

FAA-H-8083-30B-ATB
PEER REVIEWED EDITION

Airframe & Powerplant Mechanics

GENERAL HANDBOOK



AIRFRAME & POWERPLANT MECHANICS

GENERAL HANDBOOK

2023

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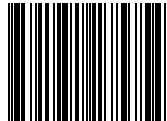
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PREFACE

The Aviation Maintenance Technician Handbook–General (FAA-H-8083-30B) was developed as one of a series of three handbooks for persons preparing for mechanic certification with airframe or powerplant ratings, or both. It is intended that this handbook will provide basic information on principles, fundamentals, and technical procedures in the subject matter areas common to both the airframe and powerplant ratings. Emphasis in this volume is on theory and methods of application.

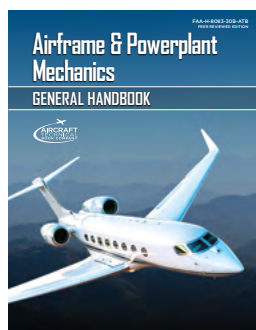
The handbook is designed to aid students enrolled in a formal course of instruction preparing for FAA certification as a maintenance technician as well as for current technicians who wish to improve their knowledge. This volume contains information on mathematics, aircraft drawings, weight and balance, aircraft materials, processes and tools, physics, electricity, inspection, ground operations, and FAA regulations governing the certification and work of maintenance technicians. New to this volume is a section addressing how successful aviation maintenance technicians incorporate knowledge and awareness of ethics, professionalism and human factors in the field.

Because there are so many different types of airframes and powerplants in use today, it is reasonable to expect that differences exist in the components and systems of each. To avoid undue repetition, the practice of using representative systems and units is implemented throughout the handbook. Subject matter treatment is from a generalized point of view, and should be supplemented by reference to manufacturers’ manuals or other publications if more detail is desired. This handbook is not intended to replace, substitute for, or supersede official regulations or the manufacturers’ instructions.

The companion handbooks to Aviation Maintenance Technician Handbook–General (FAA-H-8083-30B) are the Aviation Maintenance Technician Handbook–Airframe (FAA-H-8083-31B (as amended)), and the Aviation Maintenance Technician Handbook–Powerplant (FAA-H-8083-32B (as amended)).

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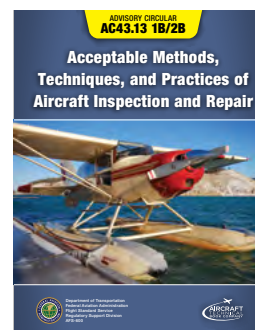
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CORRECTION LOG

About these corrections: Aircraft Technical Book Company, along with a team of Part 147 instructors, has reviewed the content of this Handbook as published by the FAA. This page lists errors from the original publication that have been corrected in this ATB edition. We do recognize that we may not have caught all the errors. If you find an additional error, discrepancy, or contradiction in this book, please contact us at info@actechbooks.com so that we may review your finding and make the appropriate correction.

- 1-6 Replaced existing image with standard fire triangle for clarity.
- 1-16 Stated that a fast EGT rise is an indicator of a hot start.
- 1-18 Modified drawing for improved clarity.
- 1-26 Added Jet-A to fuel color chart and specified that grade 100/130 is green. Identified discontinued grades of fuel.
- 2-14 Included DAMIs under representative types.
- 3-4 Added missing dimension lines to Figure 3-2. Corrected Addition of Mixed Numbers formula.
- 3-8 Specified that gear speed is measured in rpm.
- 3-10 Figure 3-7; Labeled pinion driving gear and spur driven gear.
- 3-19 Corrected erroneous formula for circumference.
- 4-13 Added word "Schematics" as alternative term to "Wiring Diagrams"
- 4-21 Figure 4-24. 5th line corrected to Break (short) type line.
- 4-23/26 Inserted wiring diagram from computer testing supplement with explanation as an example of a nomogram.
- 5-7 A screw is not a "simple machine". It is an application of an inclined plane.
- 5-12 Figure 5-13; identification of drive and driven gears added.
- 5-12 Rewrote incorrect paragraph regarding chisels.
- 5-12 "Something" called stress clarified to "forces" called stress; plus other grammar corrections.
- 5-16 Corrected erroneous equation in left column.
- 5-18 Clarified the sun is a source of radiant energy; not a form of energy in itself.
- 5-20 Most forced air engine cooling comes from the forward movement of the aircraft; not the propeller.
- 5-30 Corrected erroneous output value in Figure 5-45.
- 5-35 The effect of humidity, (not just fog), on engine performance is noticeable.
- 5-46 Figure 5-72; The rear movable surface on the rudder is called an anti-servo tab, not an anti-balance tab.
- 5-57/58 Airspeed determines lift, not groundspeed.
- 6-29 Figure 6-49; After Scales Reading corrected to Aft Scales Reading.
- 6-30 Figure 6-50; Math error corrected Total Lateral Calculation.
- 7-3 Firewalls added as a common application for stainless steel.
- 7-33 Paragraph added explaining manufacturer's shelf life of packed seals.
- 7-39 A Jo-Bolt is a blind fastener, not a rivet.
- 7-41 Specified that hardware substitutions are allowed only with manufacturer's approval.
- 7-42 Removed rocker box covers as an example for the use of self locking nuts.
- 7-42/46 "Fiber" locknut inserts are obsolete and have been replaced with "Nylon" inserts. (14 instances)
- 7-45 Spring nuts are commonly called Tinnerman nuts.
- 7-44 Elastic stop nuts have limited time use and some shops require discarding after each use.
- 7-49 Explanation added on drag torque.
- 7-50 Added that washers may be placed on the nut end of a bolt to realign the cotter pin with the hole.
- 7-51 Stated need of a bucking bar when setting solid rivets.
- 7-52 AN470 rivets are typical for interior structures; not MS20430 or MS20442.
- 7-68 Only older aircraft (35 years +) used rivnuts to attach de-icer boots. Modern aircraft bond them on.
- 7-72 Left hand turnbuckle barrel ends are identified with a groove. Knurling hasn't been used for 35 years.
- 7-79 Specified that clip locks are not reusable.
- 8-14 Figure 8-22; Clarified aluminum alloy described in Figure.
- 8-15 Added warning about steam cleaning aluminum parts.
- 9-3 Deleted reference to 35° AC flared fittings which are now obsolete.
- 9-5 Deleted instruction to anneal metal tubing prior to flaring which is only done in the factory.
- 9-12 Figure 9-20; Numerous errors and omissions in chart. Replaced with correct data from AC43.13-1B.

CORRECTION LOG

- 9-12/13 Flareless fittings are colored green; not blue.
- 9-14 Figure 9-24; Incorrect labeling corrected.
- 9-19 Corrected caption on Figure 9-35 misstating it to be a flexible hose.
- 9-21 Figure 9-39; The assembly shown is a low pressure hose, not medium.
- 11-1 Replaced term “common” screwdriver as “flat blade” screwdriver.
- 11-4 Removed statement: “Allen wrenches are seldom used.”
- 11-8 Added that torque wrenches must be calibrated.
- 11-9 Corrected types of aviation snips and added their color identification
- 11-12 Deleted instruction to “tap file on a bench to clean”. Use file card. Airplanes do not have benches.
- 11-19 Corrected erroneous decimal equivalent. “1/8” = .125”, not .0125”
- 11-21 Added decimal equivalents to fractions on ruler.
- 11-23 Figures 11-35; Replaced poor quality pictures of outside micrometers.
- 11-25 To view all scales, the thimble is turned; not the micrometer.
- 12-25 Corrected 4 tolerance specifications in Figure 12-49.
- 12-110 1st paragraph; “emitter and collector” corrected to “emitter and base”.
- 12-111 Figure 12-227; Corrected flow direction on common collector schematic.
- 12-116 Figure 12-237; Band-pass filter corrected to Band-stop filter.
- Chap. 13 Added missing page numbers to entire chapter.
- 14-10/12 MEDA, SHEL, and Swiss Cheese models are not a part of the PEAR model.

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Chapter 2

Regulations, Maintenance Forms, Records, & Publications

Overview—Title 14 of the Code of Federal Regulations (14 CFR)

Aviation-related regulations that have occurred from 1926–1966 are reflected in *Figure 2-1*. Just as aircraft continue to evolve with ever improving technology, so do the regulations, publications, forms, and records required to design, build, and maintain them.

The Federal Aviation Administration (FAA) regulations that govern today’s aircraft are found in Title 14 of the Code of Federal Regulations (14 CFR). [*Figure 2-2*] There are five volumes under Title 14, Aeronautics and Space. The first three volumes containing 75 active regulations address the Federal Aviation Administration. The fourth volume deals with the Office of the Secretary of the Department of Transportation (Aviation Proceedings) and Commercial Space Transportation, while the fifth volume addresses the National Aeronautics and Space Administration (NASA) and Air Transportation System Stabilization.

These regulations can be separated into the following three categories:

1. Administrative
2. Airworthiness Certification
3. Airworthiness Operation

Since 1958, these rules have typically been referred to as “FARs,” short for Federal Aviation Regulations. However, another set of regulations, Title 48, is titled “Federal Acquisitions Regulations,” and this has led to confusion with the use of the acronym “FAR.” Therefore, the FAA began to refer to specific regulations by the term “14 CFR part XX.” Most regulations and the sections within are odd numbered, because the FAA realized in 1958 when the Civil Aeronautics Regulations were recodified into the Federal Aviation Regulations that it would be necessary to add regulations later.

Over the years, the FAA has sometimes seen the need to issue Special Federal Aviation Regulations (SFAR). [*Figure 2-3*] These are frequently focused very specifically on a unique situation and are usually given a limited length of time for effectiveness. Note that the SFAR number is purely a

sequential number and has no relevance to the regulation it is addressing or attached to.

The remainder of this handbook focuses only on those regulations relative to airworthiness certification. There are 30 of these listed in *Figure 2-4*, and they are shown graphically in *Figure 2-5*. A significant benefit of this chart is the visual effect showing the interaction of the regulation with other regulations and the placement of the regulation relative to its impact on airworthiness. It is fundamentally important that the definition of the term “airworthy” be clearly understood.

Only recently did the FAA actually define the term “airworthy” in a regulation. (Refer to the 14 CFR part 3 excerpt following this paragraph.) Prior to this definition in part 3, the term could be implied from reading part 21, section 21.183. The term was defined in other non-regulatory FAA publications, and could also be implied from the text found in block 5 of FAA Form 8100-2, Standard Airworthiness Certificate. This certificate is required to be visibly placed on board each civil aircraft. (Refer to “Forms” presented later in this chapter.)

Title 14 CFR Part 3—General Requirements

Definitions. The following terms have the stated meanings when used in 14 CFR part 3, section 3.5, Statements about products, parts, appliances and materials.

- Airworthy means the aircraft conforms to its type design and is in a condition for safe operation.
- Product means an aircraft, aircraft engine, or aircraft propeller.
- Record means any writing, drawing, map, recording, tape, film, photograph or other documentary material by which information is preserved or conveyed in any format, including, but not limited to, paper, microfilm, identification plates, stamped marks, bar codes or electronic format, and can either be separate from, attached to or inscribed on any product, part, appliance or material.

Airworthiness can be divided into two areas: original airworthiness as depicted in *Figure 2-5*, and recurrent airworthiness as depicted in *Figure 2-6*. There are three primary regulations that govern the airworthiness of an aircraft:

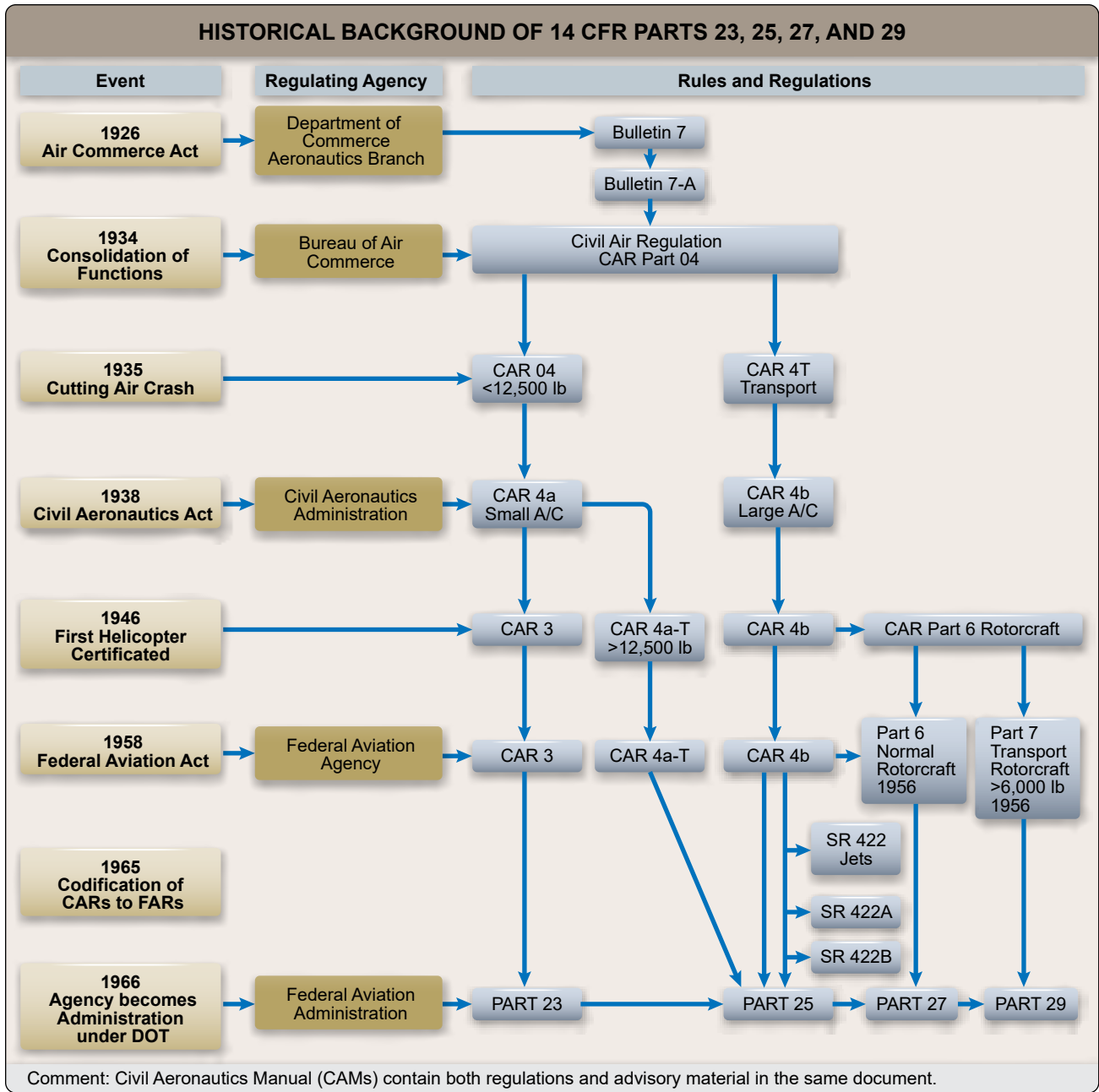


Figure 2-1. FAA historical background of aircraft airworthiness regulations.

1. 14 CFR part 21—Certification Procedures for Products and Parts
2. 14 CFR part 43—Maintenance, Preventive Maintenance, Rebuilding, and Alterations
3. 14 CFR part 91—General Operating and Flight Rules

discusses the FAA as if it was a single unit, it is important to understand that there are various subgroups within the FAA, and each have different responsibilities of oversight in the aviation industry. These may vary by organizational chart or geographic location.

Note that the chart in Figures 2-5 and 2-6 show most of the other airworthiness certification regulations link to one of these regulations.

The maintenance technician interacts mostly with FAA personnel from the Flight Standards Service (AFS) and the Flight Standards District Office (FSDO) but may also have some interaction with FAA personnel from the Aircraft Certification Service (AIR).

Although the history section that opens this chapter

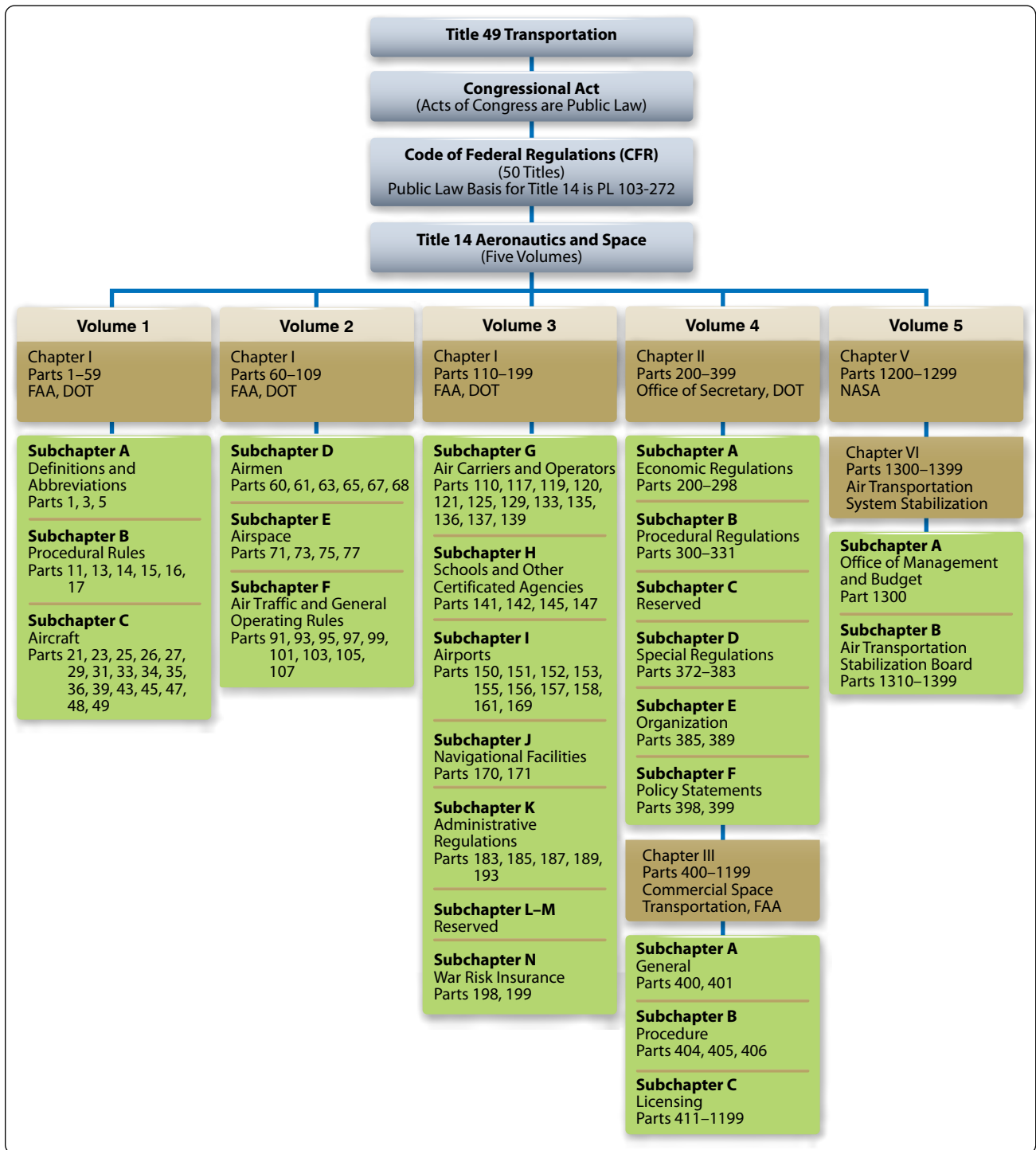


Figure 2-2. Title 14 of the Code of Federal Regulations.

Maintenance-Related Regulations

14 CFR Part 1—Definitions and Abbreviations

This section is a very comprehensive, but certainly not all inclusive, list of definitions that both pilots and mechanics must become familiar with. Many regulations often provide additional definitions that are unique to their use and interpretation in that specific part. Title 14 CFR part 1, section

1.2, Abbreviations and Symbols, tends to be highly focused on those abbreviations related to flight.

14 CFR Part 21—Certification Procedures for Products and Articles

This regulation, the first of the three, identifies the requirements of and the procedures for obtaining type

Special Federal Aviation Regulations		
SFAR No	Title	Appears in 14 CFR
13	Table of Contents	Part 25
23	Special Federal Aviation Regulation No. 23	Part 23
27-5	Fuel venting and exhaust emission requirements for turbine engine powered airplanes.	Part 11
50-2	Special Flight rules in the Vicinity of the Grand Canyon National Park, AZ	Part 91
65-1	Removal of this SFAR effective 10/8/2004 - Prohibition Against Certain Flights Between the United States and Libya	Part 91
71	Special Operating Rules for Air Tour Operators in the State of Hawaii	Part 91
73	Robinson R-22/R-44 Special Training and Experience Requirements	Part 61
77	Prohibition Against Certain Flights Within the Territory and Airspace of Iraq	Part 91
79	Prohibition Against Certain Flights Within the Flight Information Region of the Democratic People's Republic of Korea	Part 91
82	Prohibition Against Certain Flights within the Territory and Airspace of Sudan	Part 91
84	Prohibition Against Certain Flights Within the Territory and Airspace of Serbia-Montenegro	Part 91
86	Airspace and Flight Operations Requirement for the Kodak Albuquerque International Balloon Fiesta; Albuquerque, NM	Part 91
88	Fuel Tank System Fault Tolerance Evaluation Requirements	Parts 21, 25, 91, 121, 125, 129
97	Special Federal Aviation Regulation No. 97 - Special Operating Rules for the Conduct of Instrument Flight Rules (IFR) Area Navigation (RNAV) Operations using Global Positioning Systems (GPS) in Alaska	Parts 71, 91, 95, 121, 125, 129, 135
98	Construction or Alteration in the Vicinity of the Private Residence of the President of the United States	Part 77
100-2	Relief for U.S. Military and Civilian Personnel Who Are Assigned Outside the United States in Support of U.S. Armed Forces Operations	Parts 61, 63, 65
103	Process for Requesting Waiver of Mandatory Separation Age for Certain Federal Aviation Administration (FAA) Air Traffic Control Specialists	Part 65
104	Prohibition Against Certain Flights by Syrian Air Carriers to the United States	Part 91
108	Special Federal Aviation Regulation No. 108 - Mitsubishi MU-2B Series Airplane Special Training, Experience, and Operating Requirements	Part 91
109	Special Requirements for Private Use Transport Category Airplanes	Parts 21, 25, 119
112	Prohibition Against Certain Flights Within the Tripoli (HLLL) Flight Information Region (FIR)	Part 91

Figure 2-3. Special Federal Aviation Regulations From 14 CFR.

certificates (TCs), supplemental type certificates (STCs), production certificates, airworthiness certificates, and import and export approvals. [Figure 2-5] Some of the other major areas covered in this part are the procedures for obtaining a Part Manufacture Approval (PMA) or an authorization related to producing a Technical Standard Order (TSO) part. Note that part 21's greatest significance is in the original airworthiness phase, although it has minor application in recurrent airworthiness. [Figure 2-5] One of the most important sections of this regulation is section 21.50, "Instructions for continued airworthiness and manufacturer's maintenance manuals having airworthiness limitations sections." When an aircraft is delivered new from the manufacturer, it comes with maintenance manuals that define the inspection and maintenance actions necessary to maintain the aircraft in airworthy condition. Also, any STC modification that was developed after 1981 must have, as part of the STC documentation, a complete set of instructions for continued airworthiness (ICA). This ICA contains inspection and maintenance information intended to be used by the

technician in maintaining that part of the aircraft that has been altered since it was new. This ICA is comprised of 16 specific subjects. [Figure 2-7] An ICA developed in accordance with this checklist should be acceptable to the Aviation Safety Inspector (ASI) reviewing a major alteration.

14 CFR Part 23—Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes

Aircraft certificated under 14 CFR part 23 represent the greatest portion of what the industry refers to as "general aviation." These aircraft vary from the small two-place piston engine, propeller-driven trainers that are frequently used for flight training, to turbine-powered corporate jets used to transport business executives. Seating capacity is limited to nine or less on all aircraft, except the commuter aircraft where the maximum passenger seating is 19, excluding the pilot and copilot seats.

This part specifies the airworthiness standards that must