

FAA Certification: Design Production Airworthiness

AA&S (Australia) 2018 Training Day

Brisbane, QLD July 3, 2018

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**Federal Aviation
Administration**

FAA's Mission

Our continuing mission is to provide the safest, most efficient aerospace system in the world

January 25, 2018

THE WALL STREET JOURNAL.

THE MIDDLE SEAT | By Scott McCartney

WHY FLYING HAS NEVER BEEN SAFER

LAST YEAR WAS THE SAFEST year ever for air travel, with zero passenger airline fatal accidents on jets world-wide. There hasn't been a fatal crash at a major U.S. passenger airline since 2009.

and leasing companies are the top factors behind these results.

"It's just stunning," says William Voss, a safety consultant and former official at the Federal Aviation Administration and other major aviation groups. "I hope that we see

LAST YEAR WAS THE SAFEST year ever for air travel, with zero passenger airline fatal accidents on jets world-wide. There hasn't been a fatal crash at a major U.S. passenger airline since 2009.

lations and corporate changes at airlines

Please see **SAFETY** page All

Overview

- FAA organizational structure
- Design certification
- Production certification
- Airworthiness certification
- Other design approvals
- Other airworthiness approvals

Your Instructor

- Marv Nuss
 - Nuss Sustainment Solutions (6 years)
 - FAA Small Airplane Directorate (20 years)
 - McDonnell Aircraft (14 years)
 - Bell Helicopter (4 years)
- Special thanks to these FAA engineers for their help developing this material:
 - Vu Nguyen, Wichita Aircraft Certification Office
 - Sue McCormick, Design Procedures Branch

Course Material

- Course material includes information from various FAA documents and presentations
- Course material includes information from Marv Nuss' short courses:
 - *“Sustainment and Continued Airworthiness for Aircraft Structures”*
 - *“FAA Certification and Airworthiness Processes for Civil Aircraft”*

*See Marv if you are interested in bringing either
of these courses to your organization
(marv.nuss@marvnuss.com)*

Motivation

Question:

Why do we need to understand the design, production and airworthiness certification?

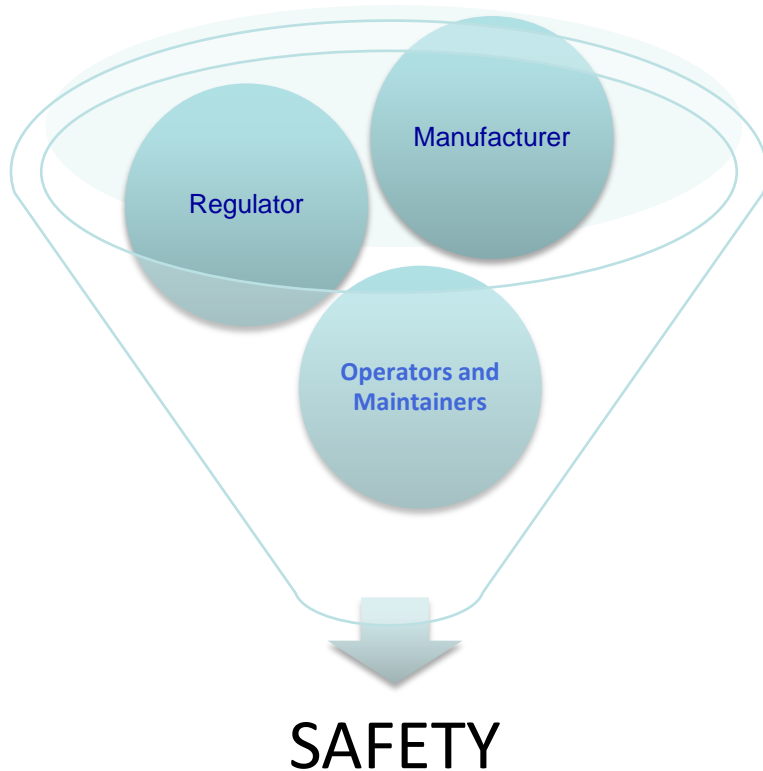
Answer:

A safe and efficient aerospace system begins with the design and manufacture of safe aircraft

Objectives

- Identify the three certification programs: design, production and airworthiness
- Identify the key tasks of each of the three certification programs
- Recognize and understand the relationships between the three certification programs
- Recognize and understand the relationship with other design and airworthiness approvals

Teamwork between Authority, Manufacturer, Operator, and Maintainer



- Common interest in safety
- All must interact together to achieve best results
- Authority wants industry to succeed with safety
- DAH and operator require safety to succeed
- Common bond, common interest, common definition of success

Certification Responsibilities

Applicant

- Develop and maintain product design
- Develop and maintain production quality system
- Show compliance to all applicable requirements
- Certify compliance in writing to FAA

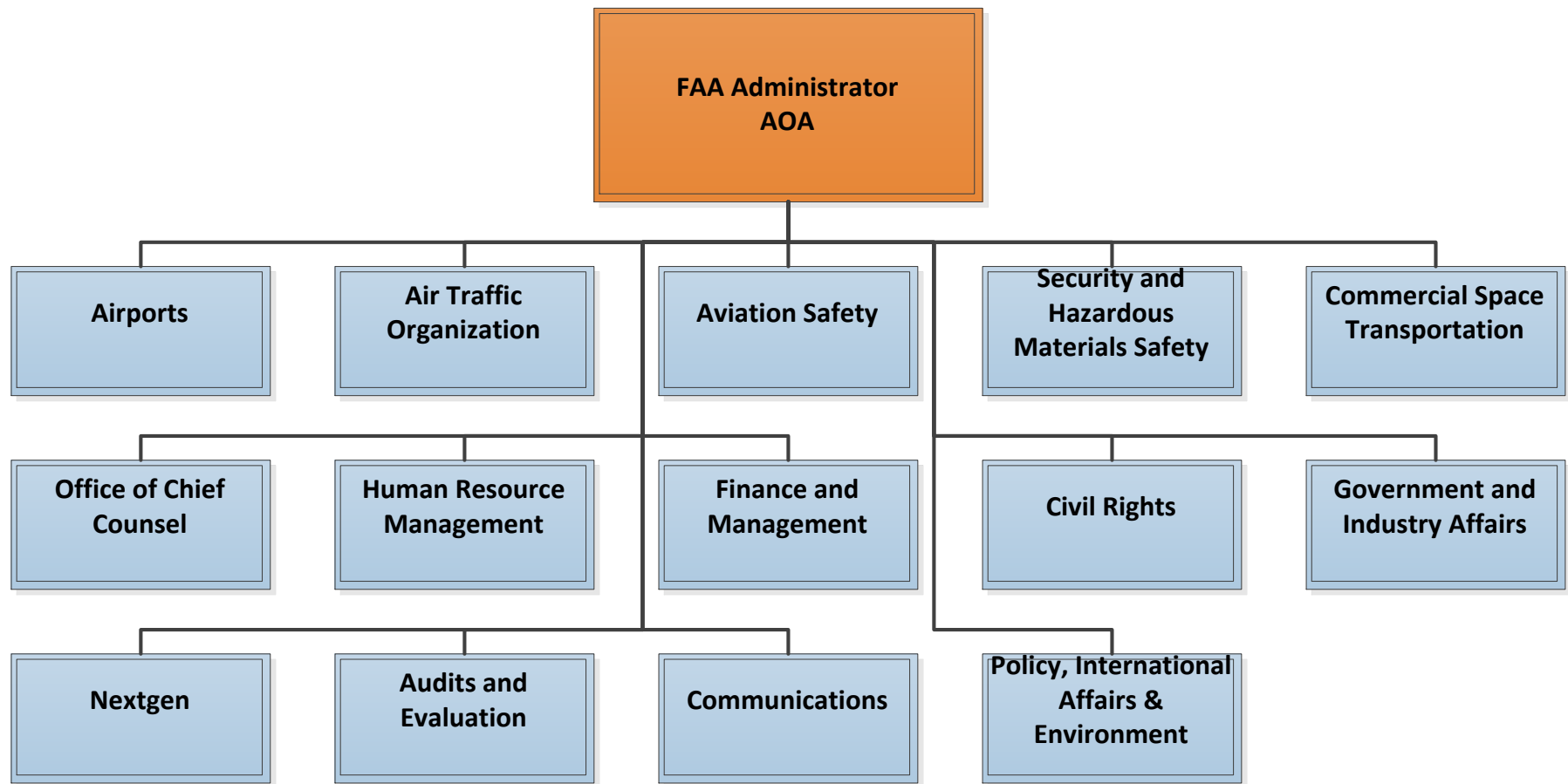
FAA

- Accept Certification Plans
- Find compliance

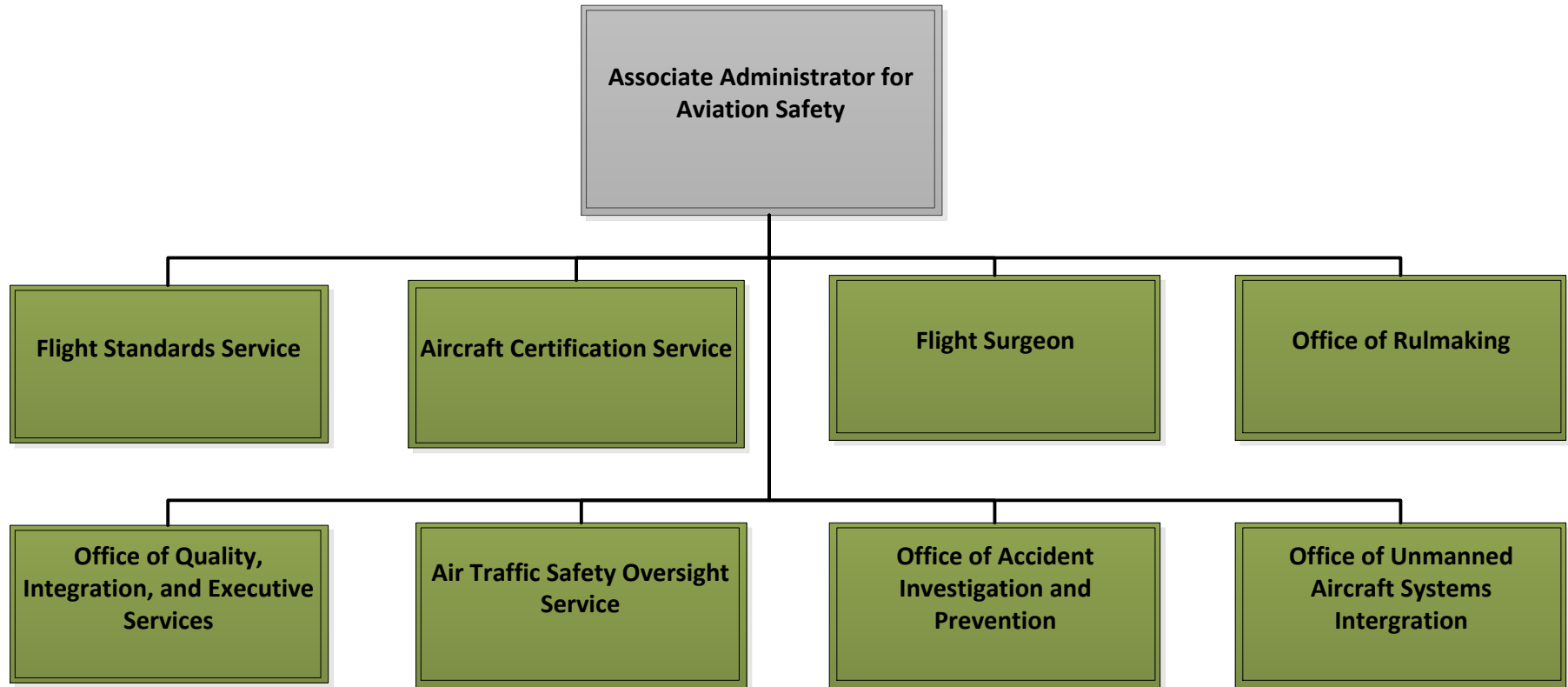
FAA Certification Outline:

- FAA Aircraft Safety (AVS) Organization
- Overview of FAA regulations
- Certification requirements
- Production requirements
- Operational requirements
- Related “personnel” requirements

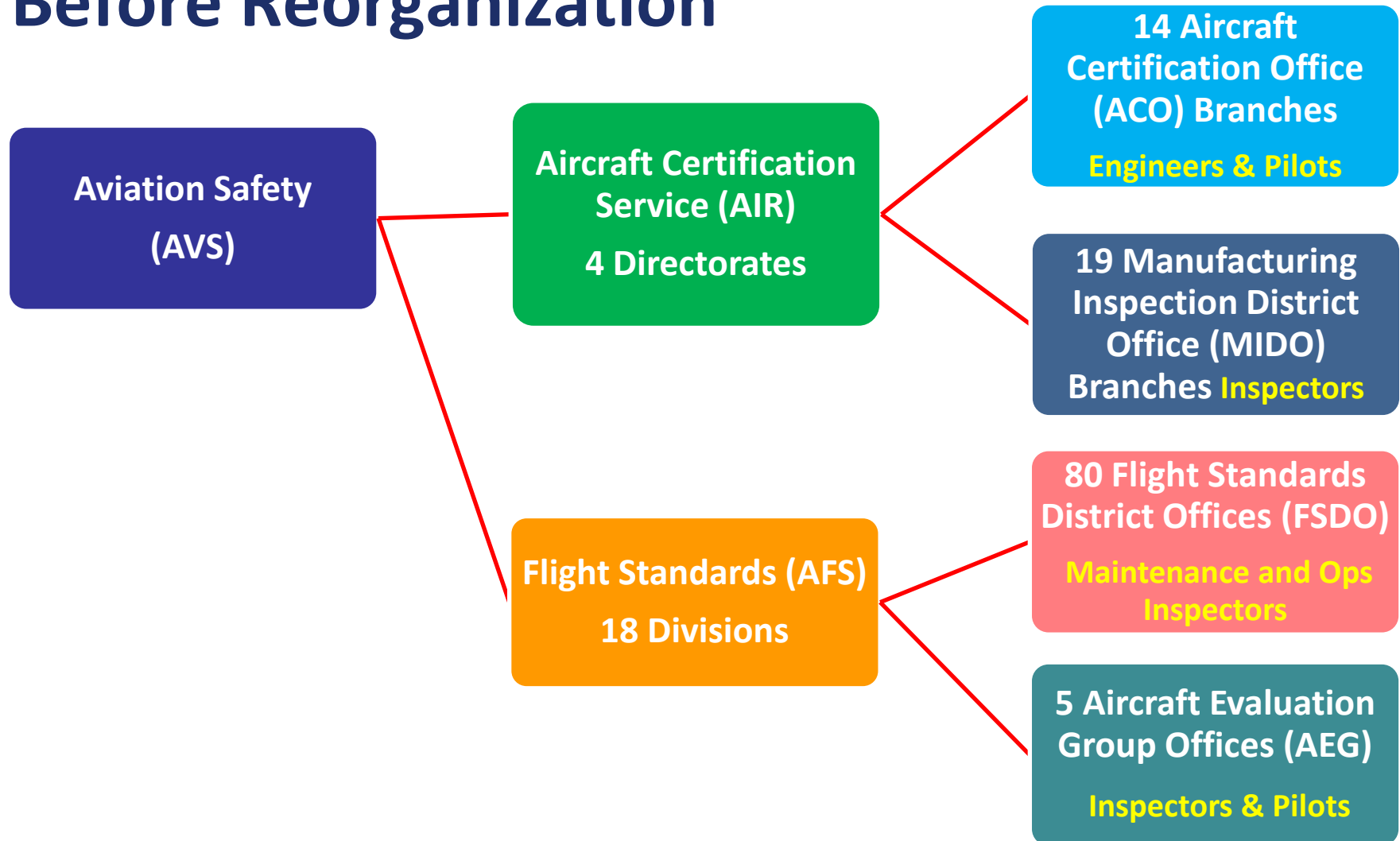
FAA Organization



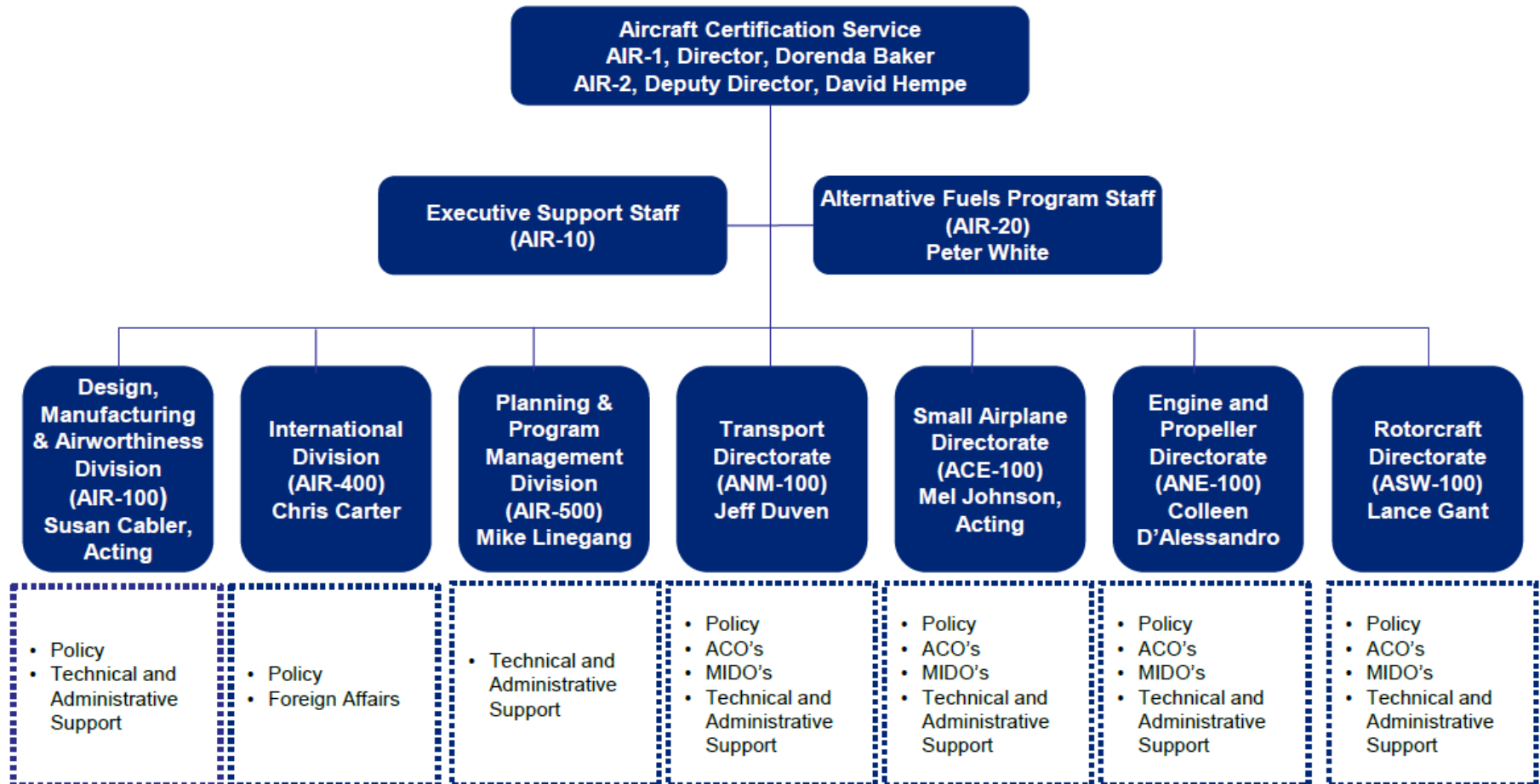
FAA Aviation Safety (AVS) Organization Chart



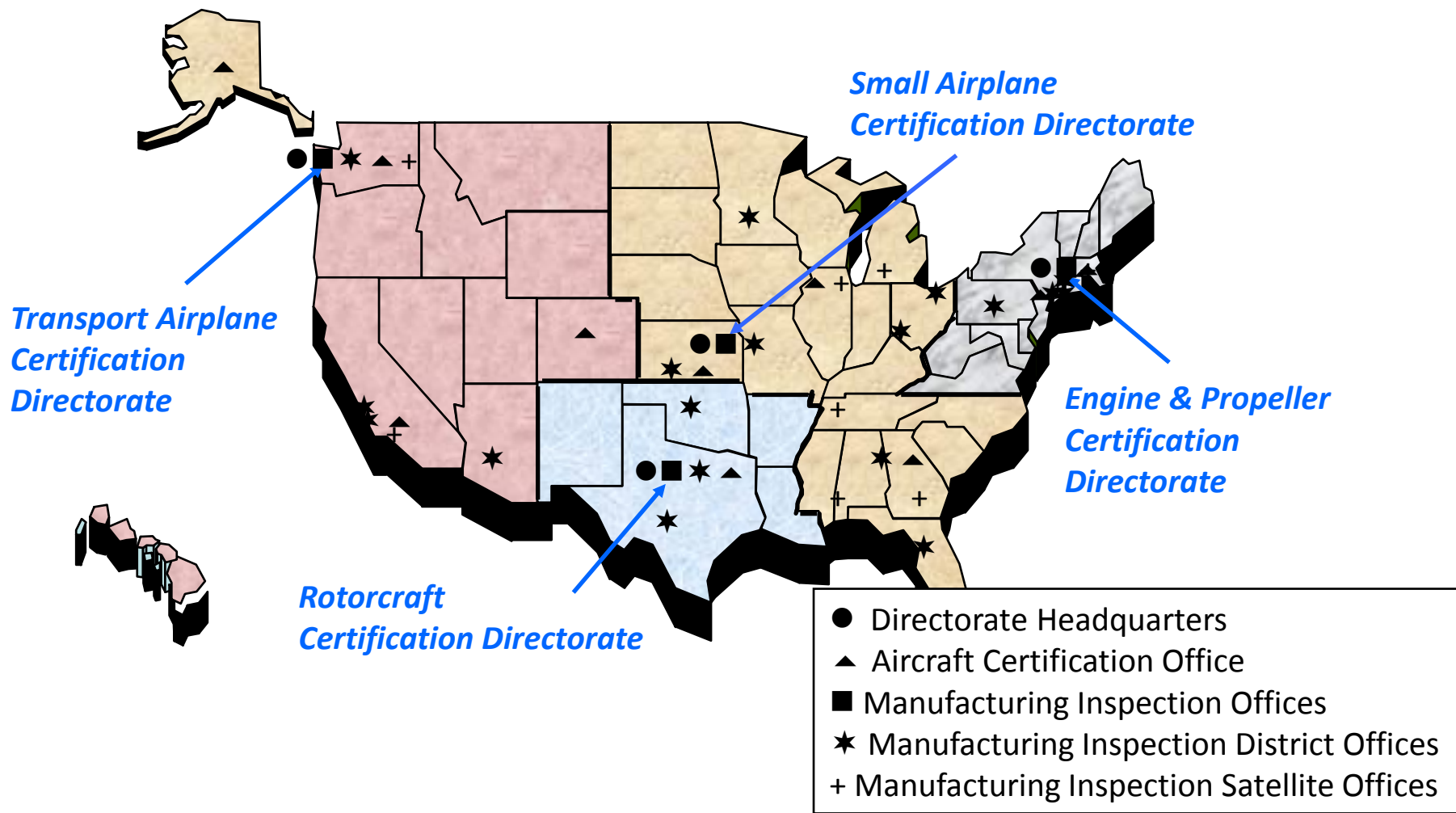
Aviation Safety Organization Before Reorganization



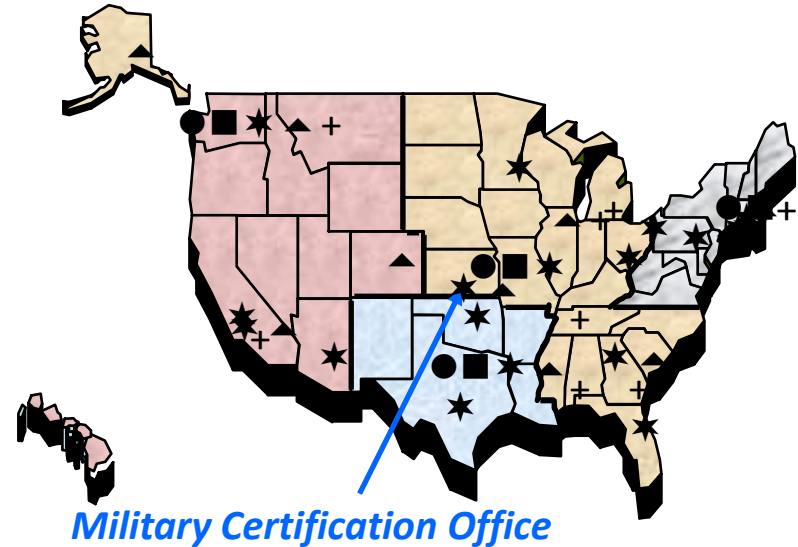
AIR Before the Organizational Change



Aircraft Certification “Geographical” Boundaries – Historical Perspective

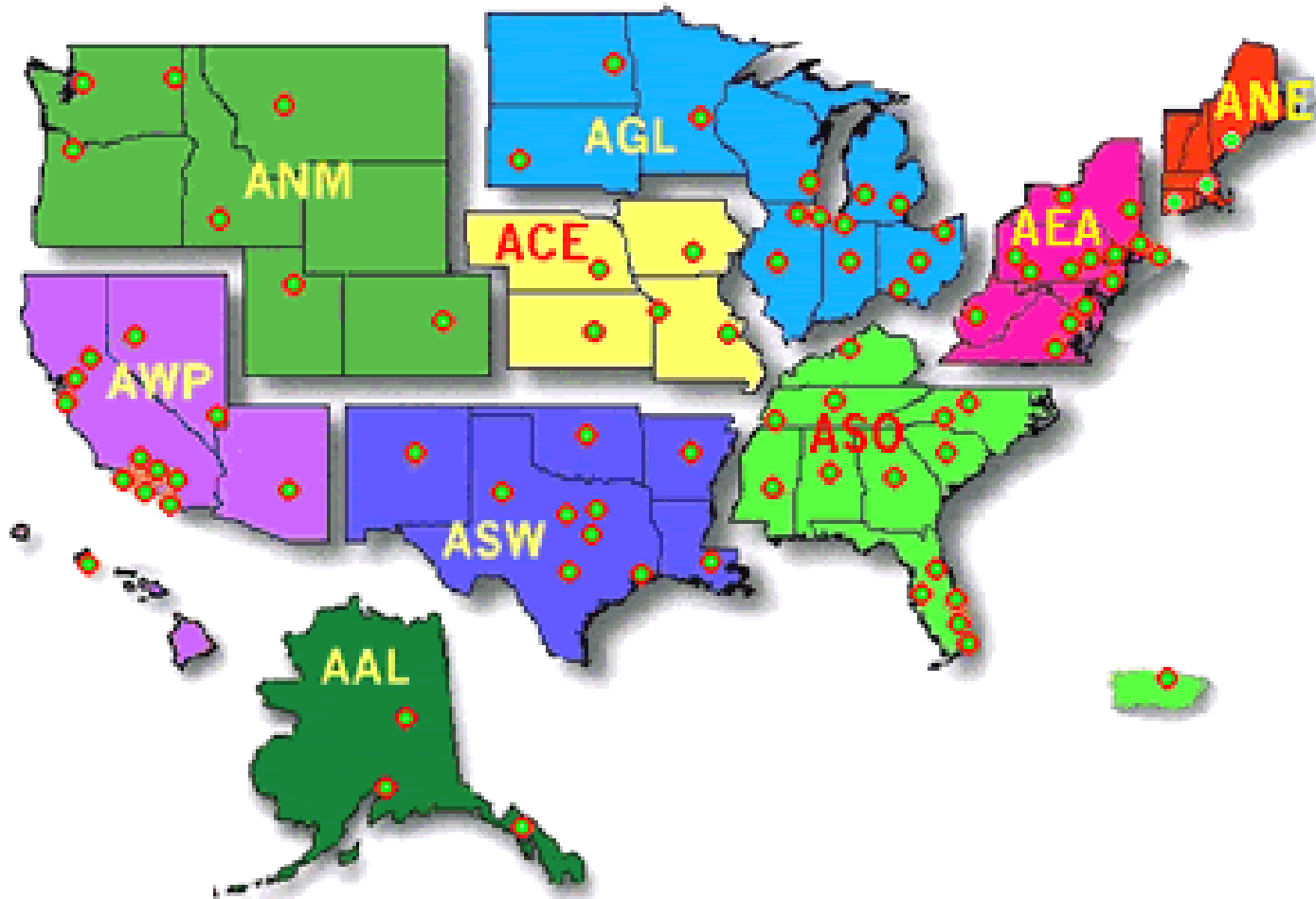


Exception to Aircraft Certification “Geographical” Boundaries



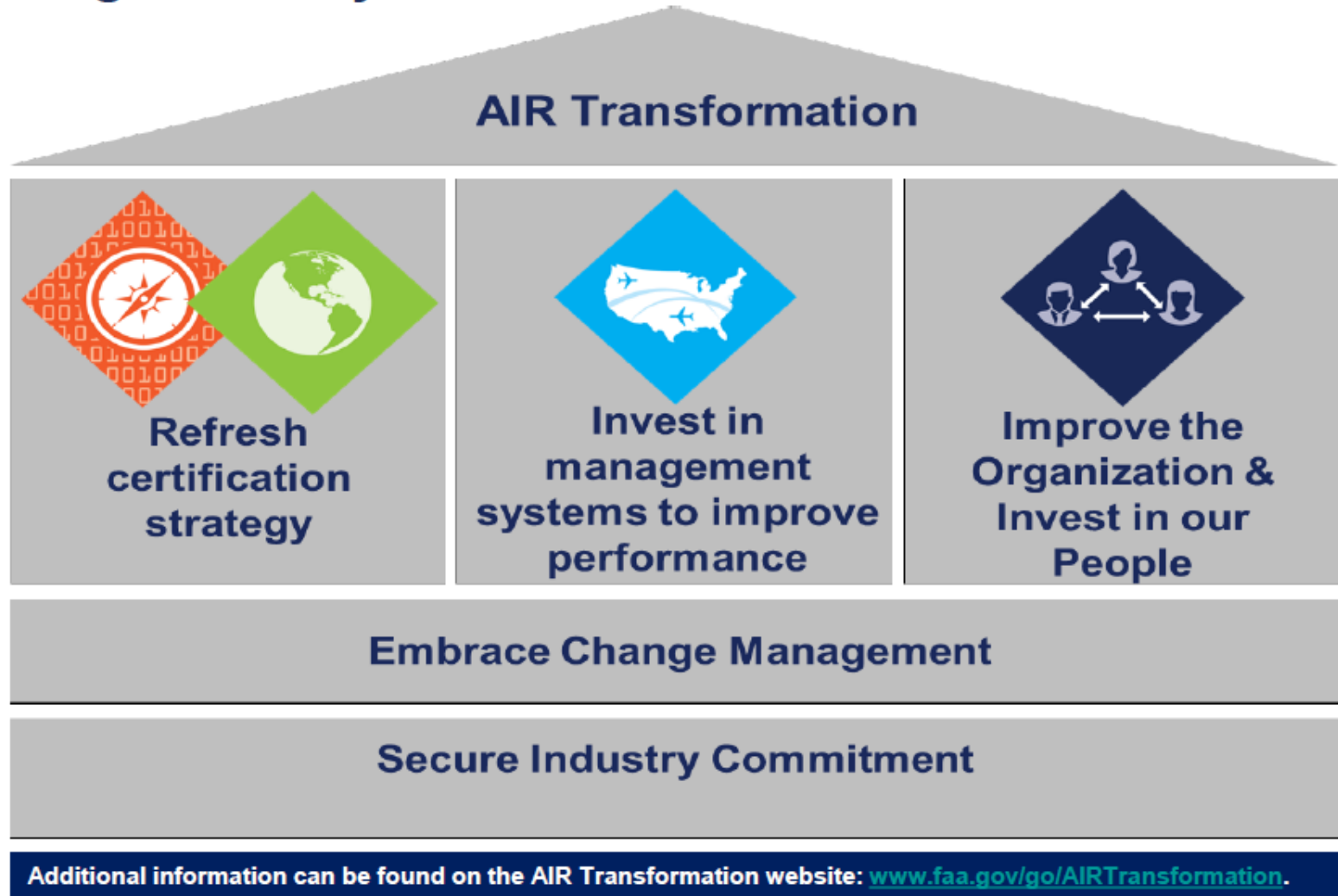
- All military commercial derivative aircraft projects are assigned to the Military Certification Office (MCO)
 - Functions like an Aircraft Certification Office (ACO)
 - Located in Wichita, KS

Flight Standards District Offices (FSDO) – Historical Perspective



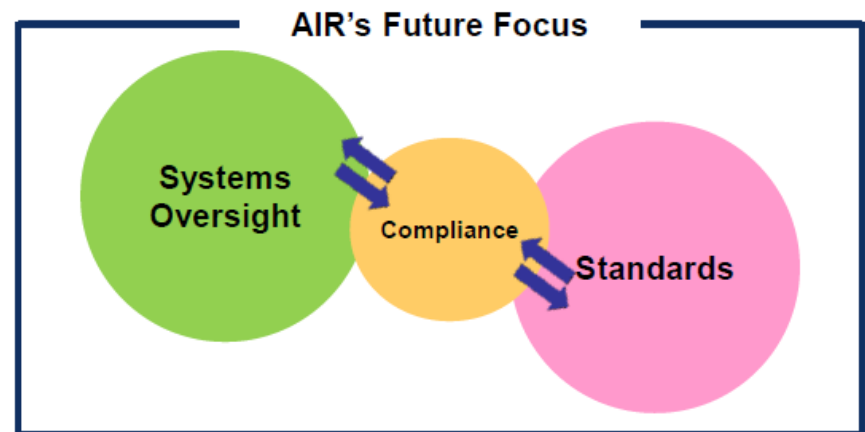
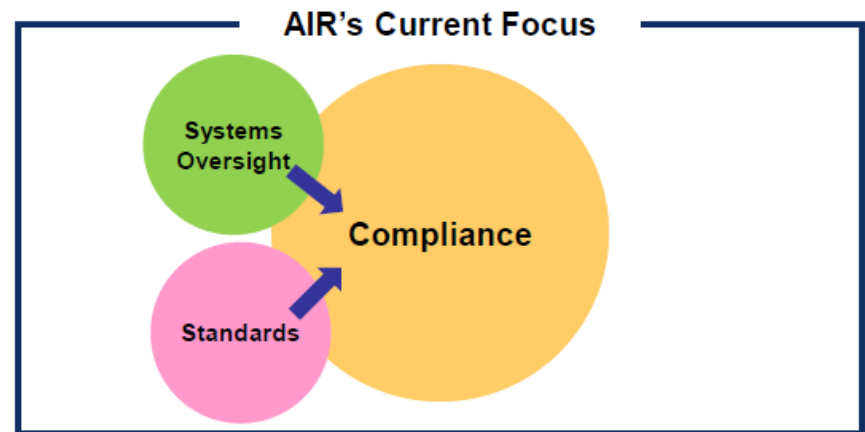
AIR Transformation

Improving Efficiency and Effectiveness

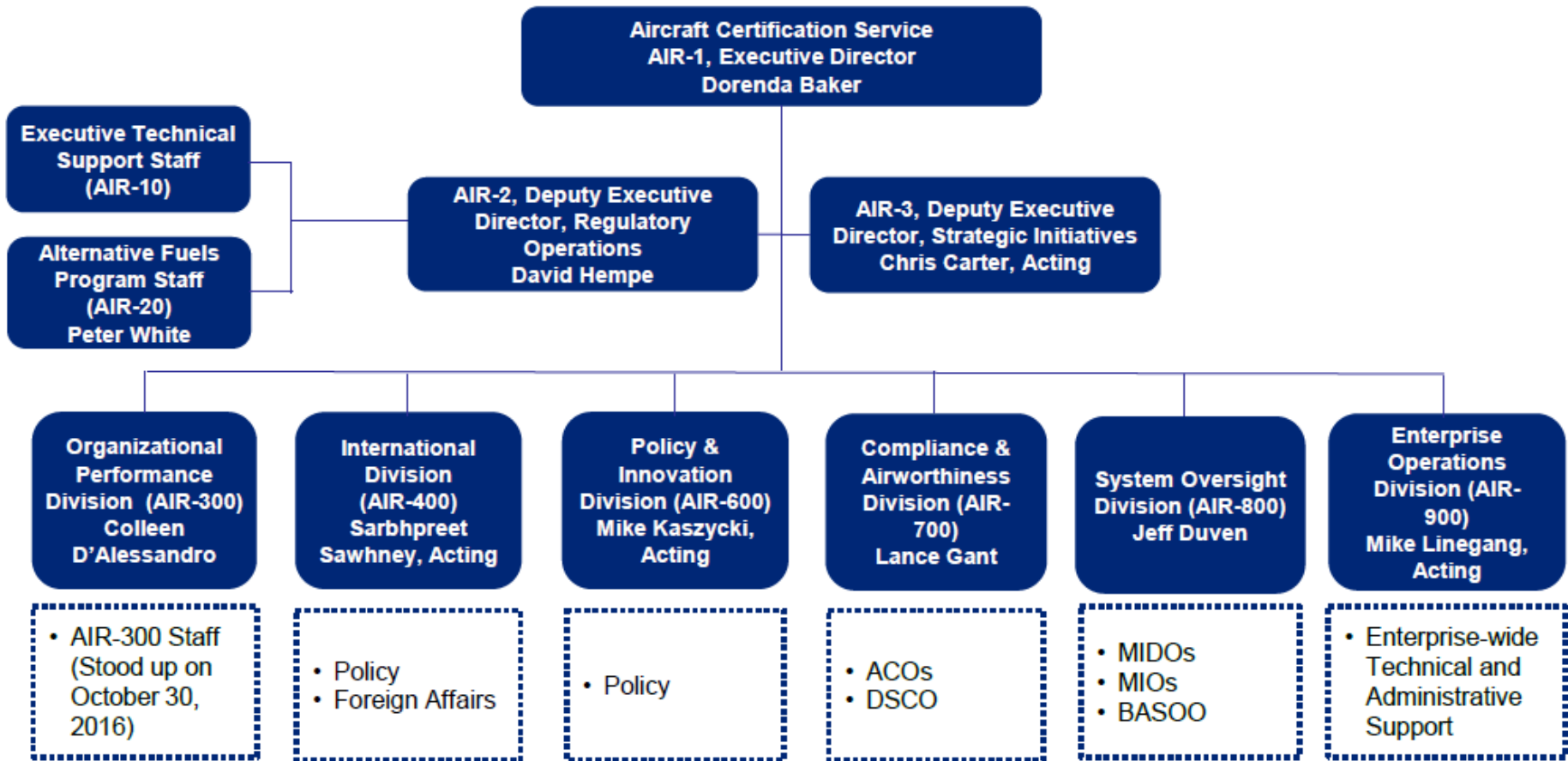


Benefits of AIR Transformation

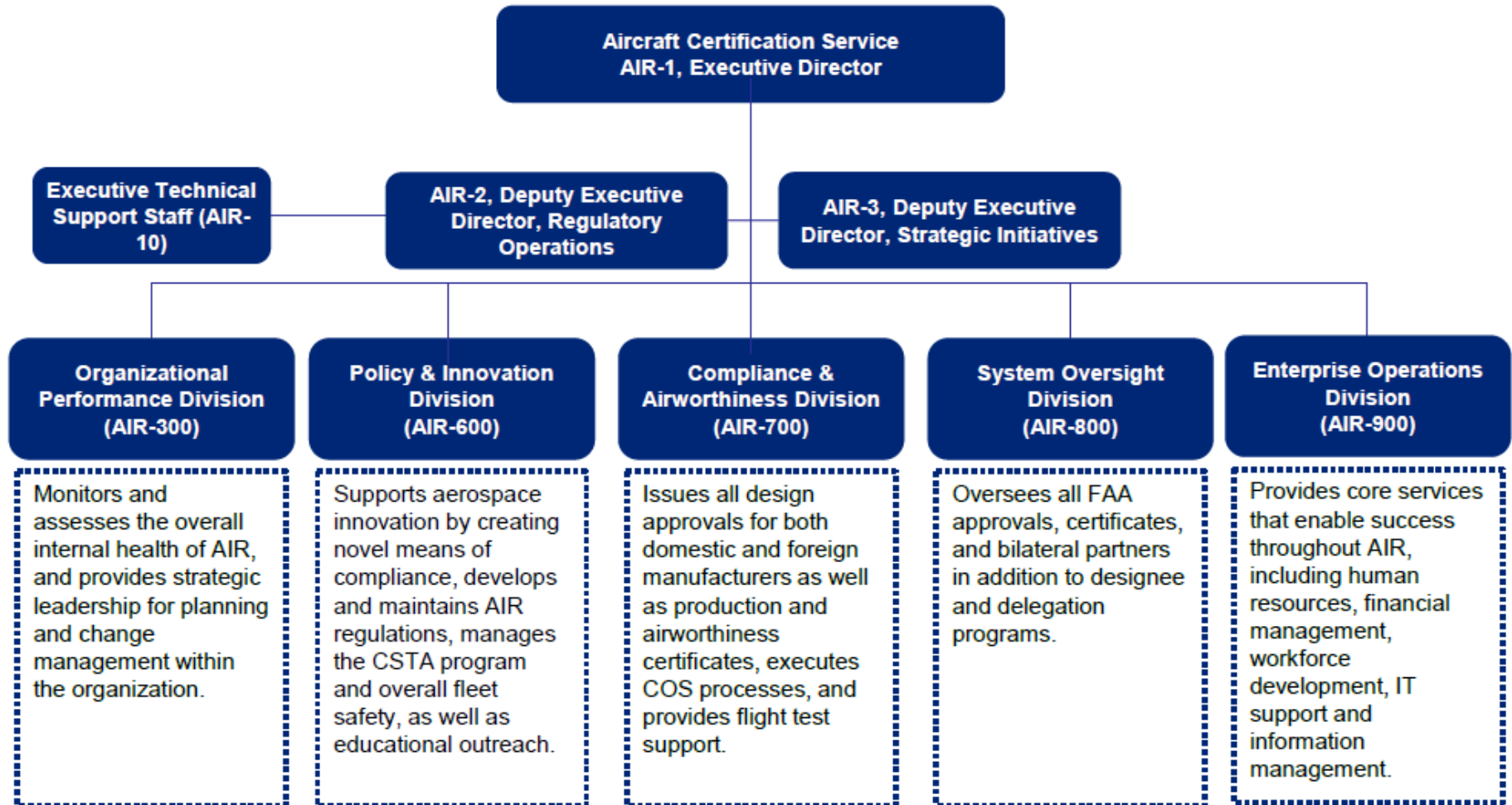
- Encourages early industry engagement and risk-based system surveillance to **eliminate barriers** from unnecessary FAA involvement during certification
- Improves **consistency and standardization** by establishing single functional lines for 1) certification, 2) standards and 3) system oversight
- Fosters **innovation** by engaging industry applicants early to understand new concepts and ensure viable path to compliance
- Provides **agility and adaptability** to meet the challenges of the dynamic global aviation industry
- Establishes business practices for utilizing **metrics for determining efficacy** of Industry/FAA associated with compliance/safety and time to market



Aircraft Certification Organization



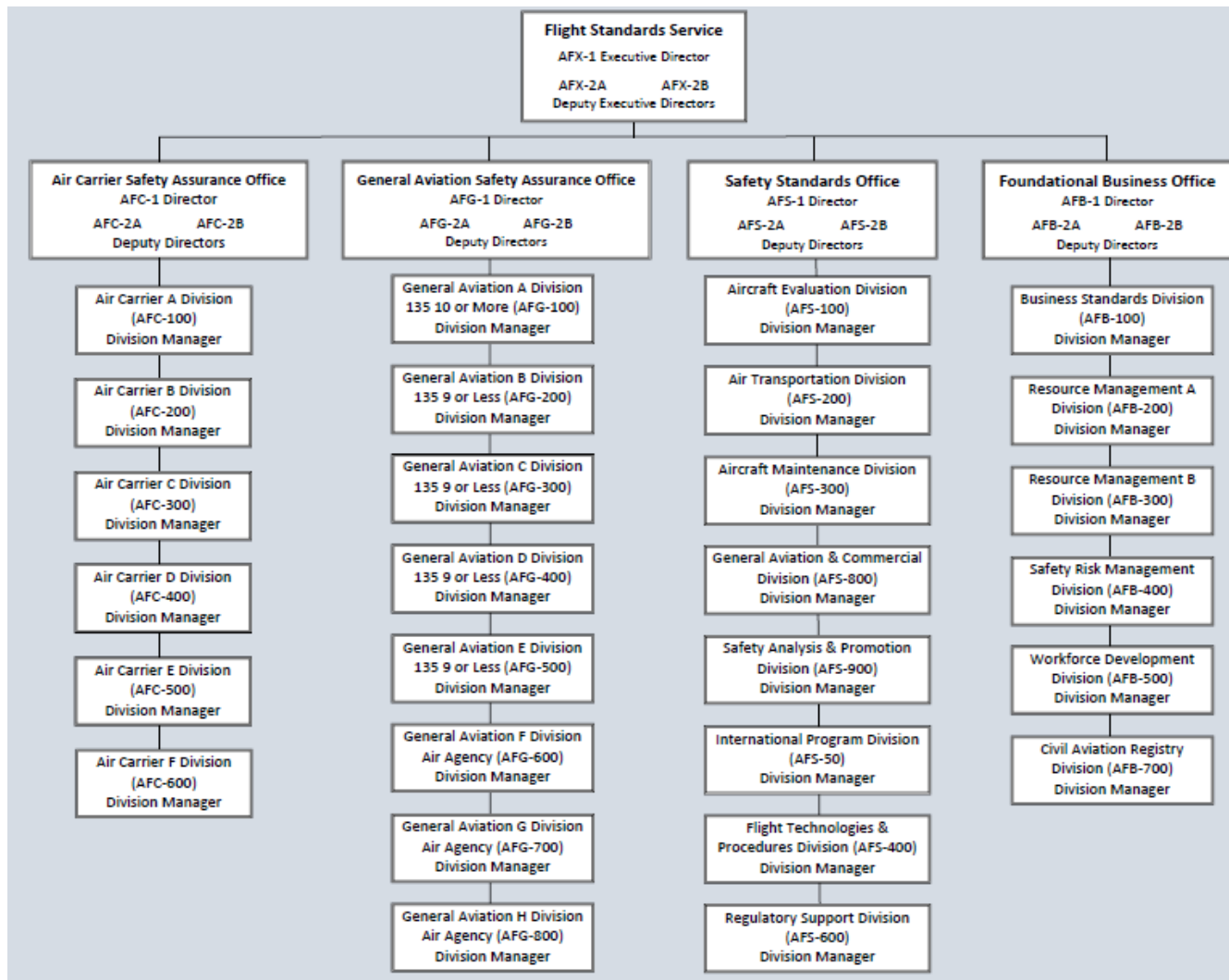
Functional Divisions



Organization - Continued

- Flight Standards Involvement
 - Aircraft Evaluation Group (AEG) – a Flight Standards Organization
 - ◆ Responsible that operations and maintenance aspects of a design are acceptable
 - ◆ Reviews/Accepts Instructions for Continued Airworthiness (ICA) (14 CFR, 21.50)
 - ◆ Reviews/Comments on Aircraft Flight Manual, Airworthiness Directives, and if necessary Alternative Methods of Compliance
 - Flight Standards District Offices
 - ◆ Handle operational airworthiness issues
 - Flight Standards Headquarters
 - ◆ Writes all policy

Organization - Continued

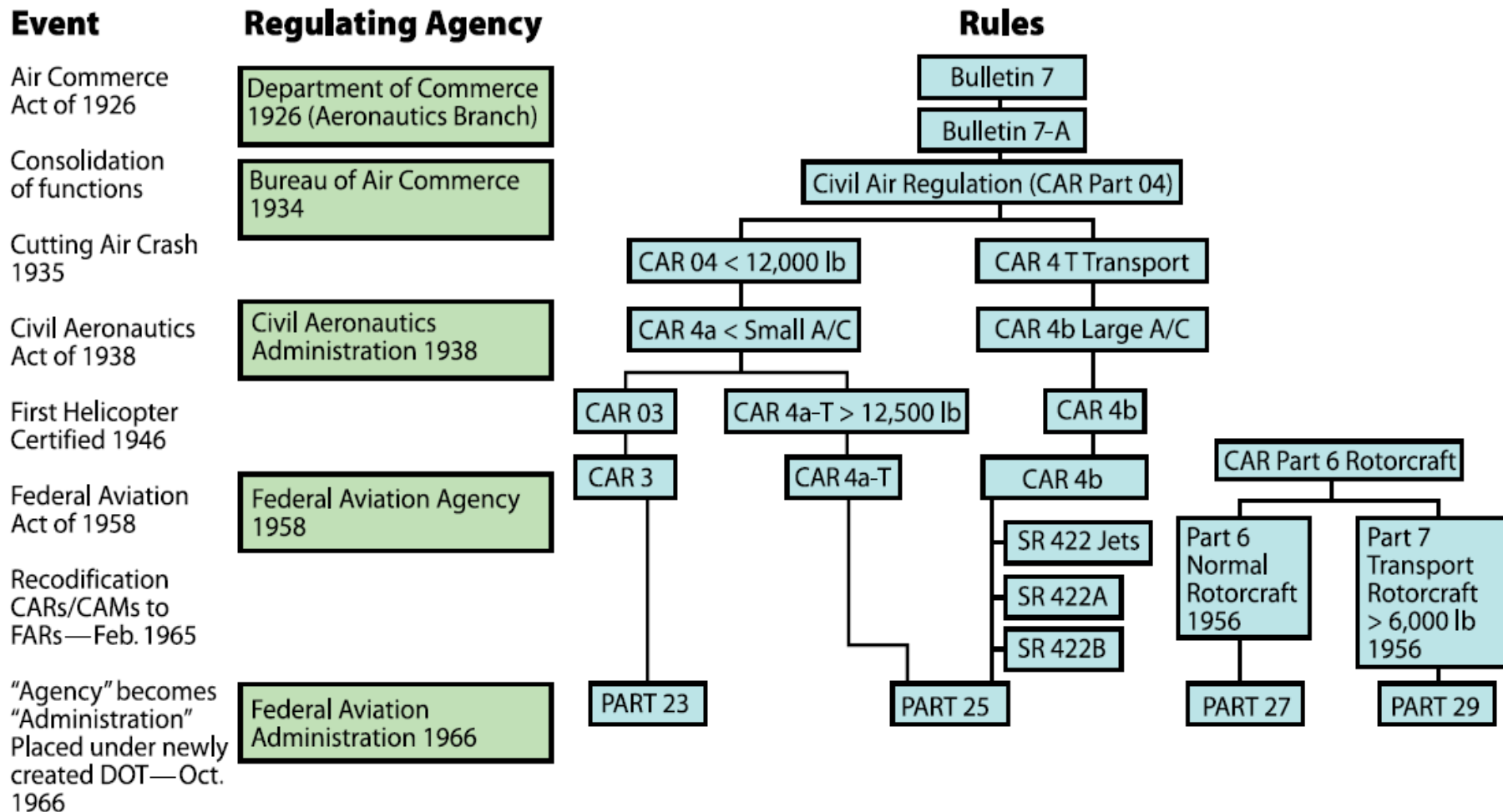


So, you want to design, build, and fly an aircraft?



Buhl Airster, Aircraft Type Certificate No. 1, March 29, 1927

Historical Background of CFR 23, 25, 27, & 29



Comments: CAMs (Civil Aeronautics Manual) contained both regulations and advisory material in the same document.

Federal Aviation Regulations Basics

- Official reference to FAA regulations:
 - Title 14 Code of Federal Regulations (CFR) – Aeronautics and Space
- Specific regulation paragraph reference example:
 - 14 CFR § 25.571
- Often called the “FARs”
 - (Federal Aviation Regulations)

Certification - General

The U.S. Congress established a law that authorizes the FAA Administrator to issue **Type Certificates, Production Certificates and Airworthiness certificates** for an aircraft, aircraft engines or propeller

Section 44704 – Title 49, United State Code

Federal Aviation Regulations Basics

Rules that affect the “aircraft”

- Part 21
 - General certification requirements
- Parts 23, 25, 26, 27, 29, 31
 - Certification requirements specific to aircraft category
- Parts 33, 34, 35, 36
 - Certification requirements specific to engines and propellers
- Part 39
 - Changes to type design to correct an unsafe condition
- Part 43
 - Maintenance and alteration

Federal Aviation Regulations Basics

Regulations that affect the “owner/operator”

- Part 91
 - General operational requirements
- Part 121
 - Operational requirements for most airlines
 - ◆ Generally 10 or more passengers
- Part 125
 - Defines basic operating and flight rules for charters
- Part 135
 - Operational requirements for commuter/ air taxi

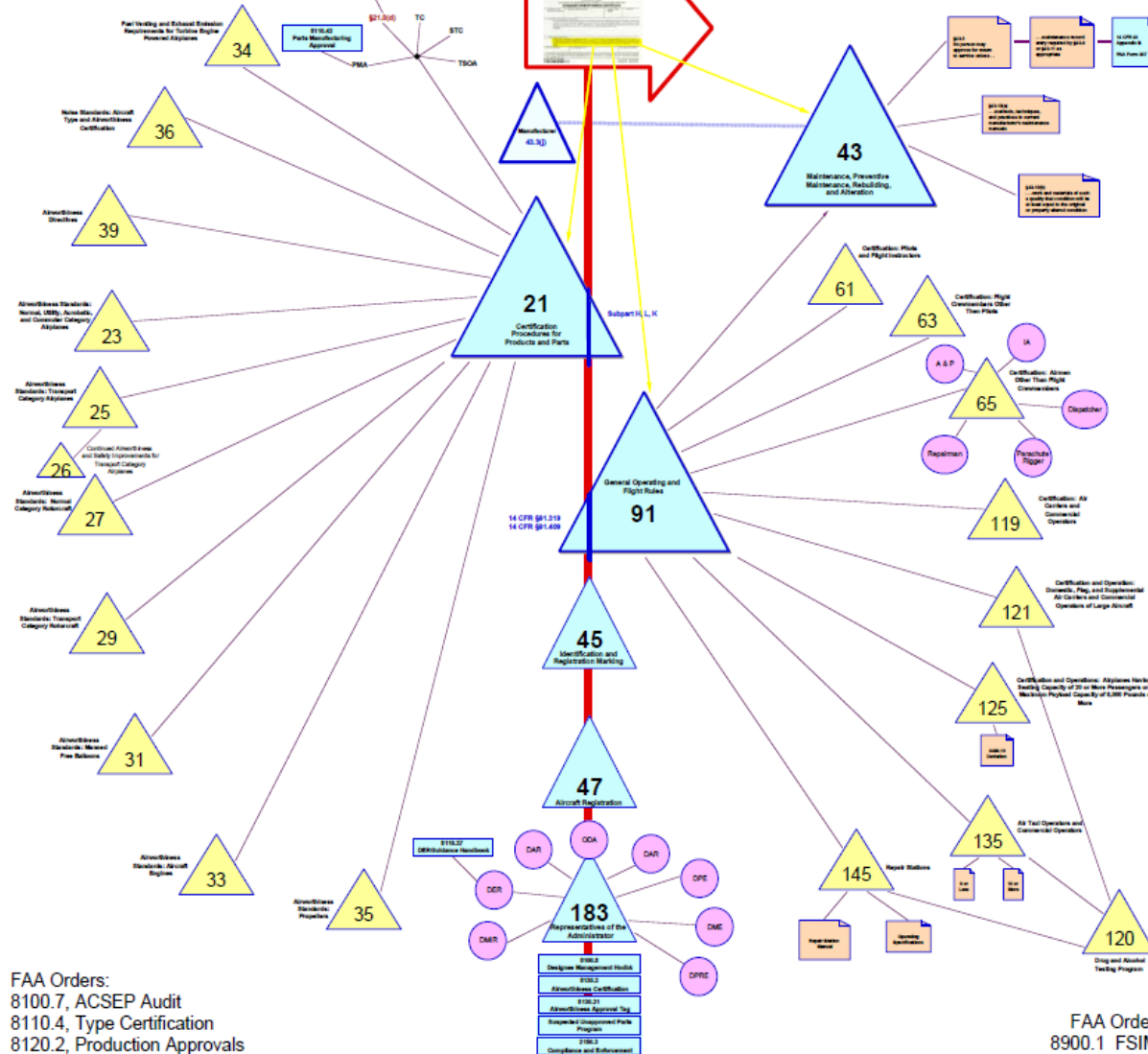


Aircraft Certification (AIR) Original Airworthiness ACO – CMO – MIDO

Flight Standards (AFS) Recurrent Airworthiness CMO – FSDO – IFO

AIR - Original Airworthiness
ACO - CMO - MIDO

Recurrent Airworthiness
CMO - FSDO - IFO - **AFS**



FAA-H-8083-30,
Aviation
Maintenance
Technician
Handbook

Federal Aviation Regulations Basics

- Regulations associated with certification:
 - 14 CFR part 21 – Certification procedures for products and articles
 - 14 CFR part 23 – Airworthiness standards: Normal*, utility, acrobatic, and commuter category airplanes
 - 14 CFR part 25 – Airworthiness standards: Transport category airplanes
 - 14 CFR part 26 – Continued airworthiness and safety improvements for transport category airplanes
 - 14 CFR part 27 – Airworthiness standards: Normal category rotorcraft
 - 14 CFR part 29 – Airworthiness standards: Transport category rotorcraft

Federal Aviation Regulations Basics

- Regulations associated with certification (con't):
 - 14 CFR part 31 – Airworthiness standards: Manned Free Balloons
 - 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
 - 14 CFR part 39 – Airworthiness directives

Federal Aviation Regulations Basics

- Regulations associated with airworthiness
 - 14 CFR part 43 – Maintenance, preventative maintenance, rebuilding, and alteration
 - 14 CFR part 91 – General operating and flight rules
 - 14 CFR part 121 – Operating requirements: domestic, flag, and supplemental operations
 - Part 125 – Certification and operations: airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity or 6,000 pounds or more; and rule governing persons on board such aircraft
 - 14 CFR part 135 – Operating requirements: Commuter and on-demand operations and rules governing persons on board such aircraft


Federal Aviation Regulations Basics

- Other important parts:
 - 14 CFR part 65 – Certification: Airmen other than flight crew members
 - ♦ Licensed mechanics and Inspection Authorization
 - 14 CFR part 145 – Repair stations
 - 14 CFR part 183 – Representatives of the Administrator
 - ♦ Individual and Organizational Designees

Federal Aviation Regulations Basics

- *Your most important resource for FAA reference documents:*
- www.faa.gov
 - <http://rgl.faa.gov/> (RGL = Regulatory and Guidance Library)
 - ◆ Regulations – current and historical (and future and proposed (NPRM))
 - ◆ Advisory Circulars (and draft ACs)
 - ◆ Airworthiness Directives (and proposed ADs (NPRM))
 - ◆ Orders and Notices
 - ◆ Type Certificate Data Sheets
 - ◆ Supplemental Type Certificates
 - ◆ Other info
 - <http://fsims.faa.gov/>– Flight Standards information

FAA Regulatory and Guidance Library (RGL)

 http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgWebcomponents.nsf/Frameset?OpenPage



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Title 14 of the Code of Federal Regulations

This database is a repository of certain Code of Federal Regulations (CFRs) and Special Federal Aviation Regulations (SFARs) from 14 CFR in their current version as well as historical versions. The current CFRs and SFARs refer to those documents that are in effect today. The historical CFRs and SFARs represent each CFR Part section from the original (since re-codification from the Civil Air Regulations). The CFR includes the active document as a result of the most recent amendment. When looking at the historical CFRs and SFARs, the checkmark indicates the CFR Part section or SFAR Part that is most current.

Preamble material can be found in the "CFR Final Rules" database.

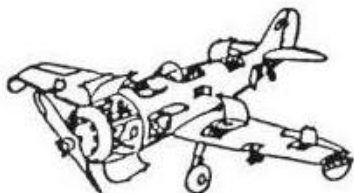
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So, you want to design an aircraft?



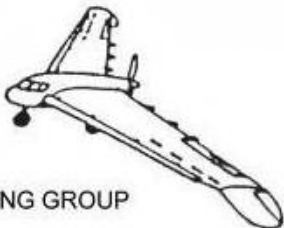
SERVICE GROUP



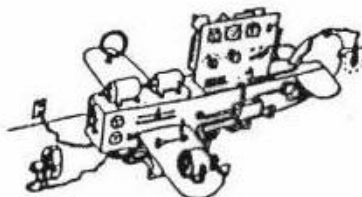
EQUIPMENT GROUP



ARMAMENT GROUP



WING GROUP



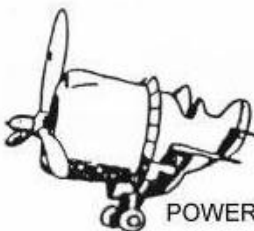
ELECTRICAL GROUP



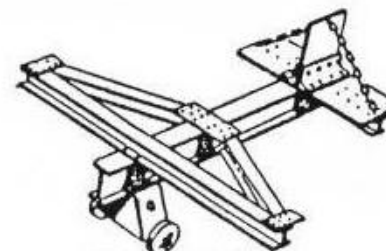
AERODYNAMICS GROUP



EMPENNAGE GROUP



POWER PLANT GROUP



STRESS GROUP

Design Certification

Design Certification

- Type certificates are issued for a product
- A product is defined in 14 CFR, 21.1(b)(6) as:
 - Aircraft
 - Aircraft Engine
 - Propeller
- Other approvals are issued for an article
- An article is defined in 14 CFR, 21.1(b)(2) as:
 - Material
 - Part
 - Component
 - Process
 - Appliance

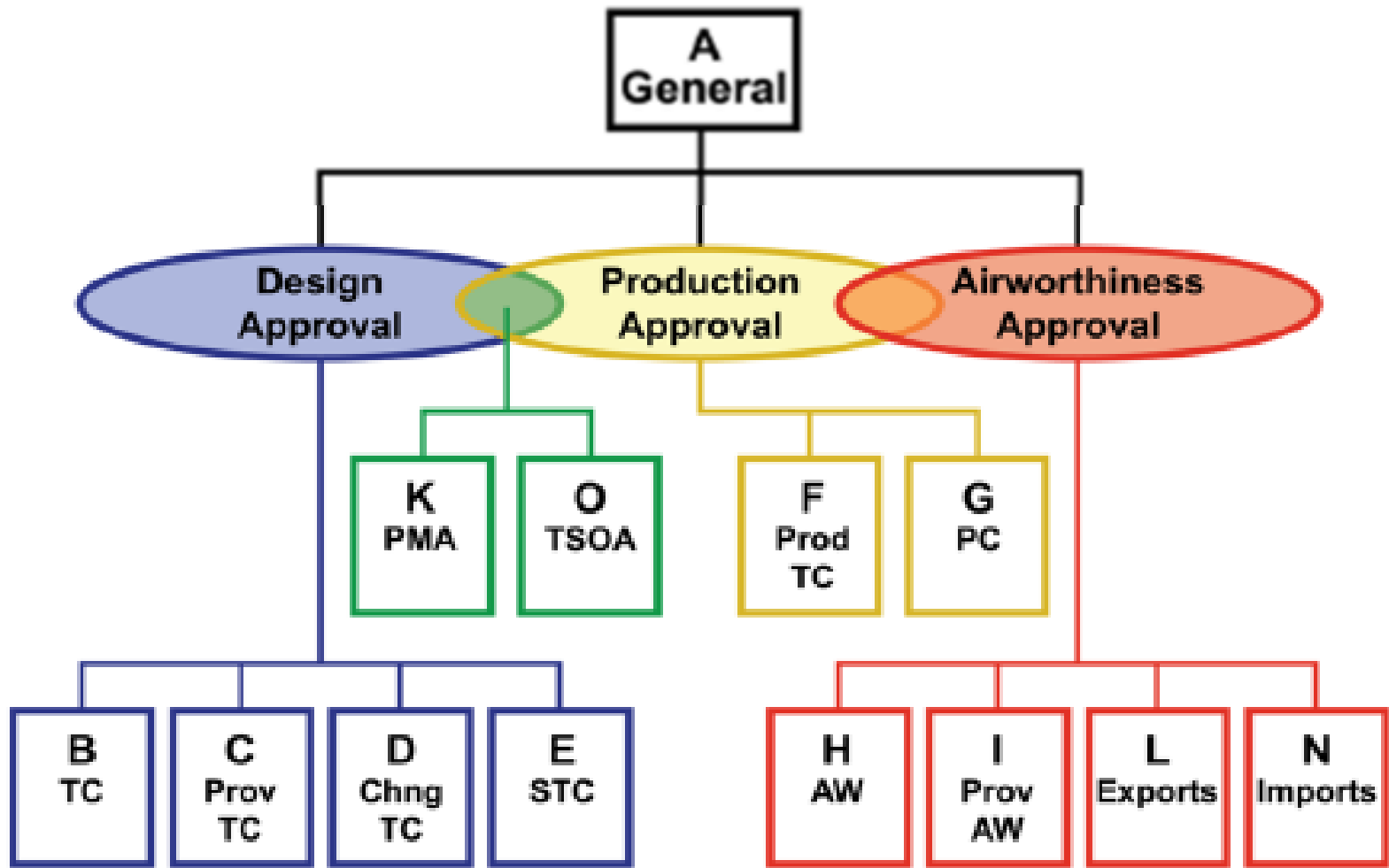
Part 21 -- Certification procedures for products and articles

- Subpart A – General
- Subpart B – Type Certificates
- Subpart C – Provisional Type Certificates
- Subpart D – Changes to Type Certificates
- Subpart E – Supplemental Type Certificates
- Subpart F – Production Under Type Certificate
- Subpart G – Production Certificates
- Subpart H – Airworthiness Certificates

Part 21 -- Certification procedures for products and articles (con't)

- Subpart I – Provisional Airworthiness Certificates
- Subpart K – Parts Manufacturer Approvals
- Subpart L – Export Airworthiness Approvals
- Subpart N – Acceptance of Aircraft Engines, Propellers, and Articles for Import
- Subpart O – Technical Standard Order Approvals
- Subpart P – Special Federal Aviation Regulations

Part 21 Roadmap



Design Certification

- Type Certificate is more than a certificate
- A Type Certificate includes
 - Information about the Type Design
 - Operating limitations
 - Type Certificate Data Sheet
 - Applicable airworthiness standards
 - Any other limitations or conditions prescribed by 14 CFR, Subchapter C

Note: Military Commercial Derivative Aircraft designs also fall under this “umbrella” of Type Certificate requirements and policies.

Part 21 -- Certification procedures for products and articles

Subpart B – Type Certificates

§ 21.17 Designation of applicable regulations.

§ 21.21 Issue of type certificate: normal, utility, acrobatic, commuter, and transport category aircraft; manned free balloons; special classes of aircraft; aircraft engines; propellers

§ 21.31 Type design.

§ 21.33 Inspection and tests.

§ 21.41 Type certificate.

- Addresses Type Certificate Data Sheets (TCDS)

§ 21.50 Instructions for continued airworthiness and manufacturer's maintenance manuals having airworthiness limitations sections.

Type Certification Data Sheet

- TCDS defines aircraft category
 - *Normal airplane – CFR part 23
 - Utility airplane – CFR part 23
 - Acrobatic airplane – CFR part 23
 - Commuter airplane – CFR part 23
 - Transport airplane – CFR part 25
 - Normal rotorcraft – CFR part 27
 - Transport rotorcraft – CFR part 29
 - Special classes (e.g. restricted) – CFR part 21



Type Certification Data Sheet

Examples

- P-51
- DC-3
- Boeing 747
- Beech King Air
- Cessna 172



TCDs on FAA's RGL



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B747 Type Certification Data Sheet (TCDS)

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION



A20WE
BOEING
Revision 55
~~747-100 Series~~
747-200B Series
~~747-200F Series~~
747-200C Series
747SR Series
747SP Series
747-100B Series
747-300 Series
747-100B SUD Series
747-400 Series
747-400D Series
747-400F Series
~~747-8 Series~~
747-8 Series
July 25, 2014

TYPE CERTIFICATE DATA SHEET NO. A20WE

This data sheet, which is a part of Type Certificate No. A20WE, prescribes conditions and limitations under which the product for which the Type Certificate was issued meets the airworthiness requirements of the Federal Aviation Regulations.

Type Certificate Holder: The Boeing Company
1901 Oakesdale Avenue SE, M/C OA1-37
Seattle, WA 98057-2623

I - 747-100 (Approved December 30, 1969) Transport Aircraft

Engines: 4 Pratt and Whitney JT9D-3, JT9D-3A, or JT9D-7, JT9D-7A, JT9D-7F, JT9D-7J.
See NOTE 5 regarding intermixing of engines.

Fuel: See NOTE 2

Design Certification

- A Type Design is:
 - Drawings and Specifications
 - Listing of those drawings and specifications
 - Includes dimensions, materials and processes
 - Everything necessary to define the configuration and design features of an aircraft, engine or propeller
- Example of a Type Design
 - A Boeing 747 and its derivative models (-100 to -800)
- Time limit for Type Certification process
 - 5 years for transport category
 - 3 years for other categories

Design Certification

- Definitions:
 - Certification Basis - a listing of all the airworthiness standards (safety rules) that the applicant must comply with to show that their design is safe
 - ◆ Typically the certification basis is the all of the applicable 14 CFR airworthiness standards in effect on the date of applicant's application plus any special conditions (also safety rules) the FAA deems necessary

Type Certification Basis

- § 21.41 Refers to “applicable regulations”
 - Commonly called “certification basis”
- Certification basis defined in TCDS
 - Certification regulations in effect at the time of application for type certification remain in effect indefinitely
 - Important for determining how to comply with fatigue rules, for instance
- Requirements “frozen” with type certification (TC)

TCDS: Type Certification Data Sheet

Part 23/25/27/29 -- Airworthiness standards:

Subpart A -- General

§ 23.3 Airplane categories. (*legacy small airplanes*)

- Normal, utility, acrobatic limited to 12,500 lbs
- Commuter category limited to 19,000 lbs, 19 passengers, propeller multi-engine (some biz-jets “exempted” into commuter category)

§ 23.2000 Applicability and definitions (*Effective Aug 30, 2017*)

- Normal category airplanes

§ 27.1 Applicability.

- Normal category rotorcraft with maximum weights of 7,000 pounds or less and nine or less passenger seats

§ 29.1 Applicability -- Transport rotorcraft category

Note: There is no definition of transport category airplane – “transport category” is any airplane that isn’t as defined in § 23.3 or in § 23.2000

Small Airplane Certification

Levels and Performance Definitions

§23.2005(b) Certification Level	Maximum Seating Configuration
Level 1	0 to 1 passengers
Level 2	2 to 6 passengers
Level 3	7 to 9 passengers
Level 4	10 to 19 passengers
§23.2005(c) Performance Level	Speed Criteria
Low Speed	V_{NO} and $V_{MO} \leq 250$ Knots Calibrated Airspeed (KCAS) and $M_{MO} \leq 0.6$
High Speed	V_{NO} or $V_{MO} > 250$ KCAS or $M_{MO} > 0.6$
Note: Levels per §23.2005, amendment 23-64	

Small Airplane Certification and Performance Levels

§23.2005(c) Performance Level	§23.2005(b) Certification Level Maximum Seating Configuration			
Speed Criteria	Level 1 0-1 Pax	Level 2 2-6 Pax	Level 3 7-9 Pax	Level 4 10-19 Pax
Low Speed $V_{NO}/V_{MO} \leq 250$ Kts $M_{MO} \leq 0.6$	Piston Trainer (Cessna 152) 19,000 lb. ag plane	Typical personal A/C (Cessna 172, Cirrus SR22, etc.)	Medium twins (Cessna 402)	deHavilland Twin Otter (DHC-6)
High Speed $V_{NO}/V_{MO} > 250$ Kts $M_{MO} > 0.6$	Fast single seat jet	VLJ: (Cirrus, Honda Jets, etc.)	Cessna CJ, Beech Premier jets; PC-12	Commuter (Beech 1900)

Part 23 -- Airworthiness standards: Normal category airplanes

New Part 23 Regulatory Approach

- Consensus-based standards will become means of compliance
- Standards being developed by industry-led ASTM committees
 - FAA, other countries participating
 - Standards must be “accepted” by FAA (not approved)
- Examples: fatigue evaluation standards
 - Level 1, Low Speed: Keep 1g stresses < 5.5 ksi, $K_t < 4 = 10,000$ hr. safe life
(Recently accepted per ASTM F3264-18)
 - Level 4, High Speed: Damage tolerance and full scale fatigue test
(Probable)

Airworthiness Standards (Parts 23, 25, 27, 29)

- Subpart A – General
- Subpart B – Flight
- Subpart C – Structures
- Subpart D – Design and Construction
- Subpart E – Powerplant
- Subpart F – Equipment
- Subpart G – Flightcrew Interface and Other Information *(P25)*
or Operating Limitations and Information (P23, 27, 29)
- Subpart H – Electrical Wiring Interconnection Systems
(EWIS) (part 25 only)

B747 Type Certification Data Sheet (TCDS)

DATA PERTINENT TO ALL MODELS, EXCEPT MODEL 747-400 AND 747-8 SERIES (cont'd):

Control Surface

Movements:

To insure proper operation of the airplane, the movement of the various control surfaces must be carefully controlled by proper rigging of the flight control systems. The airplane must, therefore, be rigged according to the following FAA-approved data:

Boeing Drawing Numbers

65B04001	Control Installation	Aileron and Spoiler
65B04002	Control Installation	Elevator
65B04003	Control Installation	Rudder
65B04004	Control Installation	Stabilizer Trim
65B04006	Control Installation	Rudder Trim
65B04007	Control Installation	Wing Flap
65B04016	Control Installation	Speed Brakes

Service Information:

Boeing Reports D6-13592, "Structural Repair Manual", (except for 747SP) is FAA-Approved.
Boeing Reports D6-34024, "Structural Repair Manual", is FAA-Approved for the 747SP. Service Bulletins and other service information, when FAA-Approved, will carry a statement to the effect.

Certification Basis:

FAR Part 1, FAR Part 21, FAR Part 36, FAR Part 25 effective February 1, 1965, Amendments 25-1 through 25-8 plus 25-15, 25-17, 25-18, 25-20, and Amendment 25-39 transmitted by FAA letter dated February 4, 1977, and special conditions summarized for record purposes as enclosed with FAA letter to The Boeing Company dated February 20, 1970. Special Condition 4A, revised to apply to airplanes with the landing gear load evenner system deleted, was recorded as attachment to an FAA letter to The Boeing Company dated May 12, 1971.

Based on 14 CFR § 21.101(g) for changes to TC's, applicable provisions of 14 CFR part 26 are included in the certification basis. For any future 14 CFR part 26 amendments, the holder of this TC must demonstrate compliance with the applicable sections.

Compliance has been found for the following regulations at Amendment 26-0: §26.11

Compliance has been found for the following regulations at Amendment 26-1: §26.49

Compliance has been found for the following regulations at Amendment 26-4: §26.43, §26.45

Compliance has been found for the following regulations at Amendment 26-6: §26.21

Amendment 25-46, Section 25.803(d) transmitted by FAA letter to The Boeing Company dated September 2, 1983. This is limited to all passenger configurations and 6/7 pallet combi configurations for Model 747-100, -200, and -300 series airplanes.

Design Certification Process

- The details of Type Certification are described in:

FAA Order 8110.4C, Type Certification

- Additional information can be found in:

The FAA and Industry Guide to Product Certification
(aka CPG or CPI Guide)

Note: In addition to 8110.4C, Military Commercial Derivative Aircraft design process details are described in Order 8110.101A, Type Certification Procedures For Military Commercial Derivative Aircraft.

FAA Delegation

- Representatives of the Administrator (part 183)
 - Designated Engineering Representatives (DER)
 - Designated Manufacturing Inspection Representatives (DMIR)
 - Designated Airworthiness Representative (DAR)
 - Organization Designation Authorization (ODA)
 - ◆ ODA administrator
 - ◆ Unit Members (UM)
 - Designee details explained in FAA Orders:
 - ◆ 8100.8D, Designee Management Handbook
 - ◆ 8000.95, Designee Management Policy

Role of Designees

- Designees are representatives of the FAA
 - *Individual designees*
 - ◆ **DER**: Designated Engineering Representative
 - ◆ **DMIR**: Designated Manufacturing Inspection Representative
 - ◆ **DAR**: Designated Airworthiness Representative
 - *Organization designees*
 - ◆ **ODA**: Organization Designation Authorization program
 - ◆ There are 8 different types of ODAs
 - ◆ Not every organization is eligible for every ODA type

Role of Designees

- *Individual designees:*
 - This system enables the FAA to use qualified technical individuals to perform certain examinations, testing, and inspections necessary to determine compliance with applicable airworthiness standards.
 - The FAA directly oversees and manages each individuals' performance.

Role of Designees

- *Organizational designees:*
 - FAA delegates certain types of authority to organizations; these are **ODA holders**.
 - The **ODA holders** are responsible for the delegated organization's performance
 - ◆ **ODA unit** is the group of individuals (at least two) within the **ODA** that perform the authorized functions.
 - A small group of FAA personnel is responsible for oversight of the **ODA**

Role of Designees

- ODA is essential to the FAA's safety mission
- Essential to FAA's safety oversight role due to the imbalance between the FAA's workload and resources
- Allows targeting of FAA's limited resources to the most safety critical issues
- Delegate in areas where ODA has demonstrated ability and FAA has high degree of confidence
- Ultimately frees FAA resources and increases industry efficiency

Design Certification

- **Definitions:**

- Type Certification Board (TCB) – Established to oversee projects involving:
 - Major changes in type design
 - New type certification programs
- TCB members include:
 - ACO Manager or representative
 - Project Officer from the accountable branch
 - Managers from appropriate engineering disciplines in ACO
 - MIDO Manager
 - Aircraft Evaluation Group Manager (AFS connection)
- TCB is largely “company only” members for ODA

Design Certification

- **Definitions Continued (TC Board):**

- Purpose of the Type Certification Board
 - ◆ Acquaint applicant & FAA with a new TC project
 - ◆ Identify and resolve significant problems
 - ◆ Establish a schedule for the type certification project
- TCB meetings are formal - minutes are taken
- TCB meetings are convened to:
 - ◆ Coordinate the transition to the next phase, or
 - ◆ Resolve issues preventing advancement
- TCB is largely a “company only” meeting for ODA

Design Certification

- Design Certification is divided into 3 phases
 - Project Initiation and Certification Planning
 - Data Submittal and Design Evaluation
 - FAA Inspection and Evaluation



Design Certification

- Project Initiation and Certification Planning
 - Process orientation on certification (FAA to applicant)
 - Familiarization briefing (applicant to FAA)
 - Certification project* starts
 - ◆ Application Submitted (FAA Form 8110-12)
 - ◆ ACO accepts application
 - ◆ ACO notifies interested parties using Certification Project Notification website
 - ◆ Type Certification Board (TCB) established
 - ◆ Certification Basis established
 - ◆ FAA may develop a Certification Project Plan
 - TCB is largely a “company only” meeting for ODA

Example Type Certification Regulations

Subpart D – Design and Construction

§ 25.601 General.

§ 25.603 Materials.

§ 25.605 Fabrication methods.

§ 25.607 Fasteners.

§ 25.609 Protection of structure.

§ 25.611 Accessibility provisions.

§ 25.613 Material strength properties and design values.

§ 25.619 Special factors.

§ 25.621. Casting factors.

§ 25.623. Bearing factors.

§ 25.625. Fitting factors.

§ 25.629 Aeroelastic stability requirements.

Regulations vs. Policy/Guidance

- Certification regulations specify minimum safety standards
- Advisory Circulars (AC) provide guidance regarding “means of compliance” to specific regulations

(Remember, all ACs are at <http://rgl.faa.gov>)

Regulations vs. Policy/Guidance

Regulation	Policy
Written broadly (many situations)	Written more narrowly (narrower range)
Mandatory – Force of law	Not mandatory – expect consistent application
Specific public processes	Not necessarily public Can adjust to situations
Applied universally	Applied selectively

Information Sources

- The applicable regulation
- Orders and notices
- Advisory Circulars
- Memos and letters, such as decisions papers
- Regulation preambles, federal register publications
- Submitting questions to the rule or policy owning organization
- Issue papers
- Corporate knowledge

Regulations vs. Policy/Guidance

Example

Specific rule:

“§ 25.571 Damage tolerance and fatigue evaluation of structure.

An evaluation must show that catastrophic failure due to fatigue, corrosion, manufacturing defects, or accidental damage, will be avoided throughout the operational life of the airplane.”

Associated guidance:

- AC 25.571-1D, Damage Tolerance and Fatigue Evaluation of Structure
 - Loading spectrum
 - Identification of principal structural elements
 - Analysis and tests
 - Inspection
 - Widespread fatigue damage/limit of validity
 - Etc.

Regulations vs. Policy/Guidance

Examples

Specific rule:

§ 25.1309 Equipment, systems, and installations.

Requires failure that prevents “continued safe flight and landing” to be “extremely improbable”

Associated guidance:

- AC 25.1309-1A, System Design and Analysis
 - Defines “catastrophic:” failure condition which would prevent continued safe flight and landing
 - Defines “extremely improbable:” probability on the order of 1×10^{-9} or less

Rulemaking Process

- Changes to regulations require “due process”
- Administrative Procedure Act (APA) governs regulatory process
 - Proposed rule changes must be submitted for public comment (Notice of proposed rulemaking (NPRM))
 - Public comments must be considered
 - Economic cost/benefit usually required (regulatory Flexibility Act)
 - Final rule must include “comment resolution”
- Although not part of the APA, FAA issues proposed policy and guidance (ACs and Policy Memos) for public comment
 - Enables open relationship with industry and public

Special Considerations to Regulations

- Special conditions
- Exemptions
- Equivalent Level of Safety

Note: Military Commercial Derivative Aircraft designs generally do not use these. AC 20-169, Guidance for Certification of Military and Special Mission Modifications and Equipment for Commercial Derivative Aircraft (CDA), covers “special” DoD installation provisions.

B747 Type Certification Data Sheet (TCDS)

747 Dreamlifter

XIV. 747-400 Large Cargo Freighter (LCF) Major Design Change

A 747-400 LCF is a 747-400 Series passenger airplane that has been modified in accordance with FAA-approved Boeing Service Bulletin 747-00-2084 to operate in a freighter configuration. These aircraft remain 747-400 Series aircraft for documentation purposes on this TCDS and with regard to the applicability of airworthiness directives. Because of the magnitude of this design change, the certification basis for the changed aspects was required to be established and documented in accordance with section 21.101 (Changed Product Rule). All general information in TCDS A20WE for the 747-400 Series remains applicable to an airplane operating in the 747-400 LCF configuration, with the following exceptions:

Maximum Passengers: Maximum of four (4) persons including the flight crew, per exemption 8769C and limitations outlined in the FAA approved Airplane Flight Manual.

Minimum Crew: Two (2) persons: pilot and copilot

FAA Approved Weight and Balance Control and Loading Manual: D043U545-BHC1

FAA Approved Airplane Flight Manual: D6U10001.4J61

Maximum Operating Altitude: 43,100 feet

Service Information: Boeing Report D634U105, "Structural Repair Manual," is FAA-approved. Service Bulletins and other Service Information, when FAA-approved, will carry a statement to that effect.

Certification Maintenance Requirements (CMR's):

The CMR's are listed in the FAA-approved Section 9 of Boeing Maintenance Planning Data Document D621U400-9 or the applicable engine Type Certificate Data Sheet. The more restrictive requirement from these two documents shall be in force.

Allowable Cargo: These airplanes are not approved for commercial freight hauling operations of material other than that approved per Exemptions 8769, 8769A and 8769B. Only cargo that supports Boeing corporate lines of business is allowed for carriage. All items intended for carriage must conform to the standards found in Document D926U013-44, "747-400 LCF Flammability Acceptance Criteria for Cargo Carriage," or be accepted by the FAA once a safe method of transport has been established. A summary of all items allowed for carriage is identified in Document D451U742-01, "Allowable Cargo – 747-400 Large Cargo Freighter." Document D451U742-01 is considered part of the Weight and Balance Manual/Airplane Flight Manual. In addition, a listing of the FAA-approved shipping mechanical equipment (SME) fixtures that are approved for installation on the 747-400 LCF aircraft are contained in the Weight and Balance Control and Loading Manual (Document D043U545-BHC1).



B747 Type Certification Data Sheet (TCDS)

747 Dreamlifter Certification Compliance

XIV. 747-400 LCF Major Design Change (cont'd)

14 CFR part 26:

Based on 14 CFR § 21.101(g) for changes to TC's, applicable provisions of 14 CFR part 26 are included in the certification basis. For any future 14 CFR part 26 amendments, the holder of this TC must demonstrate compliance with the applicable sections.

Compliance has been found for the following regulations at Amendment 26-0: §26.11

Compliance has been found for the following regulations at Amendment 26-1: §26.49

Compliance has been found for the following regulations at Amendment 26-4: §26.43, §26.45

Compliance has been found for the following regulations at Amendment 26-6: §26.21



Special Conditions:

Special conditions that are part of the certification basis for the 747-400 Series apply to the airplane operating in the 747-400 LCF configuration, unless otherwise noted below:

Special Condition 25-ANM-16 (use of an overhead crew rest area, occupancy not to exceed ten crewmembers) does not apply to aircraft operated in the 747-400 LCF configuration.

Special Conditions 25-61-NW-1 (occupancy not to exceed 32 passengers on the upper deck – spiral staircase) and 25-71-NW-3 (occupancy not to exceed 45 (or later, 110) passengers on the upper deck of airplanes with a straight segmented stairway) do not apply to aircraft operated in the 747-400 LCF configuration

Exemptions from 14 CFR Part 25:

All exemptions from 747-400 series aircraft apply to the 747-400 LCF configuration

Exemption from 14 CFR 25.855(b), 25.855(h)(2), 25.857(e)(2), 25.857(e)(3) - provide relief from the requirements to provide a complete cargo compartment liner, conduct flight tests to show compliance to smoke penetration requirements, provide a smoke detection system within the main deck and lower-lobe cargo compartment and provide a means to shut off the ventilating airflow to, or within, the main deck and lower-lobe cargo compartment; (Exemption No. 8769, dated 8/18/2006, No. 8769A, dated 1/29/2007, and No. 8769B, dated 9/12/2012)

Exemption from 14 CFR 25.791(a)(b), 25.807(b), (c)(1), (c)(5), (c)(6), 25.809(f)(1), 25.813(f), 25.857(e), 25.1447(c)(1)- provide relief to allow carriage of two non-crewmembers (commonly referred to as supernumeraries) other than flight crew to occupy the observer seats located within the flight deck of the 747-400 LCF. (Exemption No. 8769C, dated 5/29/2013)

Equivalent Safety Findings: All existing Equivalent Safety Findings listed in TCDS A20WE for the 747-400 Series apply to the 747-400 operated in the 747-400 LCF configuration, except those listed below:

- Section 25.815, Width of Aisle, does not apply
- Section 25.1203, Fire-Detection System, does not apply
- Section 25.1103(d), Pressure Relief, does not apply

Special Conditions

- FAA provides for “Special Conditions”
 - § 21.16: if reg’s *“...do not contain adequate or appropriate safety standards ... because of a novel or unusual design feature...”*
- Process
 - Applicant presents novel design features early in process
 - FAA addresses airworthiness requirements established with certification basis
 - Once issued, special conditions have the same weight as other rules

B-787 Battery Special Condition



Certification information

- FAA special conditions No. 25-359-SC, Federal Register October 11, 2007, page 57842
- “Novel and unusual design features” -- High capacity lithium ion battery technology
- Special Conditions:
 - ◆ Safe cell temperatures
 - ◆ No explosive or toxic fluid or gas emissions
 - ◆ Prevent battery heat caused structure/systems damage
 - ◆ Controlled charging rate
 - ◆ Battery monitoring and warning feature



Are Special Conditions Needed for This “Novel” External Store Application?



Photo: Marv Nuss

Exemptions



- 14 CFR provides provisions to petition for exemption from a specific rule (§ 11.81)
 - Why it's in the public interest
 - Why it would not adversely affect safety

Exemptions from 14 CFR Part 25:

All exemptions from 747-400 series aircraft apply to the 747-400 LCF configuration

Exemption from 14 CFR 25.855(b), 25.855(h)(2), 25.857(e)(2), 25.857(e)(3) - provide relief from the requirements to provide a complete cargo compartment liner, conduct flight tests to show compliance to smoke penetration requirements, provide a smoke detection system within the main deck and lower-lobe cargo compartment and provide a means to shut off the ventilating airflow to, or within, the main deck and lower-lobe cargo compartment, (Exemption No. 8769, dated 8/18/2006, No. 8769A, dated 1/29/2007, and No. 8769B, dated 9/12/2012)

Exemption from 14 CFR 25.791(a)(b), 25.807(b), (c)(1), (c)(5), (c)(6), 25.809(f)(1), 25.813(f), 25.857(e), 25.1447(c)(1)- provide relief to allow carriage of two non-crewmembers (commonly referred to as supernumeraries) other than flight crew to occupy the observer seats located within the flight deck of the 747-400 LCF. (Exemption No. 8769C, dated 5/29/2013)

Equivalent Level of Safety (ELOS)



- 14 CFR provides provisions to allow for an equivalent level of safety to a specific rule (§ 21.21)
 - Applicant cannot show literal compliance
 - Show compensating factors that maintain required level of safety
 - Accountable standards branch makes the ELOS finding
(was accountable Directorate)

B747 Type Certification Data Sheet (TCDS)

747-8F Equivalent Level of Safety

XV. Model 747-8F (cont'd)

The following regulations have been complied with by findings of an Equivalent Level of Safety:

Applicable Part 25 Section	Amndt Level	Subject	ELOS Number
25.107(e)(1)(iv)		Minimum Unstick Speed (VMU)	TC6918SE-T-F-6
25.689(a)(1)		Control Cable Diameter	PS05-0212-SF-2
25.777(e)	25-46	Wing Flap Control Lever	PS05-0212-SF-1
25.783(e)	25-88	Visual Indication of Forward and Aft Lower Lobe Cargo Door Locked Condition	PS05-0212-C-1
25.783(e)	25-88	Visual Indication of Main Deck Side Cargo Door Closed, Latched, and Locked Condition.	PS05-0212-C-2
25.811		Door Sill Reflectance and Exterior Exit Markings	TC6918SE-T-CS-2
25.831(g)		Acceptable High Temperature Physiological Environment During Failure Conditions	PS05-0020-ES-3 Rev 1
25.857(c)(1)		Cargo Compartment Classification Inadvertent Smoke Detection in Lower Lobe Class C Cargo Compartments	AT8167-T-ES-1
25.863 25.1182(a) 25.1183(a)		Engine Nacelle Power Door Opening System (PDOS) Fire Testing	PS05-0211-P-6
25.863 25.1182(a) 25.1183(a)		Nacelle Areas Behind Firewalls for Thrust Reverser Directional Control Valve (DCV)	PS05-0212-P-18
25.933		Flight Critical Thrust Reverser	TC6918SE-T-P-2
25.934		Engine and Thrust Reverser System Testing	TC6918SE-T-P-17
25.981(a)(3)		Means of Compliance for the Installation of GFI Relays on Boeing Model 707, 727, 737CL, 737NG, 747 CL, 747-400, 757, 767, & 777 Airplanes and Equivalent Safety Finding for Ground Fault Interrupter Circuit Protection for Fuel Override and Jettison Pumps	PS05-0123-P-1 Re PS05-0212-P-24



Cirrus SR-20 Equivalent Level of Safety (ELOS)

- SR-20 wing design prevents classic stall/spin situation
- § 23.221 requires demonstration of quick spin recovery
- Since SR-20 can't spin, demonstration is impossible
- SR-20 included a General Aviation Recovery Device (GARD) in its design (ballistic recovery parachute) to provide an ELOS to the spin requirement

Cirrus calls the system CAPS: Cirrus Airframe Parachute System)

Link to video of recent CAPS deployment near Hawaii:

<https://www.youtube.com/watch?v=gBCUQIF3MMU>



Design Certification

- Data Submittal and Design Evaluation
 - Applicant creates drawings and develops manufacturing processes
 - Applicant begins making parts and assembling product (aircraft, engine or propeller)
 - Applicant begins ground testing of product
 - Applicant begins submitting data to FAA
- For ODA, much of this is internal to the company

Design Certification

- Data Submittal and Design Evaluation
 - Data submittal is a continuing process
 - Applicant usually takes 3-5 years to obtain TC
 - Data is obtained from inspections and tests of **conformed** parts, assemblies and complete product
 - Applicant follows FAA approved test plans when obtaining data for FAA

Design Certification

- Data Submittal and Design Evaluation
 - What is all the fuss about conformity?
 1. Applicant creates a set of drawings and documents manufacturing processes
 2. Applicant builds prototype that conforms exactly to the drawings and process specifications

Design Certification

- Data Submittal and Design Evaluation
 - What is all the fuss about conformity?
 3. The prototype is rigorously tested and shown to meet airworthiness standards - safety rules - its certification basis
 4. After the TC is issued, the new TC holder will build duplicates of the prototype using the drawings and processes that were used to build the prototype

Note: Military Commercial Derivative Aircraft designs may have unique conformity issues. These are documented with FAA Form 8130-31, Statement of Conformity – Military Aircraft.

Design Certification

- Data Submittal and Design Evaluation
 - Facts about Conformities
 - ◆ A conformity inspection is a process for determining that the product being certified complies with the proposed type design
 - ◆ Conformities include making sure that the correct raw materials are used, parts are consistently made, processes are followed; that is, quality is built-in
 - ◆ Parts, assemblies and installation of assemblies are all conformed. Manufacturing processes are conformed.
 - ◆ Applicant will do 100% conformity inspection. The FAA will do a second conformity only on items deemed necessary
 - For ODA, much of this is internal to the company

Design Certification

- Data Submittal and Design Evaluation
 - Applicant Testing
 - ◆ Applicant builds prototype
 - ◆ Applicant conducts ground inspections and ground tests
 - ◆ Prototype must:
 - Conform to drawings and specifications
 - Meet minimum requirements for quality
 - Be in condition for safe operation (safe for intended testing)
 - ◆ FAA issues special airworthiness certificate for “research and development” by the FAA.
 - Applicant begins flight testing

Design Certification

- Data Submittal and Design Evaluation
 - Applicant Ground and Flight Testing
 - ◆ Much of applicant's testing used to show compliance to 14 CFR airworthiness standards
 - Results of ground and flight tests submitted to FAA engineering and flight test for review
 - FAA engineering examines data to find compliance to 14 CFR airworthiness standards
 - For ODA, much of this is internal to the company
 - ◆ Depends on complexity of ODA project

Design Certification

- Data Submittal and Design Evaluation
 - Compliance by FAA Engineering Inspection
 - ◆ Physical inspection of product or an installation
 - ◆ Done where examination of drawing or reports is not adequate to ascertain compliance to 14 CFR
 - For ODA, much of this is internal to the company

Design Certification

- Data Submittal and Design Evaluation
 - The Data submittal and Design Evaluation phase ends when:
 - ◆ Technical data is complete
 - ◆ Applicant has shown compliance to certification basis, i.e., the 14 CFR airworthiness standards
 - For ODA, much of this is internal to the company

Design Certification

- FAA Inspection and Certification Evaluation
 - FAA begins FAA testing
 - ◆ FAA issues a formal plan authorizing inspection of the type design
 - ◆ The plan is called a Type Inspection Authorization (TIA)
 - ◆ TIA authorizes the FAA to do:
 - Final FAA conformities
 - Airworthiness inspections
 - Ground and flight tests
 - ◆ TIA tests are a verification of previous applicant testing
 - ◆ For ODA, much of this is internal to the company

Design Certification

- FAA Inspection and Certification Evaluation
 - Final TCB Meeting
 - ◆ Review/disposition any outstanding items
 - ◆ Formalize decision to issue **Type Certificate**
 - ◆ With concurrence of accountable Standards Branch, authorize issuance of Type Certificate
(Was accountable Directorate)
 - For ODA, much of this is internal to the company
 - ◆ FAA must still issue type certificate

Design Certification

Shared responsibility

- **Applicant** submits data to *show compliance*
 - Type design
 - Test reports
 - Computations, etc.
 - Written statement of compliance
- **FAA finds compliance**
 - Type design/product meets requirements
 - No feature or characteristics make the aircraft unsafe
 - Uses discretion in amount and kind of data to inspect

The United States of America
Federal Aviation Administration
Department of Transportation

Type Certificate

Number A6WF

This certificate issued to MCDONNELL DOUGLAS CORPORATION
certifies that the type design for the following product with the operating limitations and conditions therefor as specified in the Federal Aviation Regulations and the Type Certificate Data Sheet, meets the airworthiness requirements of Part 4b of the Federal Aviation Regulations.

DC-9-11, DC-9-12, DC-9-13, DC-9-14, DC-9-15,
DC-9-31, DC-9-15F, DC-9-32, DC-9-32F, DC-9-41,
DC-9-33F, DC-9-21, DC-9-51, DC-9-34F, DC-9-34,
DC-9-81, DC-9-82, DC-9-83

This certificate, and the Type Certificate Data Sheet which is a part hereof, shall remain in effect until surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

This certificate consists of three pages.

Date of application: See Page 2.

Date of issuance: See Page 3.

By direction of the Administrator

(Signature) Keith D. Anderson

(Title) MANAGER, LOS ANGELES AIRCRAFT
CERTIFICATION OFFICE

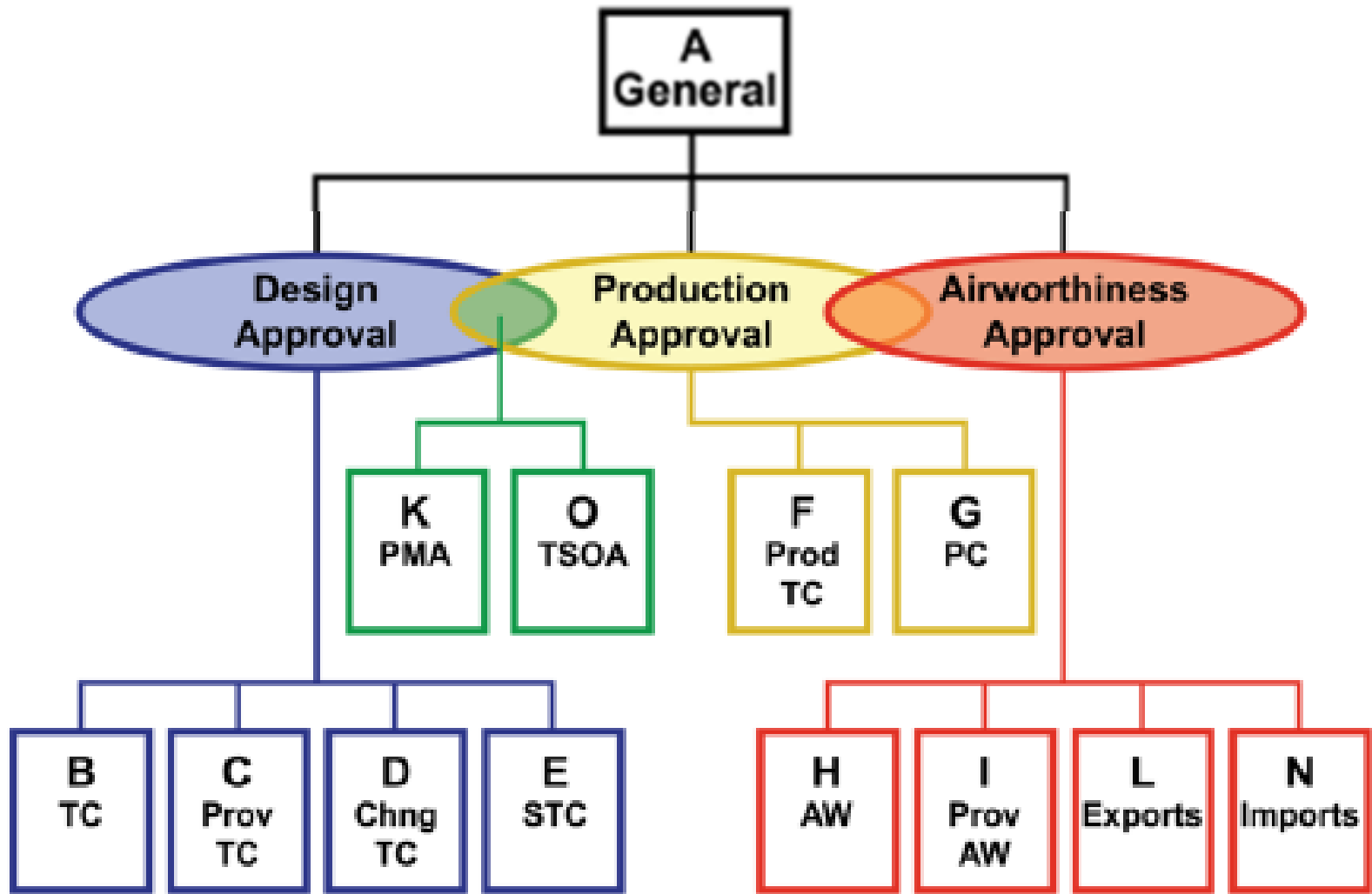
This certificate may be transferred if endorsed as provided on the reverse hereof.

Any alteration of this certificate and/or the Type Certificate Data Sheet is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years, or both.

So, you want to design and/or make stuff that goes on an aircraft?



Part 21 Roadmap



Design Certification

- Other Design Approvals
 - Parts Manufacturer Approval (PMA)
 - ◆ A design and production approval for modification or replacement articles
 - ◆ Part 21 Subpart K – Approval of Materials, Parts, Processes, and Appliances
 - ◆ PMA Orders 8110.42D and 8110.119
 - PMA permits “aftermarket” parts
 - ◆ “Reverse engineering” is an acceptable practice for data approval
 - ◆ Rules for sale of parts
 - Examples: engine, landing gear, mechanical systems parts , etc.
 - Thousands of PMAs
 - ◆ Rules for manufacturer’s use only
 - Typically airlines

PMA – Key Concepts

- Must be tied to one or more TC'd products
 - Installation Eligibility
- Must mark PMA part in a specific way
- Can be simpler than the process for issuing a TC or PC (limited scope of approval)
- Suppliers can find the PMA profitable
- Owners/operators may prefer PMA parts
- PMAs are not transferable

Ways to Obtain a PMA

- Test reports and computations
- Identity
- A licensing agreement (a form of identity)

Design Certification

- Other Design Approvals
 - Technical Standard Order Authorization (TSOA)
 - ◆ A design and production approval for an article used on an aircraft
 - ◆ The article defined by a minimum performance standard called Technical Standard Order (TSO)
 - ◆ Part 21 Subpart O – Technical Standard Order Authorizations
 - ◆ TSOA Order 8150.1D, AC 21-46A, AC 21-50
 - ◆ There are active TSOs for about 180 parts or components
 - Examples are aircraft tires, aircraft seats, airspeed indicators, altimeters, turn and bank indicators
 - Letter of Design Authorization (LODA)
 - ◆ Like a TSOA but issued to a foreign manufacturer and only a design approval

TSO – Basis Description

- TSO: A minimum performance standard for an article, designed for use on a civil aircraft
 - Spells out design requirements and testing procedures for the article
 - Only articles within a selected list have TSOs
 - Article is independent of the aircraft
 - Developed chiefly as a convenience to manufacturers
 - Use of TSO requires two approvals
 - ◆ Approval of the article by issuing a TSOA or LODA
 - ◆ Approval of installation of article on a particular TC'd product
 - TSO may be updated and revised

TSOA – Basic Description

- TSOA: A Technical Standard Order Authorization is a dual approval for manufacturing an article that meets the requirements of a TSO
- LODA: Letter of Design Approval
- TSO is issued by FAA's Policy and Innovation Division
 - Defines minimum performance standard
- TSOA is issued from an ACO with concurrence of MIDO
 - Approves manufacture of an article that meets the TSO
- TSOA Reciprocal Agreements with EASA and TCCA

MIDO: Manufacturing Inspection District Office
EASA: European Aviation Safety Agency
TCCA: Transport Canada Civil Aviation

Design Certification

- TSO examples
 - Tire
 - Seat
 - Avionics
 - “Steam gauge”
 - Seat belt extender



TSO Installation

- FAA requires separate approval to install a TSO article
 - Must consider the article's environment relative to the installation
 - Just because an article meets a TSO doesn't mean it's safe to use in a particular installation
- Suitable approvals
 - TC
 - STC
 - FAA Flight Standards field approval or alteration using Form 337

§ 21.8(d) Approvals

- In any other manner approved by the FAA
 - Some TSOs where standards are different between FCAAs
- NORSEE: Non-Required (for TC) Safety Enhancing Equipment
 - IPAD Mounts, CO Detectors, USB chargers, etc.
- Applies only to GA & Rotorcraft (Parts 23, 27, 29 aircraft)
- FAA Policy Memo, PS-AIR-21.8-1602, dated March 31, 2016

FCAA: Foreign Civil Aviation Authority
CO: Carbon Monoxide
USB: Universal Serial Bus

Design Certification

- Other Design Approvals (continued)
 - Supplemental Type Certificates and Amended Type Certificates
 - Field Approvals
- These will be discussed later...

Design Approval

Shared responsibility

- **Applicant** submits data to *show compliance*
 - Type design
 - Test reports
 - Computations, etc.
 - Written statement of compliance
- **FAA finds compliance**
 - Type design/product meets requirements
 - No feature or characteristics make the aircraft unsafe
 - Uses discretion in amount and kind of data to review

So, you want to build an aircraft?

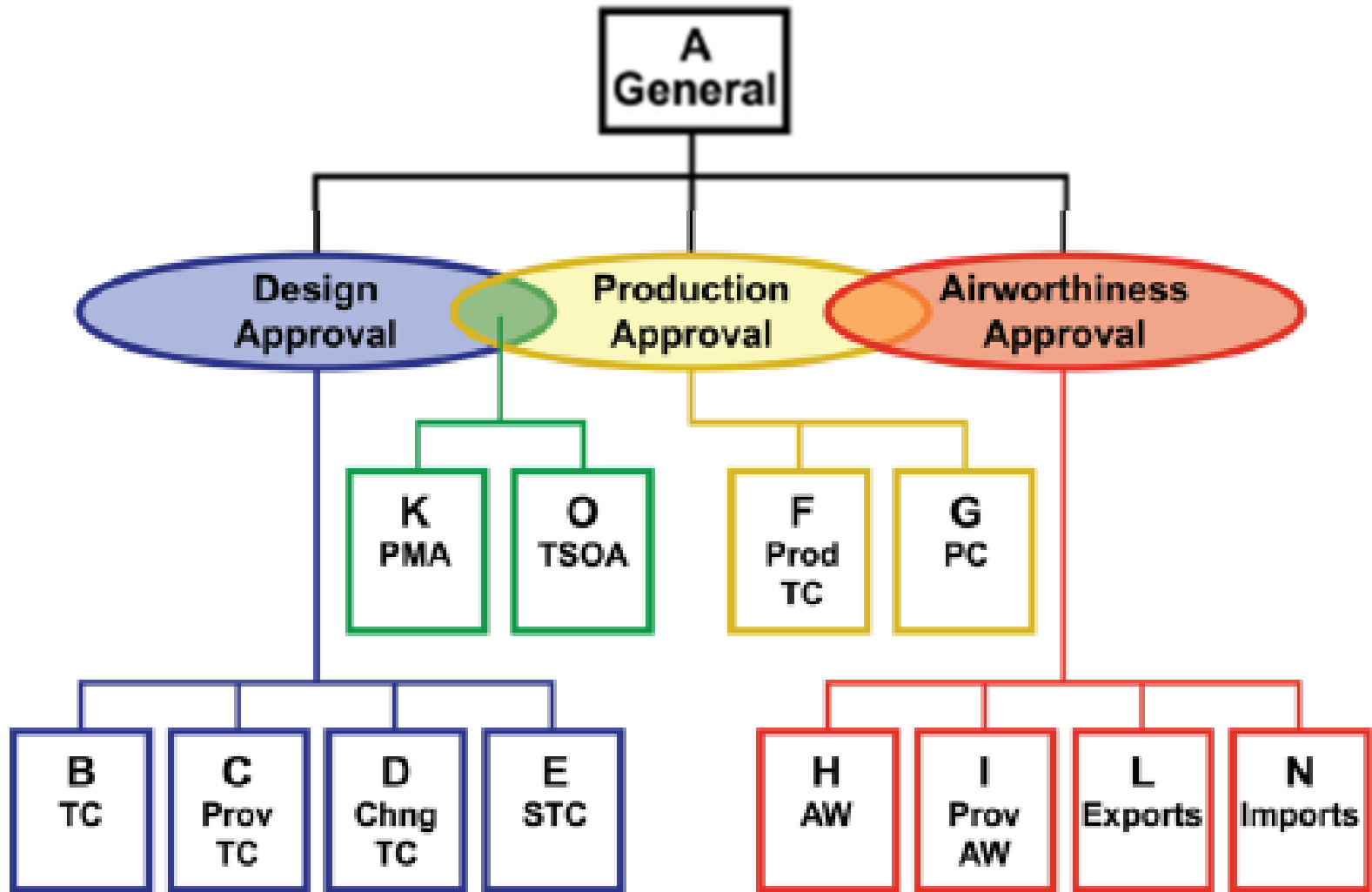


Production Certification

Production Approval

- Signifies that an organization and its personnel, facilities, and quality system can produce a product or article that both conforms to its approved design and is in a condition for safe operation
- Tied to one or more specific design approvals
- Allows production of replacement parts for products or articles as included within the design upon which the approval was based

Part 21 Roadmap



Part 21 -- Certification procedures for products and parts

- Subpart A – General
- Subpart B – Type Certificates
- Subpart C – Provisional Type Certificates
- Subpart D – Changes to Type Certificates
- Subpart E – Supplemental Type Certificates
- **Subpart F – Production Under Type Certificate Only**
- **Subpart G – Production Certificates**
- Subpart H – Airworthiness Certificates

Production Under Type Certificate

- Provides an interim means to begin producing TC'd products
- Provides time to mature and refine the quality system on the way to a PC
- Applies only to aircraft, engines, or propellers
 - Specifies required operational tests, markings, ground checks, etc.
- Requires the FAA to inspect and determine airworthiness conformity for every individual product
 - Each product must be available for FAA inspection and flight-testing
 - Manufacturer must maintain technical data and drawings at the production facility
 - Either FAA Manufacturing Inspector or DAR must do all airworthiness approvals
- Production under TC is allowed for only 6 months after issuance of the TC

DAR: Designated Airworthiness Representative

Production Certification

- A production certificate (PC) represents the approval of a manufacturer's quality system
- That quality system controls the production of a civil aviation product, including any suppliers as appropriate
- The FAA issues a PC after finding the applicant complies with the requirements of Part 21 Subpart G – Production Certificates

Production Certification

- Facts about Production Certificates
 - Always accompanied by a Production Limitation Record (PLR)
 - Anyone who holds a current TC, a STC or a license for a TC or STC can apply for a PC
 - PCs are not transferable
 - PC holders must have an established quality system
 - PC holders must have an approved manual that describes the quality system
 - Quality system revisions require FAA approval

Production Certification

- Facts about Production Certificates
 - Production Limitation Record (PLR)
 - ◆ Lists the TC'd products the PC holder is approved to manufacture
 - ◆ Authorizes production and sale of replacement parts for listed products
 - ◆ The PLR is considered part of the PC
 - ◆ Allows FAA to update approvals without issuing a new PC
 - Revisions or additions to the PLR
 - ◆ Used to add a new TC'd product or amended product, remove a product no longer in production, add a new facility, etc.
 - ◆ Amendments must supply revised data on the QC system before FAA approval

Production Certificate: Minimum Quality System Requirements

- Quality system described in writing (manual)
- Description of assigned responsibilities
 - Delegation
 - Relationship of those responsible for quality to management
- AC 21-43 provides info for production approval holders (PAH)

AC 21-43, Production Under 14 CFR Part 21, Subparts F, G, K, and O

Production Certification

- A PC quality system must have procedures for:
 - Inspection and testing
 - Status of inspection and testing
 - Implementing corrective and preventative actions
 - Preventing damage and deterioration of product & parts
 - Accomplishing internal audits
 - Processing feedback on in-service failures
 - Identifying and initiating corrective action on quality system escapes

AC 21-43 provides details about each element

Production Certification

- A PC quality system must control:
 - Design data
 - Documents
 - Supplier and vendors
 - Inspecting, measuring and test equipment
 - Non-conforming products and parts
 - Quality records
 - Manufacturing processes

AC 21-43 provides details about each element

Production Certification

- Process for granting Production Certificate
 - First, preliminary MIDO audit is completed
 - ◆ Purpose is to evaluate the quality manual and the applicant's production facilities
 - ◆ Preliminary MIDO audit non-compliances are made available to the applicant and to the Production Certification Board (PCB)
 - Second, PCB is convened to evaluate all aspects of the applicant's production system

MIDO: Manufacturing Inspection District Office

Production Certification

Conduct of the Production Certification Board

- Initially - review results of preliminary MIDO audit
- Hold meeting to discuss audit with PC applicant
- Carry out audit
- Hold internal meeting to discuss audit findings
- Advise applicant of PCB findings
- MIDO review of corrective actions taken by applicant

Production Certification

- A PC and PLR are issued to a PC applicant when the Production Certification Board determines that an applicant complies with Subpart G of 14 CFR, Part 21.

Production Certification

- Facts about Production Certificates
 - Changes to the quality system
 - ◆ PAH must immediately notify FAA of any change that may affect its product or article's inspection, conformity, or airworthiness
 - ◆ FAA audits PAH to ensure procedure is working and it is notified of changes
 - Record retention
 - ◆ All records that establish conformity must be retained for 5 years
 - ◆ Documentation on critical parts must be retained for 10 years

Production Certification

- Facts about Production Certificates
 - Changes to manufacturing facilities
 - ◆ Location changes require prior FAA approval
 - ◆ PAH must immediately notify FAA in writing of changes that may affect inspection, conformity, or airworthiness
 - FAA does not approve production outside US unless there is no “undue burden” to the FAA
 - ◆ Reference FAA Order 8100.11D, “Requirements for Finding Undue Burden and No Undue Burden Under 14 CFR Part 21”

Production Outside the US

- FAA permits production outside the US when there is a “bilateral agreement”
 - Specific agreements with other countries or jurisdictions
 - Provides for registration and certification of aircraft and related articles intended to be used outside the country of manufacture
- Other country’s aviation authority acts on behalf of FAA
 - Mitigates “undue burden” from FAA
- AC 21-24A provides info for production outside US

AC 21-24A, Extending a Production Certificate to a Facility Located in a Bilateral Airworthiness Agreement Country

Bilateral Agreements

- **State of Design:** country or jurisdiction having regulatory authority over the organization responsible for the *design and continued airworthiness* of a civil aeronautical product or article.
- **State of Manufacture:** country or jurisdiction having regulatory authority over the organization responsible for the *production and airworthiness* of a civil aeronautical product or article.

Production Outside the US

Example

- Boeing produces 787 fuselage in Italy
 - USA is “state of design” – FAA is design approving authority
 - USA is “state of manufacture” – under the oversight of EASA
 - Boeing’s PC includes Italy manufacturing facility for specific fuselage parts/assemblies
 - ◆ Boeing is responsible for quality of the parts made there
 - ◆ Per the Bilateral Agreement, EASA is responsible for oversight of that facility – acting on behalf of FAA
- Similar provisions for 787 parts made in Japan, etc.
- Reverse is true for EASA country parts made in USA

Role of Designees - Production

- Designees are representatives of the FAA
 - *Individual designees*
 - ♦ **DMIR**: Designated Manufacturing Inspection Representative
 - 14 CFR Part 183.31
 - ♦ **DAR**: Designated Airworthiness Representative
 - 14 CFR Part 183.33
 - *Organization designees*
 - ♦ **ODA**: Organization Designation Authorization Unit Member
 - 14 CFR Part 183.51

Role of Designees – Production

- DMIR/DAR/ODA Functions:
 - DMIR/DAR/ODA activities are performed under the supervision of an FAA manufacturing inspector.
 - DMIR/DAR/ODA may determine that materials, parts, and assemblies are in conformity with the approved data and in condition for safe operation.

Production Certification

- Other Production Approvals
 - Production Under Type Certificate (Temporary)
 - Parts Manufacturer Approval (PMA)
 - Technical Standard Order Authorization (TSOA)
- Other production approval system requirements are the same as those for PC, 14 CFR Part 21.137

Production Approval Similarities

- What PAH must provide
 - Organization
 - Quality System
 - Quality manual
 - Location of/changes to manufacturing facilities
 - Requirements for inspections and tests
- System characteristics
 - Issuance
 - Duration
 - Transferability
- PAH management
 - Responsibilities of holder
 - Changes to the quality system
 - Reporting
 - Record retention

Federal Aviation Administration

Production Certificate

Number 329CE

This certificate, issued to
LEARJET INC.

whose business address is
ONE LEARJET WAY
WICHITA, KANSAS 67209

and whose manufacturing facilities are located at

SEE SUPPLEMENT DATED DECEMBER 19, 2005, FOR FACILITY ADDRESSES

authorizes the production, at the facilities listed above, of reasonable duplicates
of AIRPLANES AND RELATED PARTS.

which are manufactured in conformity with authenticated data, including
drawings, for which Type Certificates specified in the pertinent and currently
effective Production Limitation Record were issued. The facilities, methods, and
procedures of this manufacturer were demonstrated as being adequate for the
production of such duplicates on date of JUNE 22, 1990.

Duration: This certificate shall continue in effect indefinitely, provided,
the manufacturer continuously complies with the requirements for original
issuance of certificate, or until the certificate is canceled, suspended, or
revoked.

Date issued:

DECEMBER 19, 2005

By direction of the Administrator

for *Norma R. Bascall*
CLEMENTE FIGUEROA, MANAGER
WICHITA MANUFACTURING INSPECTION
DISTRICT OFFICE

This Certificate is not Transferable, and any MAJOR CHANGE in the BASIC FACILITIES, OR in the LOCATION THEREOF,
SHALL BE IMMEDIATELY REPORTED TO THE APPROPRIATE REGIONAL OFFICE OF THE FEDERAL AVIATION ADMINISTRATION.

Any alteration of this certificate is punishable by a fine of not exceeding \$1,000, or imprisonment not exceeding 3 years or both

FAA FORM 8120-4 (12-69) SUPERSEDES FAA FORM 333

Department of Transportation

Federal Aviation Administration

Production Limitation Record

Page 1 of 4

The holder of

Production Certificate No. 329CE

may receive the benefits incidental to the
possession of such certificate with respect to

Wichita Facility: Aircraft and Related Parts

manufactured in accordance with the data forming the
basis for the following Type Certificate(s) No.

A5CE

Model Authorized
*23 7/31/64

Model	Authorized
*24	3/17/66
*23/24 (Remfd.)	5/23/66
*25	10/10/67
*24A/24 (Remfd.)	3/20/69
*25A	5/19/70
*24D	6/30/70
*25B	8/19/70
*35	6/28/74
35A	4/30/76
*25D	5/20/76
*24E	6/2/76
*24F-A	11/24/76
*29	2/16/79
*55B	8/29/86
*55C	12/23/88
60	1/15/93

A10CE

Model	Authorized
*24A	4/5/66
*24/24A (Remfd.)	3/17/67
*24B	12/17/68
*24B-A	4/24/69
*24C	6/30/70
*24D-A	1/31/70
*25C	8/19/70
*36	6/28/74
36A	4/30/76
*25F	5/20/76
*24F	8/2/76
*28	2/16/79
*55	4/8/81
31	9/16/88
31A	7/25/91

By direction of the Administrator

*Production Approval For Spare Parts Only

December 19, 2005

Date of issuance

FAA FORM 8120-3 (7-67)

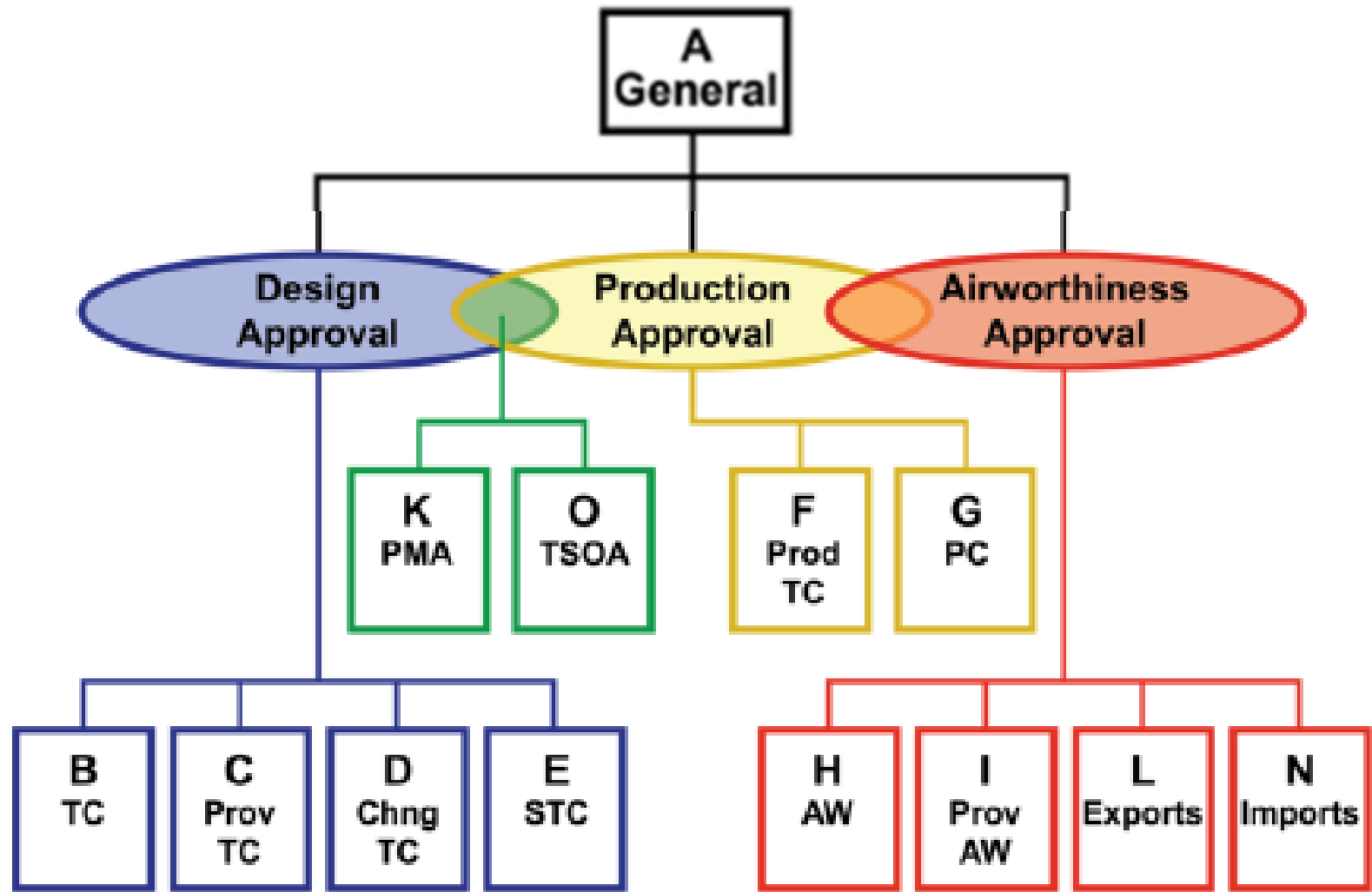
for *Norma R. Bascall*
Clemente Figueroa, Manager
Wichita Manufacturing Inspection
District Office

So, you want to operate the aircraft?



Airworthiness Certification

Part 21 Roadmap



Airworthiness Certification

- Airworthiness Certification
 - Attests that an aircraft is in condition for safe operation
 - And, as applicable, conforms to its approved type design
- At a minimum, an airworthiness certificate allows a civil aircraft to be operated in U.S. airspace
 - FAA does not issue A/W certificates for military commercial derivative aircraft
- Certification is the goal of design and production certification
 - Indicates the ability to operate at the appropriate level of safety

Public Use Aircraft

- Airworthiness Certification not required for Public Use Aircraft
 - Owned or used by US, State, or local Government
 - ◆ No commercial purpose
 - ◆ Crew or qualified non-crew only
- Use of GOV contracted aircraft is tricky
 - Depends on specific mission
- Specific GOV is responsible for aircraft safety (not FAA)
 - Prudent to maintain according to FAA reg's and policies
- AC 00-1.1A, Public Aircraft Operations, contains guidance

Airworthiness Certification

- Two classifications for airworthiness certificates
 - Standard ~ white in color
 - Special ~ pink in color
- To obtain a standard airworthiness certificate, an aircraft must:
 - Conform to its type design
 - Be in condition for safe operation

General Provisions for Airworthiness Certification

- Aircraft must be registered in the US
- Applicant showing and FAA findings including:
 - Basic eligibility
 - Identification and markings
 - Conformity to type design
 - Condition for safe operation
 - Legitimate purpose for the certification
 - Compliance to environmental standards
 - Compliance for emergency exit requirements
 - (Not all may apply)

Identification: Fireproof Data Plate



Standard Airworthiness Certification

- Meets applicable airworthiness and environmental standards
- Allows the aircraft to be operated with the most minimal restrictions
- Are type certificated in one or more categories
 - Normal
 - Utility
 - Acrobatic
 - Commuter
 - Transport
 - Manned free balloons
 - Special class (airships, powered lift, sailplanes, etc.)

Standard Airworthiness Certification

- Methods of Issuance
 - New aircraft produced under a PC
 - ◆ No further showing
 - New aircraft produced under a TC
 - ◆ Statement of conformity for each aircraft
 - Imported Aircraft
 - ◆ Country of manufacture must certify conformity and condition for safe operation
 - Used and US military surplus aircraft
 - ◆ Conforms to type design, 100 hr inspection, and FAA inspections

Airworthiness Certification

- Little known facts about Standard Airworthiness Certificates:
 - They are issued for an indefinite period as long as the aircraft is properly maintained
 - They are transferrable with the sale of an aircraft
 - They allow operation almost anywhere in the world, not just the United States (Accepted by ICAO countries)

Airworthiness Certification

- Special Airworthiness Certificates are issued to aircraft that do not meet the requirement for a standard airworthiness certificate.
 - These aircraft do have to be in a condition for safe operation.

Airworthiness Certification

- Special Airworthiness Certificates (pink) are issued for the following aircraft:
 - Restricted
 - Limited
 - Primary
 - Experimental
 - Provisional
 - Light sport



Special Airworthiness Certificate: Experimental

- Various purposes
 - R&D
 - Showing compliance for certification
 - Crew training
 - Exhibition
 - Air racing
 - Market surveys
 - Operating amateur-built aircraft
 - Operating primary kit-built aircraft
 - Operating light-sport aircraft

Light Sport Category

- FAA “accepts” industry “consensus standards”
 - Product specific specs for testing, development, and manufacture, including maintenance manuals and continued airworthiness
- Special airworthiness certificate requires:
 - Operating instructions
 - Maintenance and inspection procedures
 - Statement of compliance
 - Flight training supplement
 - FAA must inspect aircraft and find it in a condition for safe operation

Airworthiness Certification

- Special Airworthiness Certificates are also used for Special Flight Permits
- Special Flight Permit purposes are:
 - One time flight to a base for repairs, modifications, maintenance or storage
 - Delivery or export
 - Production flight testing of new aircraft
 - Evacuation from impending danger
 - Conducting customer demonstrations (new aircraft)
 - Flight at weights over maximum takeoff weight

Results of brown bear attack in Alaska



Special Flight Permits

Duct tape field repair FAA
approved for a special ferry flight



Airworthiness Certificate

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION
STANDARD AIRWORTHINESS CERTIFICATE

1. NATIONALITY AND REGISTRATION MARKS N9070U	2. MANUFACTURER AND MODEL Boeing 737-222	3. AIRCRAFT SERIAL NUMBER 19951	4. CATEGORY Transport
--	--	---	---------------------------------

5. AUTHORITY AND BASIS FOR ISSUANCE
This airworthiness certificate is issued pursuant to the Federal Aviation Act of 1958 and certifies that, as of the date of issuance, the aircraft to which issued has been inspected and found to conform to the type certificate therefor, to be in condition for safe operation, and has been shown to meet the requirements of the applicable comprehensive and detailed airworthiness code as provided by Annex 8 to the Convention on International Civil Aviation, except as noted herein.

Exceptions:
Exemption from FAR 25.1001 - allow takeoff weight 115% of maximum landing weight.

6. TERMS AND CONDITIONS
Unless sooner surrendered, suspended, revoked, or a termination date is otherwise established by the Administrator, this airworthiness certificate is effective as long as the maintenance, preventative maintenance, and alterations are performed in accordance with Parts 43, and 91 of the Federal Aviation Regulations, as appropriate, and the aircraft is registered in the United States.

DATE OF ISSUANCE 8-27-69	FAA REPRESENTATIVE F. G. Felt	DESIGNATION NUMBER DMIR No. 4032
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Any alteration, reproduction, or misuse of this certificate may be punishable by a fine not exceeding \$1,000, or imprisonment not exceeding 3 years, or both. THIS CERTIFICATE MUST BE DISPLAYED IN THE AIRCRAFT IN ACCORDANCE WITH APPLICABLE FEDERAL AVIATION REGULATIONS.

FAA Form 8100-2 (7-67) FORMERLY FAA FORM 1362

GPO : 1967-O-275 931

UNITED STATES OF AMERICA DEPARTMENT OF TRANSPORTATION - FEDERAL AVIATION ADMINISTRATION SPECIAL AIRWORTHINESS CERTIFICATE	
TYPE/DESIGNATION EXPERIMENTAL	
PURPOSE OPERATING AMATEUR-BUILT AIRCRAFT	
B MANUFACTURER	NAME N/A ADDRESS N/A
C FLIGHT	FROM N/A TO N/A
D	N- 48SB BUILDER MARK W. JACOBS SERIAL NO. 9411 MODEL PITTS SIS
DATE OF ISSUANCE 04-01-95 EXPIRY UNLIMITED	
OPERATING LIMITATIONS DATED 04-01-95 ARE A PART OF THIS CERTIFICATE	
E	SIGNATURE OF FAA REPRESENTATIVE Darrel A. Freeman DESIGNATION OR OFFICE NO. OKC-MIDO-41
Any alteration, reproduction or misuse of this certificate may be punishable by a fine not exceeding \$1,000 or imprisonment not exceeding 3 years, or both. THIS CERTIFICATE MUST BE DISPLAYED IN THE AIRCRAFT IN ACCORDANCE WITH APPLICABLE FEDERAL AVIATION REGULATIONS.	

FAA FORM 8130-7 (10/82)

SEE REVERSE SIDE

Airworthiness Approvals

- In contrast with airworthiness certificates, which are issued for aircraft...
 - Airworthiness *approvals* attest to the fact that an engine, propeller, or individual part:
 - ◆ Conforms to its type design
 - ◆ Is in condition for safe operation
 - Parts produced via PMA, TSOA, PC, TC or STC prototype parts, bilateral agreement
 - Parts made for repair, by repair station, for owner aircraft
- These airworthiness approvals can be in the form of data plates, stampings, etchings, labels, or even a piece of paper

Export Airworthiness Approvals

- New or used US manufactured aircraft that meets requirements for US airworthiness certificate
- New or used non-US manufactured aircraft must have a valid US airworthiness certificate
- Bilateral agreement must be in place for engines, propellers and articles

So, you want to maintain the aircraft ?



Maintaining an Aircraft for Continued Safe Operation

Parts 23, 25, 27, 29, 31, 33, 35

Subpart G – Operating Limitations and Information

§ 2x.1529 Instructions for Continued Airworthiness. (ICA)

- All product certification parts require ICA
 - ◆ Covers maintenance, repair, flight manuals, etc.
- ICA includes Airworthiness Limitation Section (ALS)
 - “Current” ALS (per FAA) is mandatory
 - Explanation of FAA’s “Current” would require that we stay until 8:30 tonight!

Maintaining a Transport Airplane for Continued Safe Operation

Part 26 – Continued airworthiness and safety improvements for transport category airplanes

- Subpart A – General
- Subpart B – Enhanced Airworthiness Program for Airplane Systems (EWIS)
- Subpart C – Aging Airplane Safety--Widespread Fatigue Damage
- Subpart D – Fuel Tank Flammability
- Subpart E – Aging Airplane Safety – Damage Tolerance Data for Repairs and Alterations

Subpart C (§26.21) contains regulations regarding Limit of Validity (LOV)

Example Regs for ICA

Part 25 Appendix H contains ICA detail requirements

- H25.2: Format
- H25.3: Content
 - (a) Airplane Maintenance manual or section
 - (b) Maintenance instructions
 - (c) Diagrams of structural access plates and information to gain access for inspections...
 - (d) Details for the application of special inspection techniques...
 - (e) Information needed to apply protective treatments to structure...
 - (f) All data relative to structural fasteners...
 - (g) A list of special tools needed.
- H25.4 Airworthiness Limitations section.
 - (a)(1) Each mandatory modification time, replacement time, structural inspection interval, and related inspection procedures approved under §25.571.
 - (a)(4) A limit of validity of the engineering data that supports the structural maintenance program (LOV)...
 - (b) ALS must be in main manual and clearly state that it is FAA approved and specifies **required** maintenance

Regulatory Requirements Related to ICA

- Airworthiness Limitations (ALS) are part of the TC data
 - Limitations typically listed or referenced on the TCDS
 - Usually Chapter 4 of ICA
- “Current” ALS are mandatory regardless of operation
- The rest of ICA are not necessarily mandatory
 - Depends on operations requirements
- All changes to ALS require FAA approval
 - Cannot be delegated to OEM or DER (some rare exceptions)
 - Limitations that address an unsafe condition must be mandated via AD
 - Other limitations must be approved by FAA but can be changed via TCDS change, manual or Service Bulletin, etc., revision
- FAA policy continues to evolve and is fluid

AD: Airworthiness Directive
TCDS: Type certification data sheet
OEM: Original equipment manufacturer

Regulatory Requirements Related to ICA

- Part 91 – General Operating and Flight Rules
 - § 91.403(c) No person may operate an aircraft unless the mandatory replacement times, inspection intervals, and related procedures specified in the airworthiness limitations section have been complied with
(above text is paraphrased)
 - ◆ There are some exceptions if an alternative has been approved by the FAA
 - Commercial Operations (e.g. parts 121, 125, and 135) refer back to part 91

Aircraft Certification (AIR)

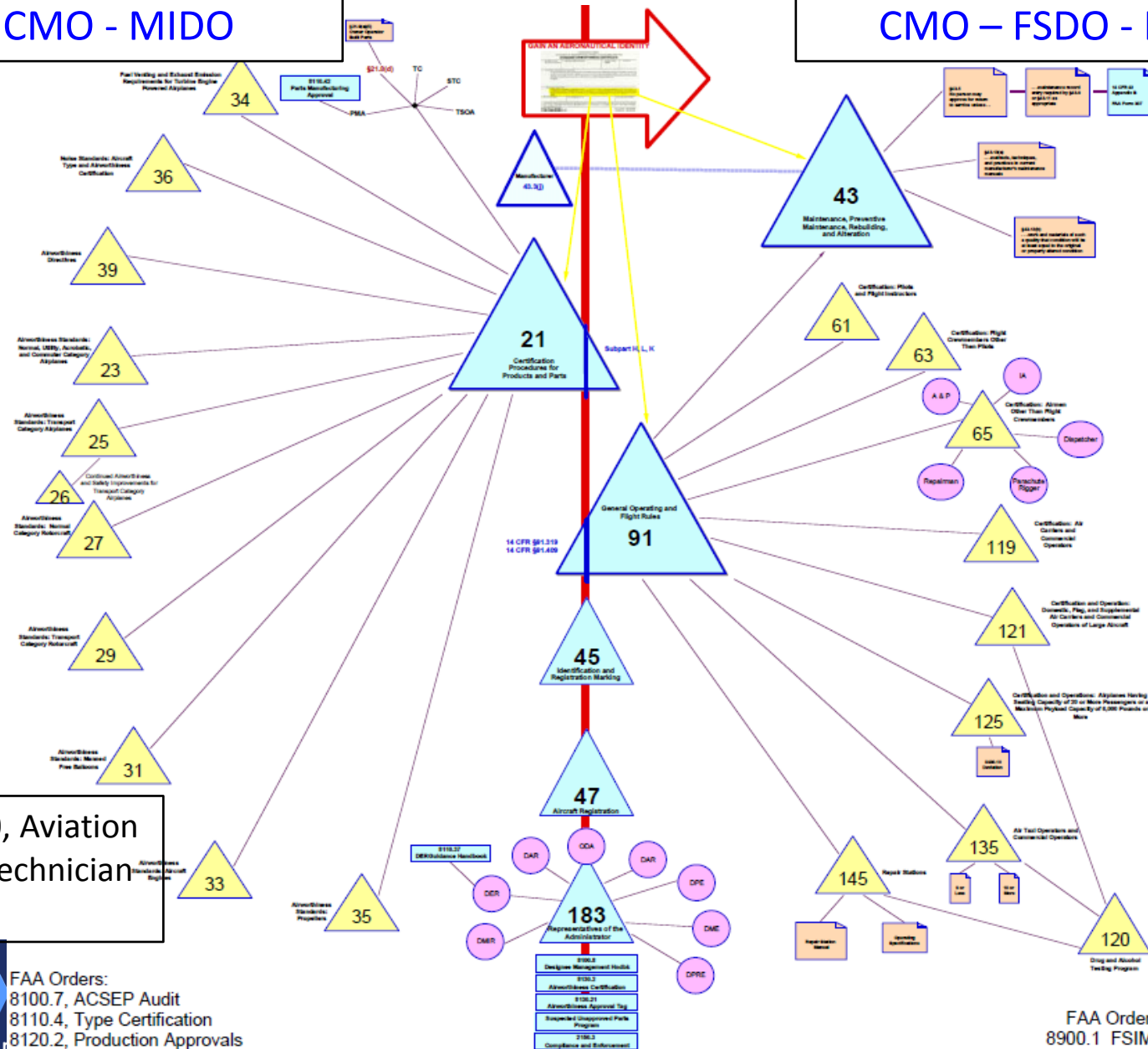
Original Airworthiness

ACO – CMO - MIDO

Flight Standards (AFS)

Recurrent Airworthiness

CMO – FSDO - IFO



FAA-H-8083-30, Aviation Maintenance Technician Handbook

Continued Operational Safety

FAA's objective

- Monitoring and oversight
 - Complete and effective fleet monitoring and oversight system
- Proactive approach
 - Cultural shift from the “fix and fly” reactive approach to a proactive one that manages risk
 - Reactive approach still necessary to investigate accidents, etc
- Tracking/ closure of concerns
 - Facilitation of tracking and closure of safety concerns

Part 39 – Airworthiness Directives (AD)

§ 39.3 Definition of airworthiness directives.

§ 39.5 When does FAA issue airworthiness directives?

§ 39.7 What is the legal effect of failing to comply with an airworthiness directive?

§ 39.19 May I address the unsafe condition in a way other than that set out in the airworthiness directive?

The FAA AD Process

- ADs address:
 - An unsafe condition that exists in a product
 - Condition is likely to exist in other products of the same type design
- ADs are mandatory (creates a rule – brings to type design)
 - Emergency
 - Immediately adopted
 - NPRM
- Administrative Procedures Act provides due process with public comment
(Emergency safety concerns exempt)
- Alternative Method of Compliance (AMOC) permitted with FAA approval

NPRM: Notice of Proposed Rulemaking

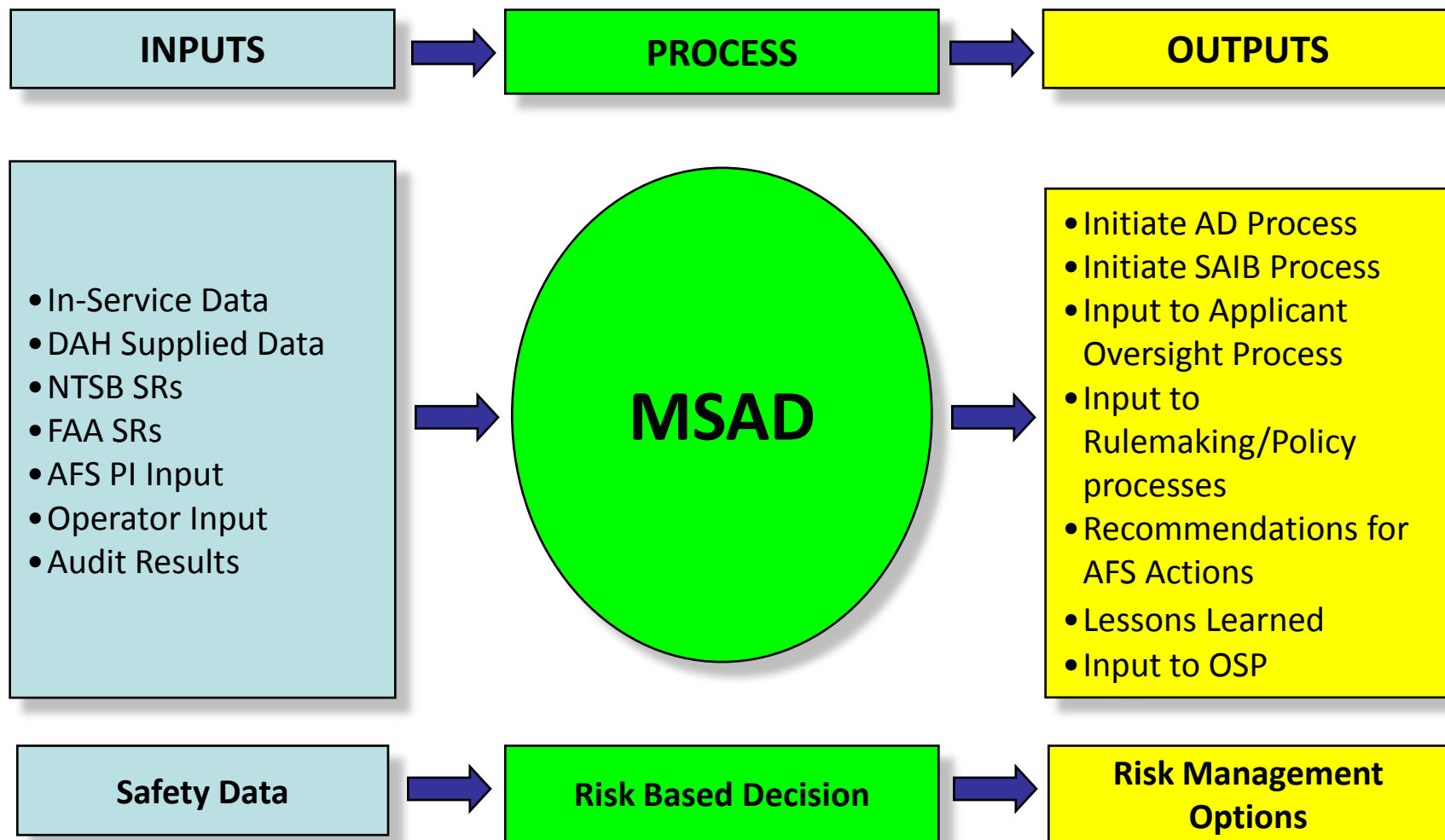
FAA's Disciplined Approach to Risk Management

- FAA established its “Safety Risk Management Policy” in 1998:
“The FAA shall use a formal, disciplined, and documented decision-making process to address safety risks in relation to high-consequence decisions affecting the complete life cycle.”

(FAA Order 8040.4A, revised to 8040.4B in May 2017)

- FAA Aviation Safety organization followed with its Safety Management System (SMS)
 - FAA Aircraft Certification Service SMS includes specific policies regarding risk assessment and management
 - **“Monitor Safety/Analyze Data” (MSAD)** is FAA’s Aircraft Certification Service’s process to manage risk:
 - “designed to promote data-driven, risk-based continued operational safety decision-making.”
 - ◆ The MSAD process is documented in FAA Order 8110.107A (2012)

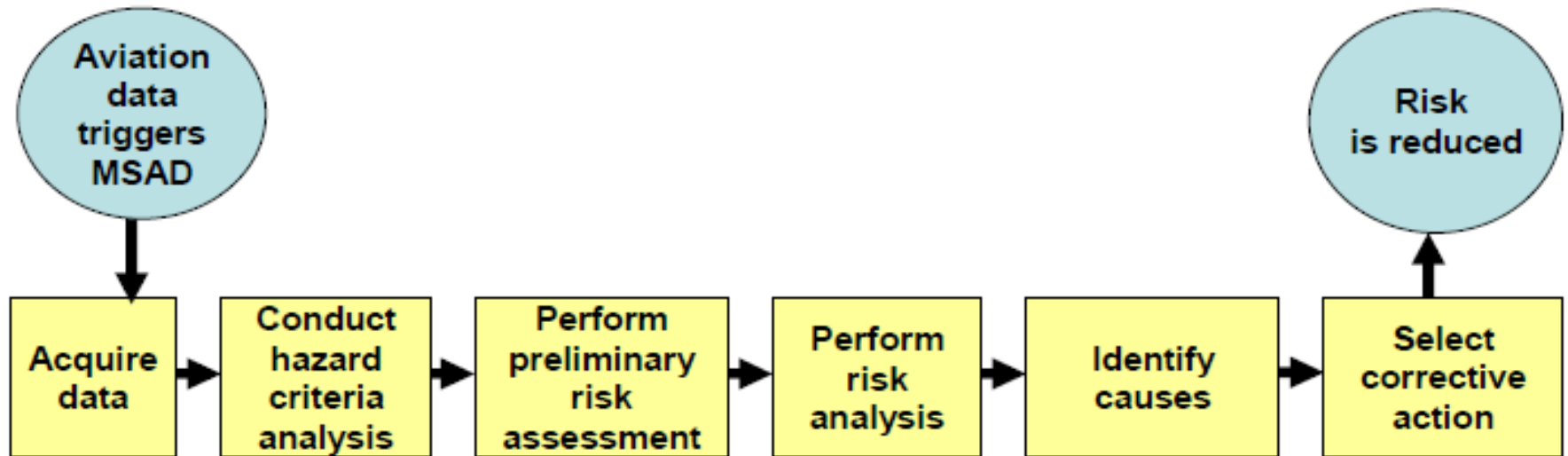
MSAD Inputs and Outputs



SR: Safety Recommendation

OSP: Oversee System Performance

MSAD Risk Management Process



MSAD process relies heavily in-service data.
Service difficulty reporting (SDR) is the major source of in-service data.

Ref: FAA Order 8110.107A

Rules for Maintaining and Operating Aircraft

- **Part 43** – Maintenance, preventative maintenance, rebuilding, and alteration
- **Part 91** – General operating and flight rules
- **Part 121** – Operating requirements: domestic, flag, and supplemental operations
- **Part 125** – Certification and operations: airplanes having a seating capacity of 20 or more passengers or a maximum payload capacity or 6,000 pounds or more; and rule governing persons on board such aircraft
- **Part 135** – Operating requirements: Commuter and on-demand operations and rules governing persons on board such aircraft

Aircraft Certification (AIR)

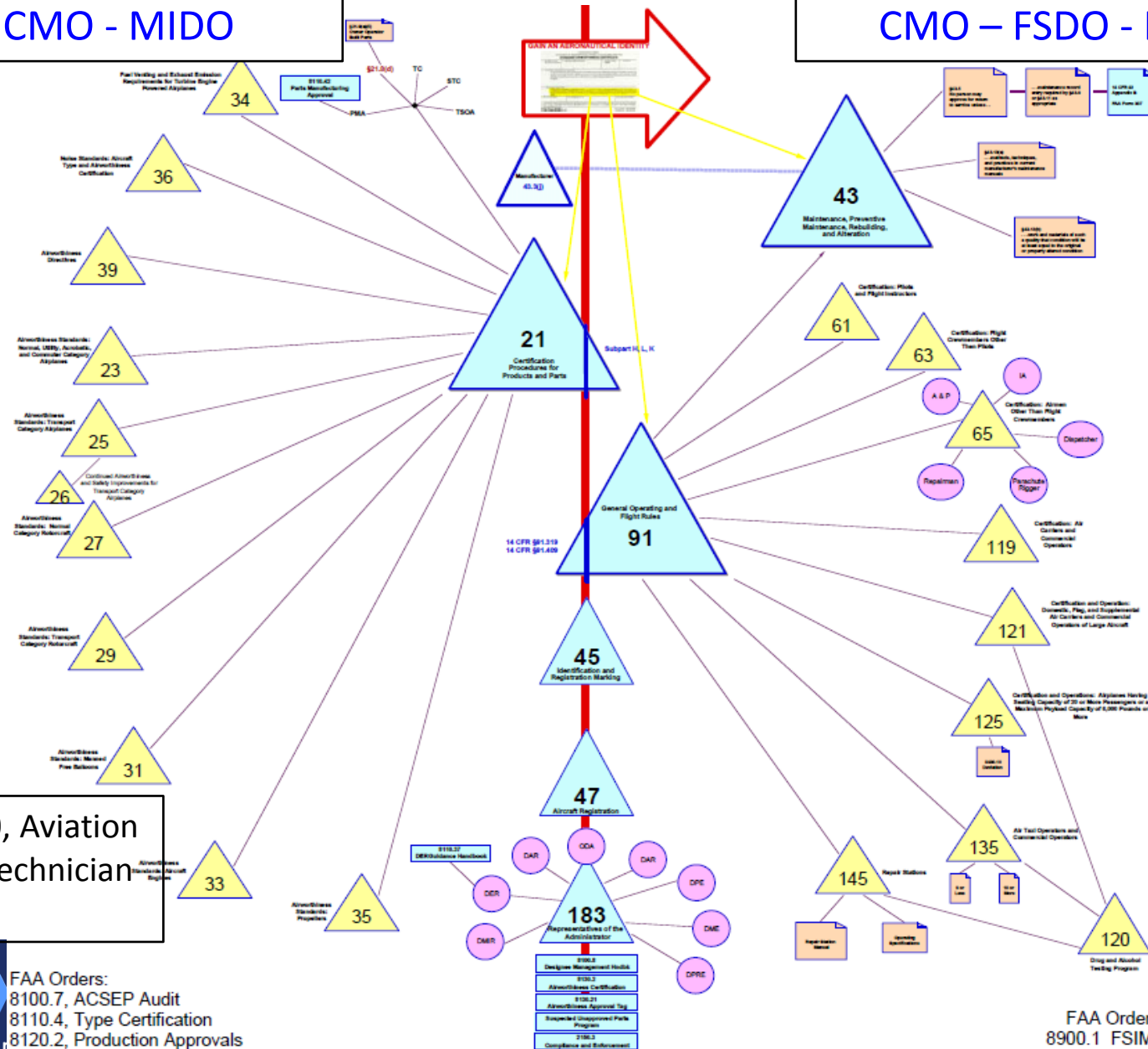
Original Airworthiness

ACO – CMO - MIDO

Flight Standards (AFS)

Recurrent Airworthiness

CMO – FSDO - IFO



FAA-H-8083-30, Aviation Maintenance Technician Handbook

Rules for Maintaining and Operating Aircraft

- **Part 43** – Defines basic maintenance requirements, recordkeeping, and mechanic qualifications
 - For work done on any aircraft
- **Part 91** – Defines basic operating and flight rules
 - Covers no paid passenger operations
 - Umbrella for commercial operations
- **Part 121** – Defines basic operating and flight rules for airlines
- **Part 125** – Defines basic operating and flight rules for charters
- **Part 135** – Defines basic operating and flight rules for commuters and air taxi

Continued Airworthiness Summary

- Design rules require Instructions for Continued Airworthiness (ICA)
- Operating rules requirements regarding ICA vary with type of operation
- Airworthiness Directives (AD) are always mandatory
- FAA's Continued Operational Safety program based on data-driven decisions

So, you want to change or add something to an aircraft design?



Changes to Type Certificates

Part 21 Subpart D – Changes to Type Certificates

§ 21.95 Approval of minor changes in type design.

§ 21.97 Approval of major changes in type design.

§ 21.99 Required design changes.

- Related to safety improvements

§ 21.101 Designation of applicable regulations.

- Important rule regarding changes to type design
- Addresses “certification basis”

Approval of a major change for a TC holder can be with an Amended TC or STC

§ 21.101 Designation of applicable regulations

- Addresses changes to type design
 - Significant changes may require certification basis change
 - ◆ Change makes the new product “distinct” from previous products on the TC
 - General configuration change
 - Principle of construction change
 - Most sustainment-related repairs/alterations not significant
 - Guidance for significant design changes
 - ◆ Order 8110.48A
 - ◆ AC 21.101-1B

TCDS: Type Certification Data Sheet


B747 Type Certification Data Sheet (TCDS)

747-8F Changed Product Rule Compliance

XV. Model 747-8F (cont'd)

Section B

The following section contains a listing of all regulations for which changed/affected areas of the aircraft comply with 14 CFR §25 at an Amendment level other than 25-120.

14 CFR §	Title	Amdt Level For Changed/Affected Areas	Comments
25.305	Strength and deformation.	25-0 for 25.305(b) for Airframe - Empennage (Outboard Elevator Balance Weight Tower)	
25.365	Pressurized compartment loads.	25-0 for 25.365(e), (f), and (g) for Systems Stress related to: Flight Deck (Linings, stowages, and latches, oxygen mask stowage box) and Interiors - Supernumerary Area (Galley and Lavatory) 25-54 for 25.365(e)(2) for Airframe - Fuselage and Floors; Section 41 Lower Lobe, Flight Deck, and Empennage (Forward Fin Box of the Vertical Stabilizer).	
25.395	Control system.	25-23 for 25.395(a), (b), and (c) for Systems Stress related to: Flight Controls Rudder Control (Cables, mech components installations, upper/lower actuator installation, rudder input linkage), Flight Controls Elevator Control (Cables, mech components installations, Elevator Feel computer, Horizontal stabilizer trim actuator - trim arm switch and control wire) and Flight Controls High Lift (Flap Detents vs Dspeed, LE/TE components, flap drive stroke, flap skew detection).	
25.397	Control system loads.	25-38 for 25.397 for Systems Stress related to: Flight Controls Rudder Control (Cables, mech components installations, upper/lower actuator installation,	

Changes to Type Certificates

Part 21 Subpart E – Supplemental Type Certificates

- § 21.113 Requirement for supplemental type certificate.
- § 21.115 Applicable requirements.
- § 21.117 Issue of supplemental type certificates.
- § 21.119 Privileges.
- § 21.120 Responsibility of supplemental type certificate holders to provide written permission for alterations.

Changes to Type Certificates

Supplemental Type Certificates

- Means for non-TC holders to change a type design
 - Substantiating data and compliance with applicable certification basis the same as for a TC
(Changed Product rule may affect the applicable certification basis)
- Installer's responsibility to ensure safety compatibility with other mods/repairs, etc.
- One-time STC data requirements are less
- FAA Order 8110.4C and AC 21-40, Guide for Obtaining Supplemental Type Certificates

Supplemental Type Certificate

Number SA03407AT

This certificate issued to UST / Kestrel Group
555 John Ross Court
Pelzer, South Carolina 29669

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 23 of the Federal Aviation Regulations.

Original Product - Type Certificate Number : A0009CH

Make : Cirrus

Model : SR20/22

Description of Type Design Change:

Installation of an Alakai "Passive" Engine Trend Monitoring System (ETMS) in the Cirrus SR20 / SR22 aircraft in accordance with Master Drawing List, Document Number, 20-001-MDL-STC-9430AT-A, Revision IR, dated, December 27, 2006, or later FAA Approved Revision.

Limitations and Conditions :

This approval should not be extended to other aircraft of this model on which other previously approved modifications are incorporated unless it is determined by the installer that the interrelationship between this change and any of those other previously approved modifications will produce no adverse affect upon the airworthiness of that airplane. If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission.

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application : October 5, 2006

Date reissued :

Date of issuance : March 8, 2007

Date amended :



By direction of the Administrator

Melvin D. Taylor
(Signature)

Melvin D. Taylor, Manager,
Atlanta Aircraft Certification Office

§ 21.9 Replacement and Modification Articles

Requirements for installing articles on TC products:

- Produced under a TC
- Produced under an FAA production approval
- A standard part manufactured via established standard
- A commercial part (as defined by § 21.1)
- Produced by owner or operator for use on own product
- Fabricated by an appropriately rated certificate holder with a quality system, and consumed in the repair or alteration of a product or article in accordance with Part 43
- Produced in any other manner approved by the FAA

Aircraft Certification vs. Operation

Summary

- Rules that affect the “aircraft” are “frozen” with TC
 - Parts 21, 23, 25, 27, 29, 31, 33
- Part 39 ADs are changes to type design
(Or brings product back to type design)
- Rules that affect the operation are not “frozen” with TC
 - Parts 91, 121, 135
 - Part 43 also not frozen with TC

TC: Type Certification
AD: Airworthiness Directive

So, you want to fly an aircraft after a modification or repair to an aircraft?

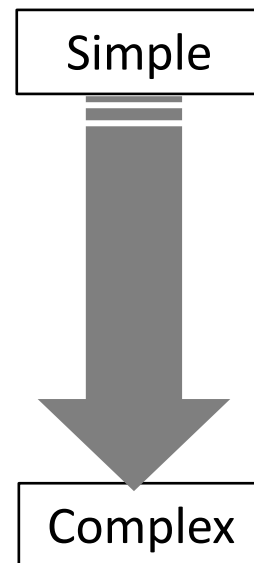


Return to Service

- Return to service is the last step for any change to an aircraft
- Part of the process is full documentation of the changes
- The rigor required to show the aircraft is safe varies with complexity of the change
- The “return to service” process is a final double-check to make sure the aircraft is ready for safe operation

Civil Operation Return to Service Options

- Simple maintenance logbook entry only
- Data approval via FAA approved data or FAA Form 337
- FAA Flight Standards Field Approval
- FAA Flight Standards Coordinated Field Approval
- One-time Supplemental Type Certificate (STC)
- STC



The more complex repair or alteration, the more complex approval and return to service process

Civil Operation Return to Service Options

- Maintenance logbook entry
 - Sufficient approval for minor alterations and repairs
 - ◆ e.g. fastener replacement
 - ◆ e.g. Small skin patches (6" or less)
 - Document with logbook entry of what was done
 - Return to service is “approved” by licensed A&P mechanic performing the work and signing the maintenance logbook

Definitions of Major and Minor

- **Major alteration** means an alteration not listed in the aircraft, aircraft engine, or propeller specifications—
 - (1) That might appreciably affect weight, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness; or
 - (2) That is not done according to accepted practices or cannot be done by elementary operations.
- **Major repair** means a repair:
 - (1) That, if improperly done, might appreciably affect weight, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness; or
 - (2) That is not done according to accepted practices or cannot be done by elementary operations.
- **Minor alteration** means an alteration other than a major alteration.
- **Minor repair** means a repair other than a major repair.

Civil Operation Return to Service Options

- Data approval via FAA Form 337 or FAA approved data
 - Approval via delegation – no direct FAA approval
 - ◆ FAA approved data documented on Form 337
 - ◆ FAA approved repair station process
- Data approval via FAA Field Approval
 - Flight Standards approval of acceptable submitted data
 - Aircraft operated in part 121 generally not eligible
 - Commercial derivative aircraft (military) require special consideration
- Data approval via FAA coordinated Field Approval
 - Flight Standards coordinates data approval with ACO

ACO: Aircraft Certification Office

Civil Operation Return to Service Options

- Data approval via STC
 - STC instructions are approved data
 - Aircraft requires return to service sign-off
 - ◆ Flight Standards
 - ◆ Authorized repair station
 - ◆ Properly authorized A&P mechanic: “Inspection Authorization” (IA)
 - One-time STC requires less data and normal STC
 - ◆ Return to service process the same as STC
 - Installer’s responsibility to ensure safety compatibility with other mods/repairs, etc.

FAA Approved Repair Stations

- Key information regarding repair stations
 - CFR part 145 – Repair Stations
 - AC 145-9A, Guide for Developing and Evaluating Repair Station and Quality Control Manuals

Role of Designees - Airworthiness

- Designees are representatives of the FAA
 - *Individual designees*
 - ♦ **DAR**: Designated Airworthiness Representative
 - 14 CFR Part 183.33
 - *Organization designees*
 - ♦ **Major Repair and Alteration (MRA) ODA**: Organization Designation Authorization Unit Member
 - 14 CFR Part 183.51 and Order 8100.15B

Role of “Authorizations”

- Certified mechanics for Airframe and Powerplant (A&P)
 - Can sign off on minor repairs and alterations and routine maintenance
- Certified A&P with “Inspection Authorization” (IA)
 - Can sign off on return to service of major repairs and alterations
 - MRA ODA can have an organizational IA

Return to Service

- Are any of these “minor repairs?”
- Are these repairs likely covered in the mfg’s SRM?
- Would these repairs qualify for a field approval?



Courtesy CASA Australia

Return to Service

- Will this be a “major” or “minor” repair?



Return to Service



- Are any of these “minor alterations?”
- Are these alterations eligible for a field approval?
- FAA approval of alterations required for this military commercial derivative airplane

Return to Service



- Are these “minor” alterations?
- Are these alterations eligible for a field approval?
- Are ICA needed?



Return to Service



- Would this modification be eligible for a field approval?
- What additional ICA might be needed?

Return to Service Wrap-up

- “Return to service” is the last step of any change to an aircraft
- The process is the final chance to make sure everything is safe
- Most alterations and repairs are “major”
- Any alteration or repair requires good documentation
 - Substantiating analysis based on aircraft certification basis
 - Drawing quality as necessary to describe the change and provide repeatability
- Easiest path is to follow manufacturer’s instructions (MM, SRM)
- Engineering substantiation of alterations and repairs outside of mfg instructions is essential
 - DER data should be complete
 - FAA is especially careful with changes to structure that may affect fatigue life
- Complete ICA are a regulatory requirement
- Order 8300.16 and AC 43-210A contain guidance for return to service

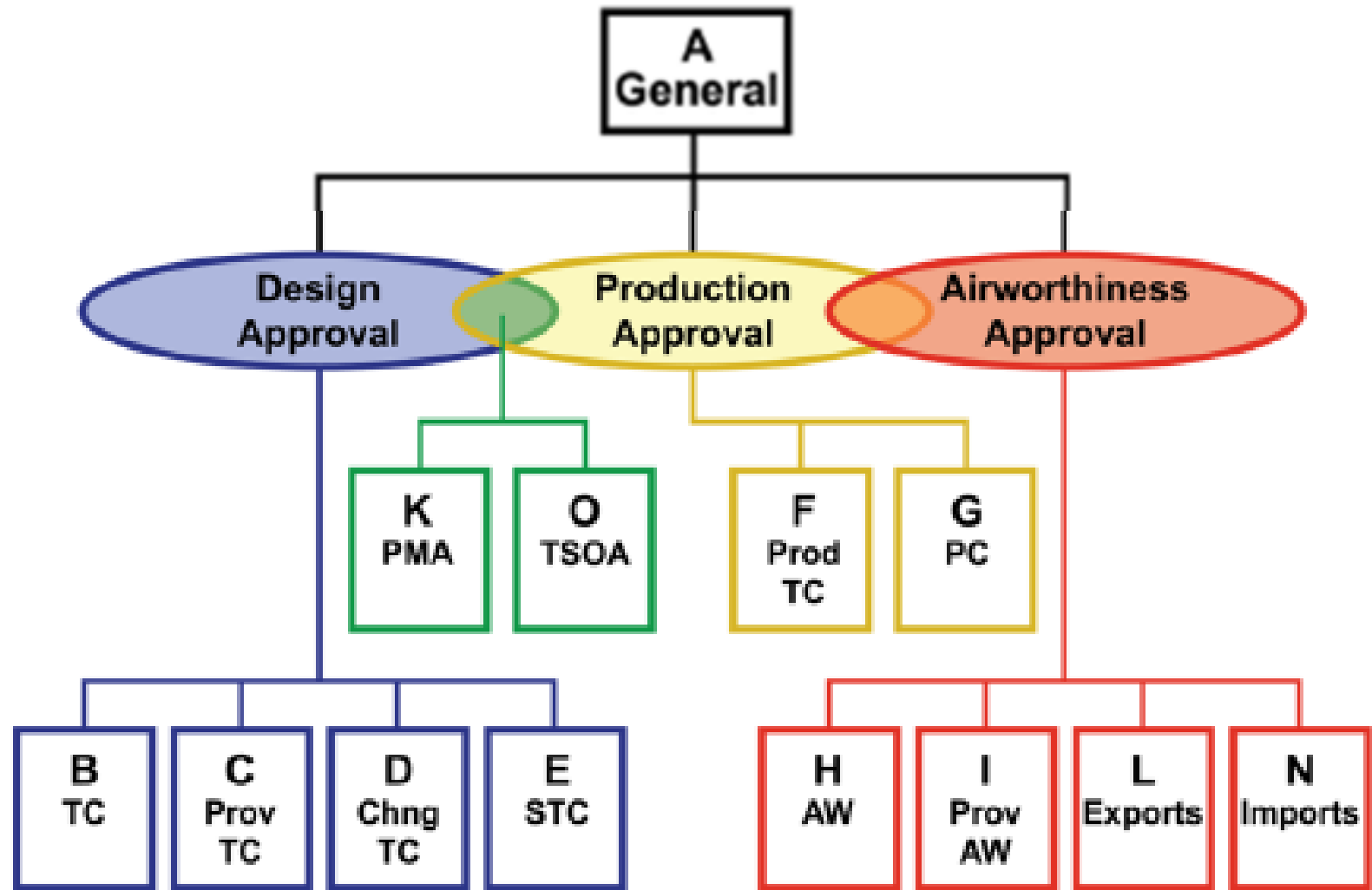
So, you want to go to dinner?



Have we Achieved our Objectives?

- Identify the three certification programs: design, production and airworthiness
- Identify the key tasks of each of the three certification programs
- Recognize and understand the relationships between the three certification programs
- Recognize and understand the relationship with other design and airworthiness approvals

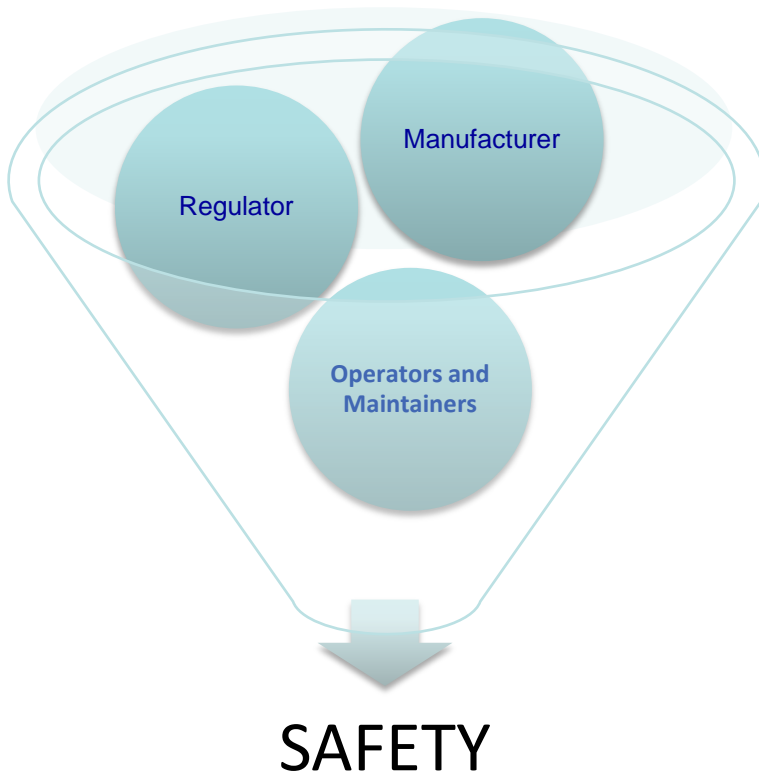
Part 21 Roadmap



Some Important Take-aways

- FAA organization has important links between Aircraft Certification and Flight Standards
- Role of designees is essential for efficiently ensuring safety
- International aspects are important and sometimes complex
- Civil use and military commercial derivative aircraft share (mostly) the same approval processes
- You can find most all info at www.rgl.gov

Teamwork between Authority, Manufacturer, Operator, and Maintainer



- Common interest in safety
- All must interact together to achieve best results
- Authority wants industry to succeed with safety
- DAH and operator require safety to succeed
- Common bond, common interest, common definition of success

FAA's Mission

Our continuing mission is to provide the safest, most efficient aerospace system in the world

Thanks for your attention!

If you would like more training from NuSS, please catch Marv during the conference or contact me at your convenience.

- Training can be arranged directly with NuSS and tailored for your organization
 - Continued Airworthiness for Structures
 - FAA Certification Processes
 - Maintenance and Inspection



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