, 23.1527, 23.1529, 23.1541, 23.1557, 23.1563, 23.1567, 23.1581, 23.1583, 23.1585, 23.1587, 23.1589; and

(5) Title 14 CFR part 36.

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APPENDIX 1 – STANDARD COMPLIANCE CHECKLIST

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