

Part 23

Amendment 64

A Performance-Based Approach to Type Certification of Small Airplanes

Presented at: DGAC 6th Annual Seminar on
Safety in Airworthiness

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**Federal Aviation
Administration**



Overview and Outline

- In 2017, the FAA implemented amendment 23-64 to part 23 airworthiness standards for normal category airplanes
- This briefing will address:
 1. Reasons for change
 2. Characteristics of performance-based rules
 3. Key aspects of amendment 23-64
 4. Means of compliance to part 23
 5. Consensus standards and ASTM International
 6. Additional information



Topic 1: Reasons for Change



Why Overhaul Part 23?



- **Improve Safety**

- Foster safety-enhancing innovation by offering applicants more flexibility in *how* to show compliance with part 23
- Add new requirements to reduce loss of control and icing-related accidents

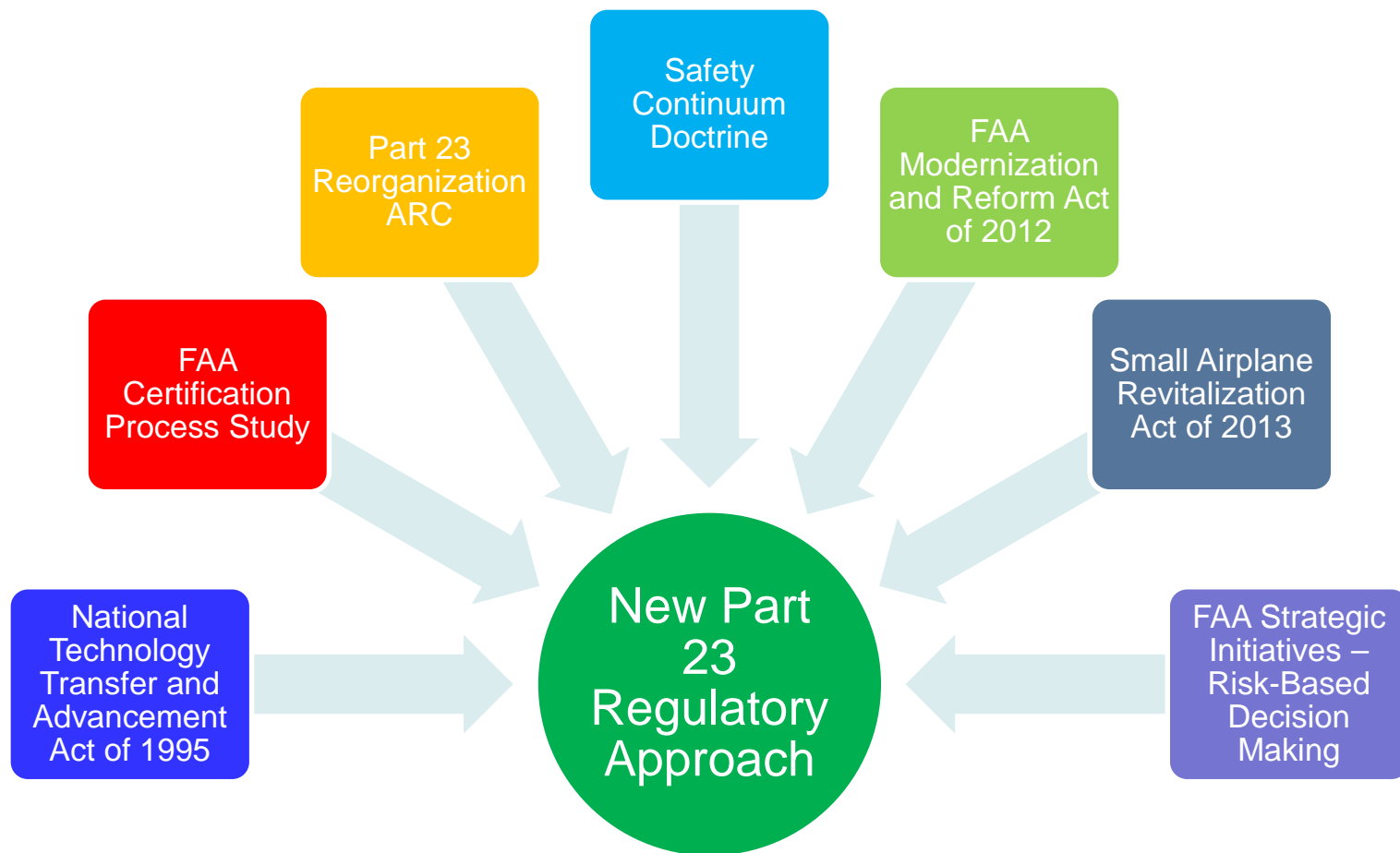
- **Increase Regulatory Agility**

Create a regulatory framework that allows the FAA to readily adapt to new technologies

- **Reduce Costs for FAA and Industry**

- Reduce the administrative burdens traditionally associated with certifying novel design features (e.g., Special Conditions)
- Tailor the level of rigor required for showing compliance based on risk (safety continuum)

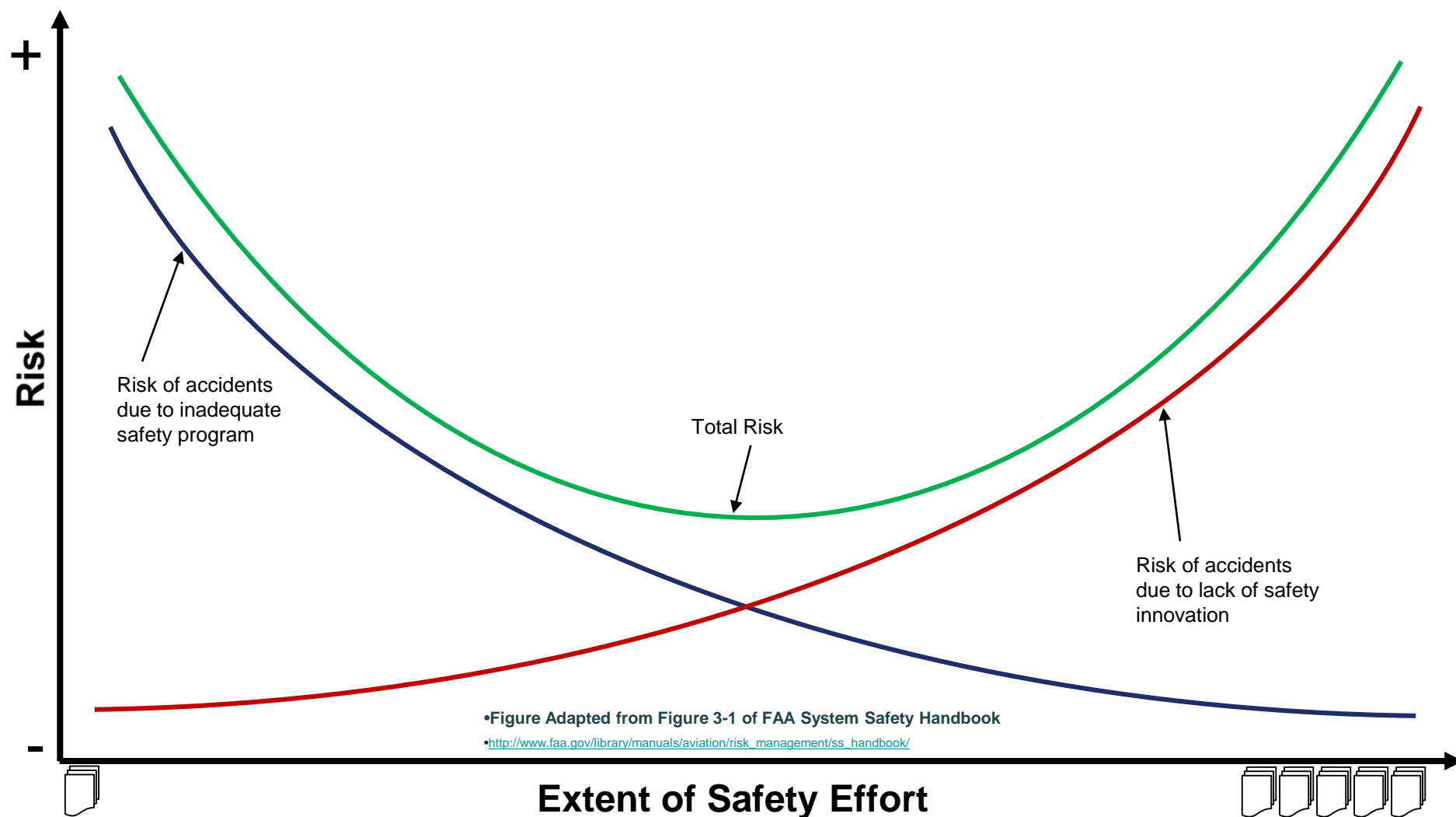
Drivers for Amending Part 23



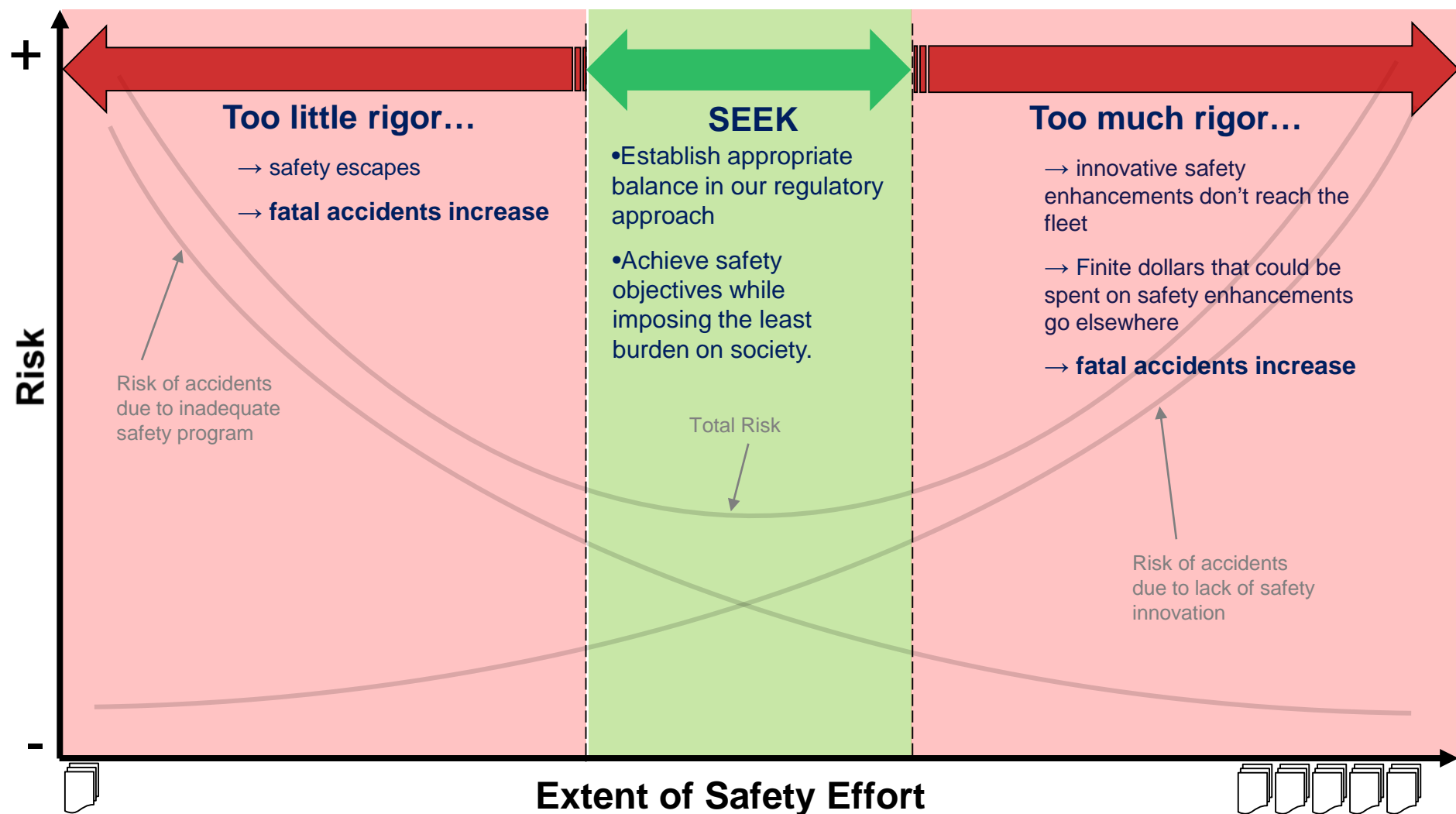
Safety Continuum



Applying the Safety Continuum



Applying the Safety Continuum



Topic 2: **Characteristics of Performance-Based Rules**





Prescriptive vs. Performance-Based Rules

Prescriptive Regulatory System (Amdt 63)	Performance-Based Regulatory System (Amdt 64)
Establishes specific technical requirements that must be met by applicants and approval holders	Establishes <i>outcomes</i> that must be achieved; allows flexibility in how the applicant or approval holder achieves those outcomes
<i>Example:</i> Emergency exits must be movable windows, panels, canopies, or external doors...that provide a clear and unobstructed opening large enough to admit a 19-by-26-inch ellipse.	<i>Example:</i> The airplane must be designed to facilitate rapid and safe evacuation in conditions likely to occur following an emergency landing.

Example: Prescriptive Rule (Amendment 23-63)

23.1397 Color specifications

Each position light color must have the applicable International Commission on Illumination chromaticity coordinates as follows:

(a) *Aviation red*--

"y" is not greater than 0.335; and

"z" is not greater than 0.002.

(b) *Aviation green*--

"x" is not greater than $0.440 - 0.320 y$;

"x" is not greater than $y - 0.170$; and

"y" is not less than $0.390 - 0.170 x$.

(c) *Aviation white*--

"x" is not less than 0.300 and not greater than 0.540;

"y" is not less than " $x - 0.040$ " or " $y_0 - 0.010$ ", whichever is the smaller; and

"y" is not greater than " $x + 0.020$ " nor " $0.636 - 0.400 x$ ";

Where " y_0 " is the "y" coordinate of the Planckian radiator for the value of "x" considered.



Example: Performance-Based Rule (Amendment 23-64)

§ 23.2530 External and cockpit lighting.

...

(b) Any position and anti-collision lights, if required by part 91 of this chapter, must have the intensities, flash rate, colors, fields of coverage, and other characteristics **to provide sufficient time for another aircraft to avoid a collision.**

(c) Any position lights, if required by part 91 of this chapter, must include a red light on the left side of the airplane, a green light on the right side of the airplane, spaced laterally as far apart as practicable, and a white light facing aft, located on an aft portion of the airplane or on the wing tips.


(d) Any taxi and landing lights must be designed and installed so they provide sufficient light for night operations.

(e) For seaplanes or amphibian airplanes, riding lights must provide a white light visible in clear atmospheric conditions.



Performance-Based Regulations

Pros and Cons

Pros	Cons
<p>Greater agility in accommodating innovation and new technologies</p> <p>Key Goal of Part 23, Amdt 64</p>	<p>Defining requirements in terms of performance can be challenging.</p> <p>Accomplished by issuance of Part 23, Amdt 64 </p>
<p>Stronger focus on achieving the desired safety performance</p>	<p>Defining what compliance looks like can be difficult</p> <p>Development and Acceptance of Means of Compliance (MOC)</p>
<p>Improved understanding of risks</p>	<p>Compliance planning requires more effort</p> <p>Appropriate Application of Accepted MOC</p>
<p>Potential for stronger safety culture within regulator and industry</p>	

*Reference: > Presentation by Dr. M. Sam Mannan, Texas A&M, 2012 Forum on Performance-Based Regulatory Models
> EASA, as summarized by European Cockpit Association



Performance-Based Rules

Where they may be a good fit*

- ➡ • Procedures or technologies are rapidly changing and an agile regulatory framework is needed in order to keep pace
- Regulated entities have a strong, demonstrated safety culture
- ➡ • Prescriptive standards are available to complement the performance-based regulatory requirements
- Sufficient resources exist to effectively implement and continually monitor compliance

*Reference: > Presentation by Dr. M. Sam Mannan, Texas A&M, 2012 Forum on Performance-Based Regulatory Models
> EASA, as summarized by European Cockpit Association



Topic 3: **Key Aspects of Amendment 23-64**



Key Aspects of Amendment 23-64

- Became effective August 2017
- Is performance-based
- Must be complied with using means accepted by the Administrator
- Establishes safety objectives without prescribing specific means of achieving them
- Maintains the level of safety achieved by Amdt 23-63



Key Aspects of Amendment 23-64 (cont'd)

- Introduces more rigorous requirements to reduce accidents caused by loss of control and icing
- Establishes four certification levels based on risk
- Establishes two performance levels
- Eliminates utility, acrobatic*, and commuter categories

*Normal category airplanes may be approved for aerobatics



Certification and Performance Levels

§23.2005

- Airplane Certification Levels

Based on maximum passenger seating configuration (not including crew):

- Level 1: 0 to 1 passenger
- Level 2: 2 to 6 passengers
- Level 3: 7 to 9 passengers
- Level 4: 10 to 19 passengers

- Airplane Performance Levels

- Low Speed: V_{NO} and $V_{MO} \leq 250$ KCAS and $M_{MO} \leq 0.6$
- High Speed: V_{NO} or $V_{MO} > 250$ KCAS or $M_{MO} < 0.6$

V_{NO} – Maximum structural cruising speed

V_{MO}/M_{MO} – Maximum operating limit speed

KCAS – Knots Calibrated Airspeed




Accepted Means of Compliance

14 CFR Part 23, Amdt 23-64


§ 23.2010 Accepted means of compliance.

(a) An applicant must comply with this part using a means of compliance, which **may** include consensus standards, accepted by the Administrator.



Use of
consensus
standards is
not required

(b) An applicant requesting acceptance of a means of compliance must provide the means of compliance to the FAA in a form and manner acceptable to the Administrator.



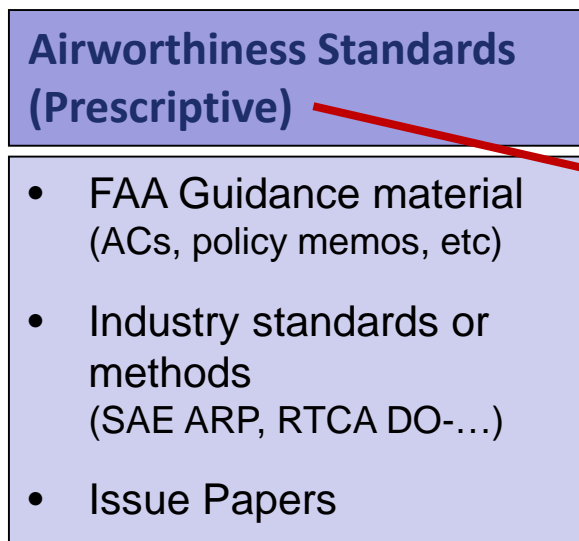
Refer to AC
23.2010-1 for
more
information

Topic 4: **Means of Compliance to Part 23**



Effect of §23.2010 on Type Certification

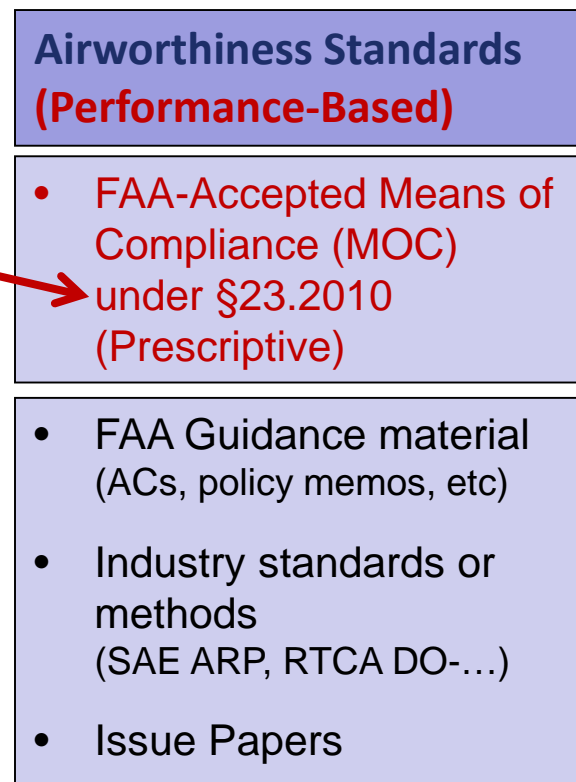
Part 23 Amdt 23-63



Regulations

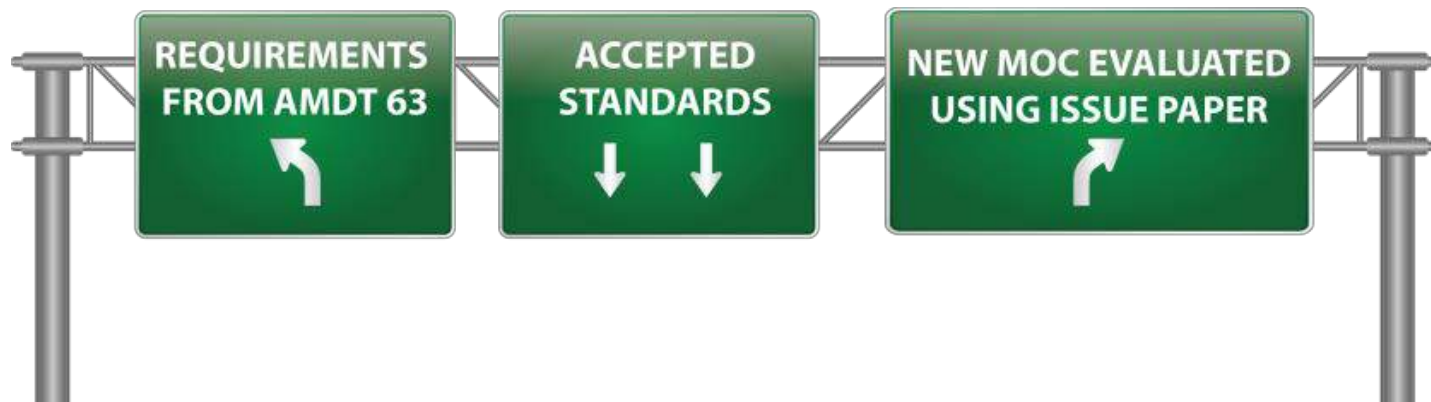
Means of Compliance

Part 23 Amdt 23-64



Accepted MOCs

- What MOCs are accepted for Part 23?
 - MOCs based on ASTM F44 standards (more info to follow)
 - The prescriptive requirements of Part 23, Amdt 23-63, with additional requirements for loss of control and icing
 - Plus MOCs to address the subject of special conditions, ELOS findings, etc. where appropriate based on design specifics
 - For further information, refer to the preamble to the final rule for part 23, amendment 23-64



Accepted MOCs Based on ASTM Standards

- The FAA has accepted MOCs based on ASTM standards for 63 of the 68 rule sections in part 23
 - Notice of Availability (NOA) 23-18-01-NOA published in the *Federal Register* on May 11, 2018
<https://www.federalregister.gov/documents/2018/05/11/2018-09990/accepted-means-of-compliance-airworthiness-standards-normal-category-airplanes>
- 46 of the 63 accepted MOCs consist of ASTM standards as published (no changes)
- 17 MOCs are based on ASTM standards but include changes required for use as MOCs to part 23
- A summary of accepted MOCs based on ASTM standards is available online at

https://www.faa.gov/aircraft/air_cert/design_approvals/small_airplanes/small_airplanes_regs/



Revisions and Additions to Accepted MOCs

- ASTM revises and adds standards content on a continual basis
- Look for follow-on Notices of Availability (NOA) to be published in the *Federal Register* accepting additional MOCs based on newly published standards content
- The summary of accepted MOCs hosted on the Internet will be updated accordingly as additional NOAs are published

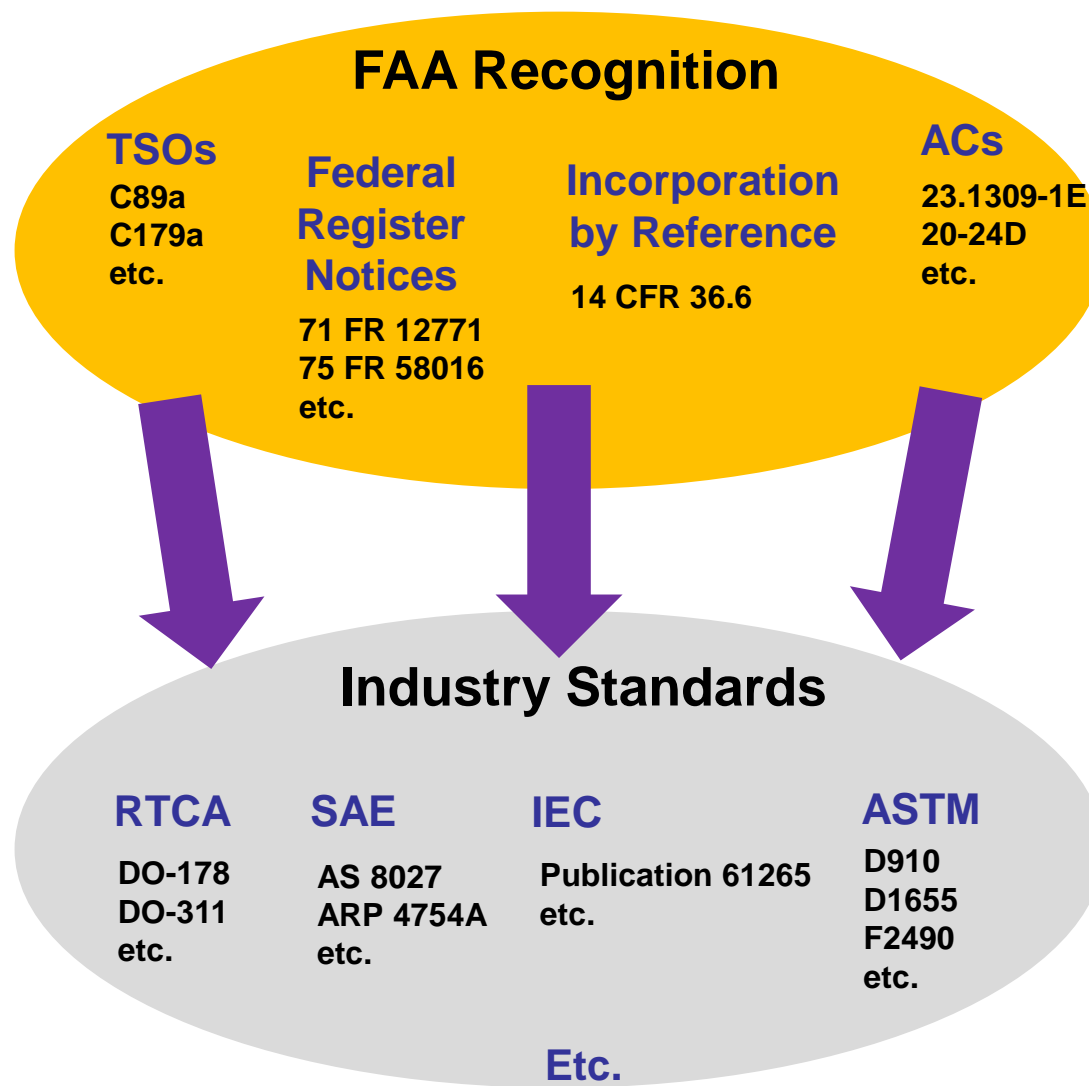
Topic 5: Consensus Standards and ASTM International





Industry Standards

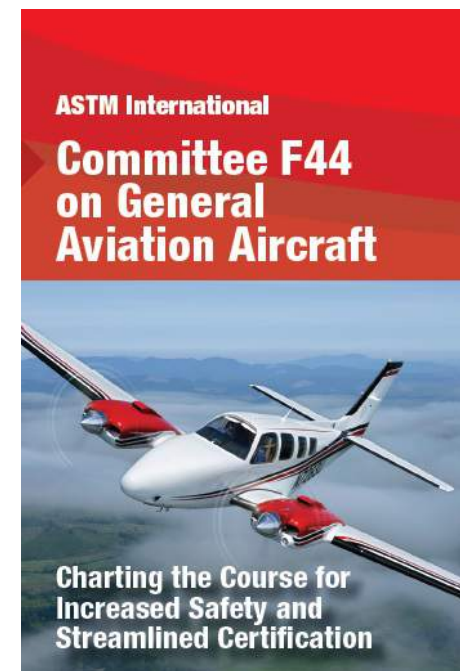
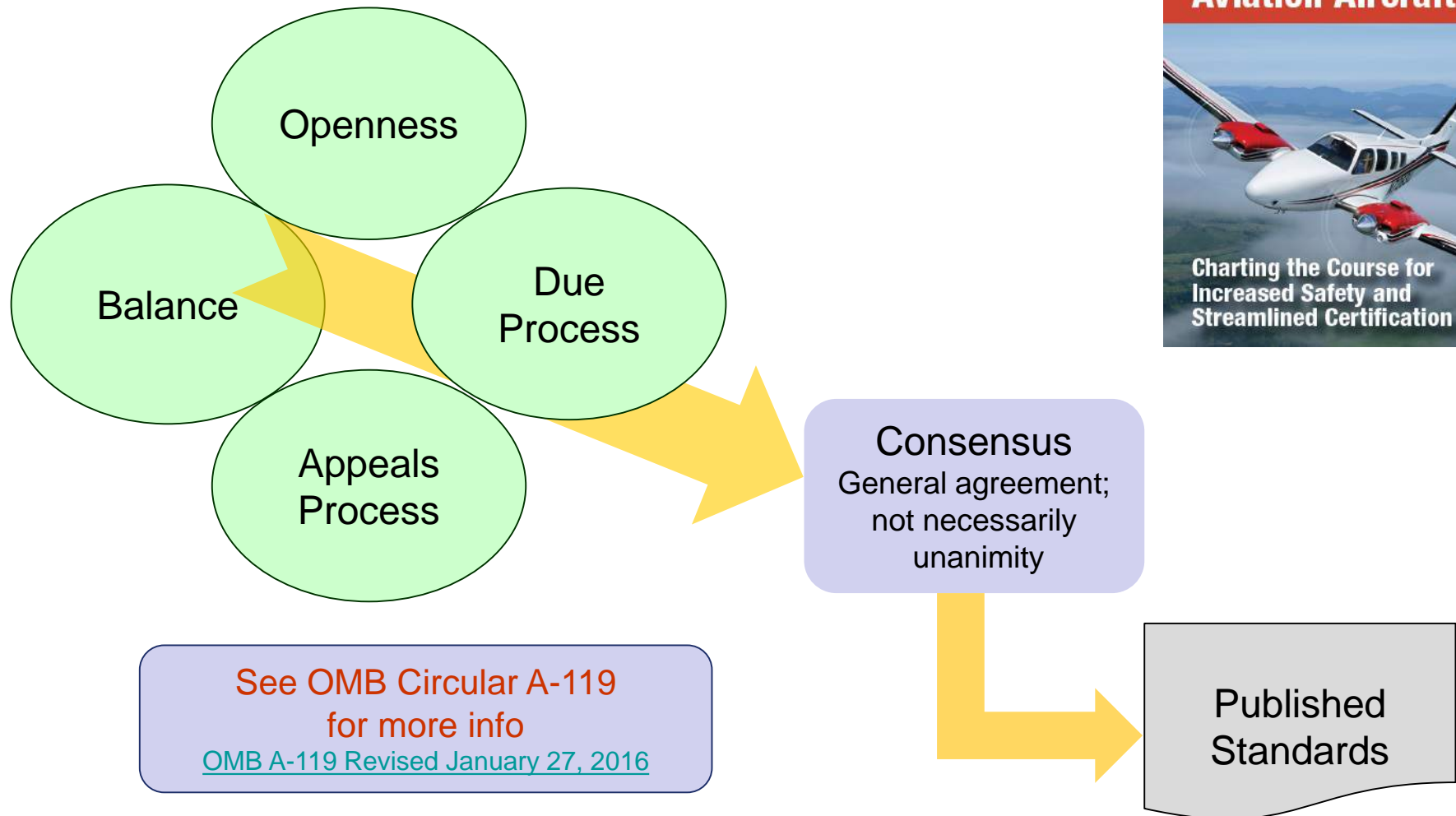
Already a key building block to Aircraft Certification





Consensus Standards

An opportunity for new, innovative means of compliance to part 23





Who is ASTM International?

- A non-profit, global, consensus standards developing organization with 30,000 members worldwide
- Has published more than 12,000 standards
- Meets the criteria of:
 - Annex 4 of the World Trade Organization's Technical Barriers to Trade Agreement
 - U.S. Office of Management and Budget Circular A-119 for voluntary consensus standards bodies
- Chosen by industry to develop standards for use with part 23, CS-23, and other CAA rules



Clearing Up Common Misconceptions

- Industry groups -- *not* FAA – chose ASTM to develop consensus standards for general aviation
- ASTM does *not* have personnel on staff writing standards for part 23 use (or any other industry)
- Knowledgeable and experienced volunteers from industry, government, etc. develop technical content
- ASTM does *not* establish part 23 certification requirements
- ASTM publishing a standard does *not* mean that standard is accepted for showing compliance to part 23

ASTM Committee F44 on GA Aircraft

- 250 members / 9 subcommittees
- Multinational effort
 - 22 countries represented in membership
 - Civil Aviation Authorities from United States, Brazil, Australia, New Zealand, European Union, Canada, and China
 - Global producers, including Textron, Diamond, Mooney, Piper, Pipistrel, Garmin, Avidyne, GAMA, etc.
 - General aviation users, academia, and other interests, including AOPA, NASA, AEA, Wichita State, Embry Riddle, etc.





ASTM F44 Published Standards

- F44 used the prescriptive requirements of Part 23 Amdt 23-62, CS-23 Amdt 4, and CS-VLA as the foundation for initial standards
- These baseline standards are the building blocks for development of additional MOCs and a clear path to compliance for future technologies





ASTM F3264-17 (-18 revision also now available)

Standard Specification for Normal Category Aeroplanes Certification

- Informally known as the ‘Top Level Specification’
- Administrative in nature; does not contain any direct technical content
- Indexes other F44 standards in a manner that links standards content to CAA regulatory requirements
- Facilitates global CAA harmonization and acceptance of standards
- Serves as the primary vehicle for formal CAA acceptance of MOCs based on ASTM F44 standards
- Available for online viewing at <https://www.astm.org/READINGLIBRARY/>



Standards Published by ASTM F44 and referenced in F3264-17

Standard Number	Standard Title
General	
F3060-16a	Standard Terminology for Aircraft
F3117-15	Standard Specification for Crew Interface in Aircraft
F3120/F3120M-15	Standard Specification for Ice Protection for General Aviation Aircraft
Flight	
F3082/F3082M-16	Standard Specification for Weights and Centers of Gravity for Aircraft
F3173/F3173M-15	Standard Specification for Aircraft Handling Characteristics
F3174/F3174M-15	Standard Specification for Establishing Operating Limitations and Information for Aeroplanes
F3179/F3179M-16	Standard Specification for Performance of Aeroplanes
F3180/F3180M-16	Standard Specification for Low-Speed Flight Characteristics of Aircraft

Standards Published by ASTM F44

and referenced in F3264-17

Standard Number	Standard Title
Structures	
F3083/F3083M-16	Standard Specification for Emergency Conditions, Occupant Safety and Accommodations
F3093/F3093M-15	Standard Specification for Aeroelasticity Requirements
F3114-15	Standard Specification for Structures
F3115/F3115M-15	Standard Specification for Structural Durability for Small Airplanes
F3116/F3116M-15	Standard Specification for Design Loads and Conditions
Powerplant	
F3062/F3062M-16	Standard Specification for Installation of Powerplant Systems
F3063/F3063M-16a	Standard Specification for Design and Integration of Fuel/Energy Storage and Delivery System Installations for Aeroplanes
F3064/F3064M-15	Standard Specification for Control, Operational Characteristics and Installation of Instruments and Sensors of Propulsion Systems
F3065/F3065M-15	Standard Specification for Installation and Integration of Propeller Systems
F3066/F3066M-15	Standard Specification for Powerplant Systems Specific Hazard Mitigation

Standards Published by ASTM F44

and referenced in F3264-17

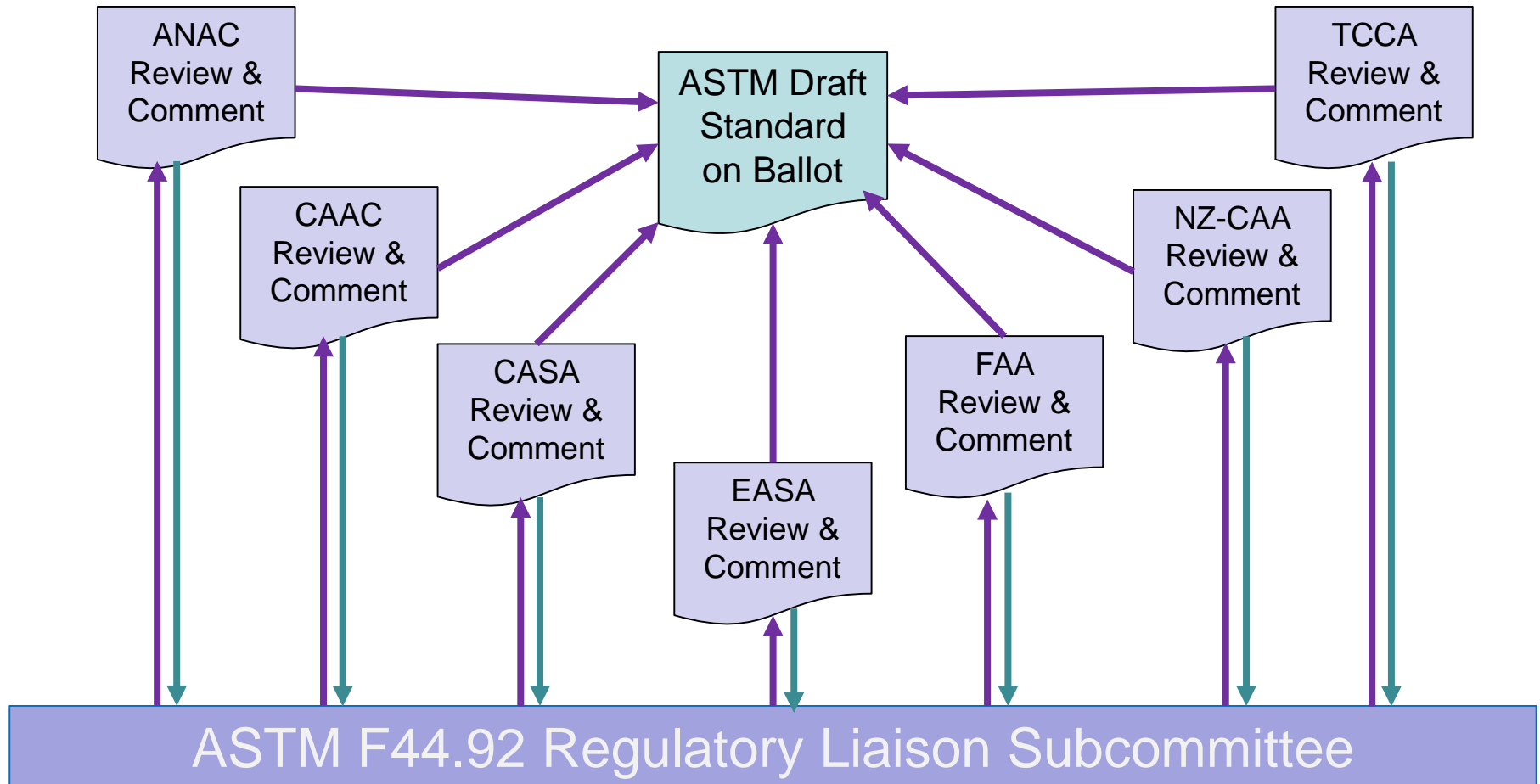
Standard Number	Standard Title
Systems and Equipment	
F3061/F3061M-17	Standard Specification for Systems and Equipment in Small Aircraft
F3227/F3227M-17	Standard Specification for Environmental Systems in Small Aircraft
F3228-17	Standard Specification for Flight Data and Voice Recording in Small Aircraft
F3229/F3229M-17	Standard Practice for Static Pressure System Tests in Small Aircraft
F3230-17	Standard Practice for Safety Assessment of Systems and Equipment in Small Aircraft
F3231/F3231M-17	Standard Specification for Electrical Systems in Small Aircraft
F3232/F3232M-17	Standard Specification for Flight Controls in Small Aircraft
F3233/F3233M-17	Standard Specification for Instrumentation in Small Aircraft
F3234/F3234M-17	Standard Specification for Exterior Lighting in Small Aircraft
F3235-17	Standard Specification for Aircraft Storage Batteries
F3236-17	Standard Specification for High Intensity Radiated Field (HIRF) Protection in Small Aircraft



Sampling of Current F44 Activities

- F44 is working on new and revised standards in a number of areas, including (not exhaustive):
 - Parallel path to dynamic seat testing
 - Simplified approach for structural durability for low stress structures
 - Interaction of systems and structures
 - Integration of electric and hybrid-electric propulsion systems
 - Simplified safety analysis of systems and equipment
 - Indirect flight control systems (fly by wire)
 - Several cleanup items that will resolve FAA changes identified in acceptance of MOCs based on the published standards
- F44 is also working to improve the usability of standards, such as through the creation of a compliance guide or other tools to create clearer connections to corresponding rules

CAA Harmonization





How to Get Involved in ASTM

- Visit <https://www.astm.org/MEMBERSHIP/index.html>
- Individual membership cost is \$75/year and includes access to one volume of standards
- Most standards development activities take place virtually using online collaboration tools and Webex
- In-person meetings generally take place twice annually
- Membership is not required to attend meetings; attendees do need to register for the meeting



Topic 6: **Additional Information**



EASA is Also Moving to a Performance-Based Approach

- EASA issued CS-23 Amdt 5 which also became effective in August 2017
- While there are some differences, EASA and FAA's rules are substantially harmonized
- Like the FAA's rule, EASA also requires use of accepted means of compliance:

CS 23.2010 Accepted means of compliance

- (a) An applicant must comply with this CS using an acceptable means of compliance (AMC) issued by EASA, or another means of compliance which may include consensus standards, when specifically accepted by EASA.
- (b) An applicant requesting EASA to accept a means of compliance must provide the means of compliance to EASA in an acceptable form and manner.

Other CAAs and Global Industry

- ANAC (Brazil), TCCA (Canada), CAAC (China), NZ-CAA (New Zealand), and CASA (Australia) have also been active in the development of consensus standards and are considering how to move forward with a performance-based approach.
- The global industry is active in developing consensus standards for use with FAA, EASA, and other CAA rules.

FAA Computer-Based Training

- The FAA has created a web-based course that highlights the recent overhaul of part 23
 - FAA27200131 -- *Part 23: A Performance-based Approach to Type Certification of Small Airplanes*
 - Covers the fundamentals of applying the new part 23 rule and associated means of compliance
 - Is a self-paced course that takes approximately 2½ hours to complete
 - Is available by registering through the Designee Registration System at <https://av-info.faa.gov/DsgReg/sections.aspx>, under the *Design, Manufacturing and Airworthiness* category

ASTM Training

Additional details on ASTM's methods for standards development are available:

- ASTM online training opportunities
 - http://www.astm.org/MEMBER_TRAINING/#NewMember
 - Membership in ASTM is not required to participate in this training
 - Training material is available as 1-hour modules covering fundamentals of standards development

Questions?



Online Resources

- [Part 23 Aviation Rulemaking Committee \(ARC\) Report and Related Files](#)
- [Small Airplane Revitalization Act](#)
- [National Technology Transfer and Advancement Act of 1995](#)
- [Office of Management and Budget \(OMB\) Circular A-119](#)
- [Part 23 Notice of Proposed Rulemaking \(March 2016\)](#)
- [Part 23 Amendment 64 Final Rule \(December 2016\)](#)
- [AC 23.2010-1: FAA Accepted Means of Compliance Process for 14 CFR Part 23](#)
- [ASTM International Committee F44 Home Page](#)
- [ASTM Reading Room](#)
- [Federal Register Home Page](#)
- [FAA Notice No. 23-18-01-NOA](#)
- [FAA Regulations, Policy, and Guidance - Small Airplanes](#)