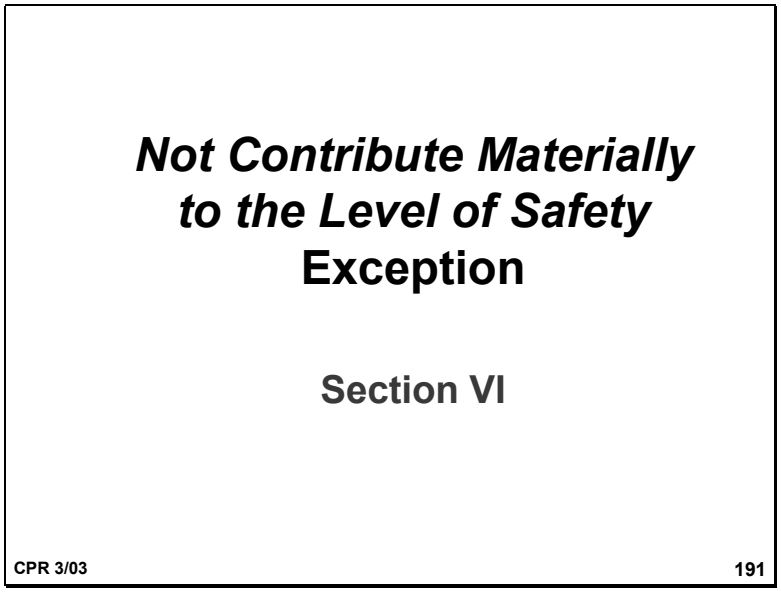
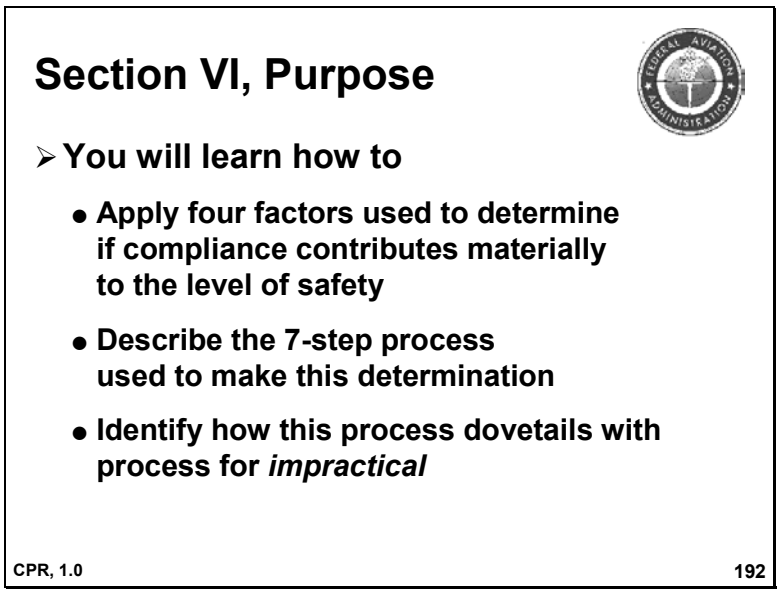
VI. NOT CONTRIBUTE MATERIALLY TO THE LEVEL OF SAFETY EXCEPTION



A. Overview

- This exception and the next, ***impractical***, share a process for building a case to use the exceptions. This section will present the commonalties of the process, as well as the details for *level of safety.*
- The objective for this section is to be able to describe and recognize appropriate applications of this exception, *does not contribute materially to the level of safety.*

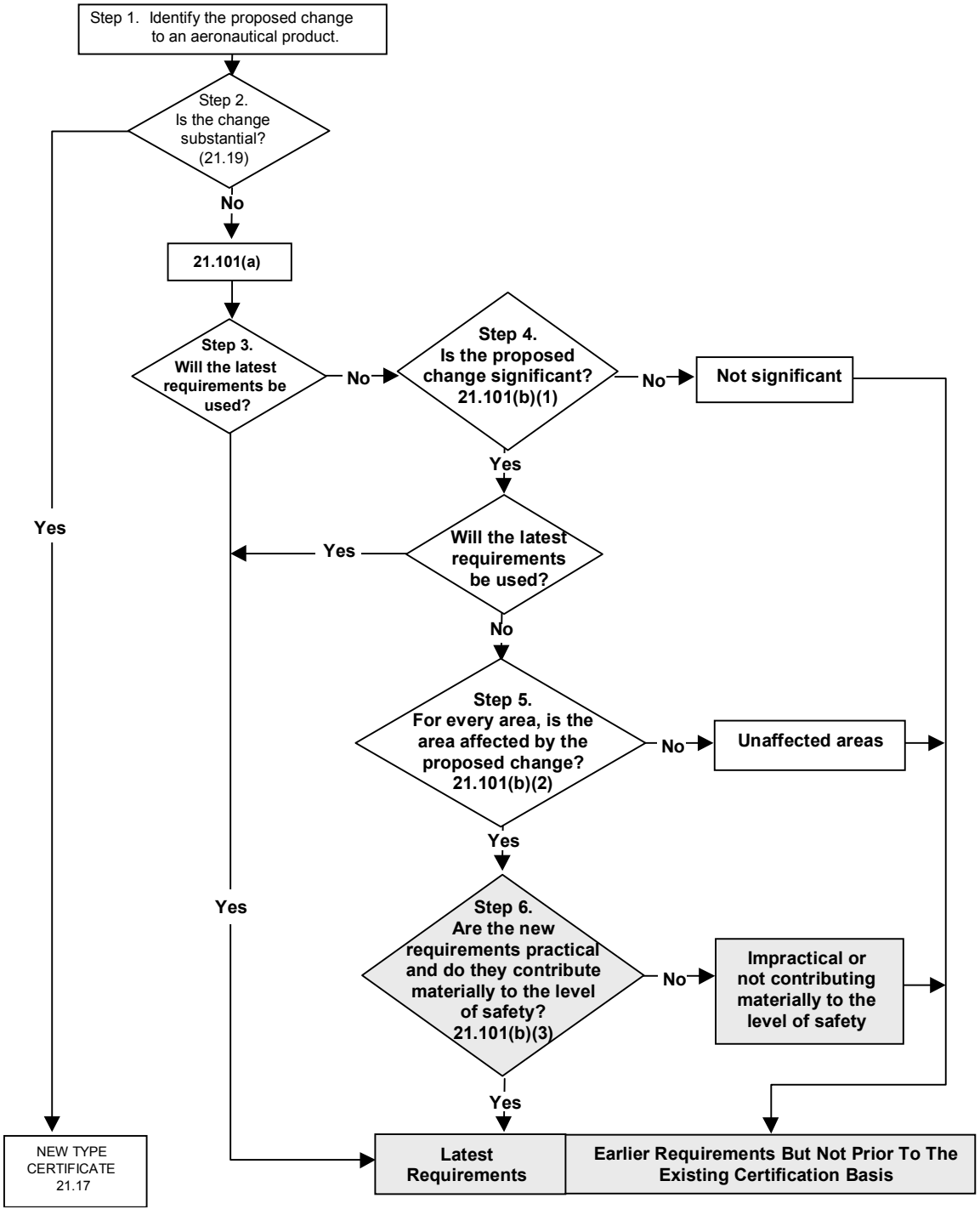


- This section is divided into the following parts:
  - Basic Concepts.
  - Defining the Exception, 21.101(b)(3).
  - What Must be Considered in Making This Determination?
  - Effect of Redesign on the Level of Safety.
  - Process for Applying this Exception.
  - Summary.

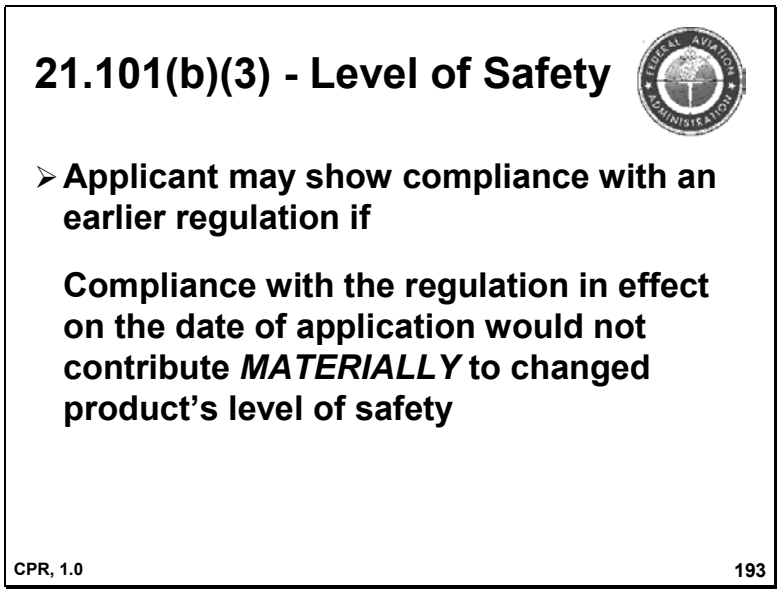
B. Basic Concepts

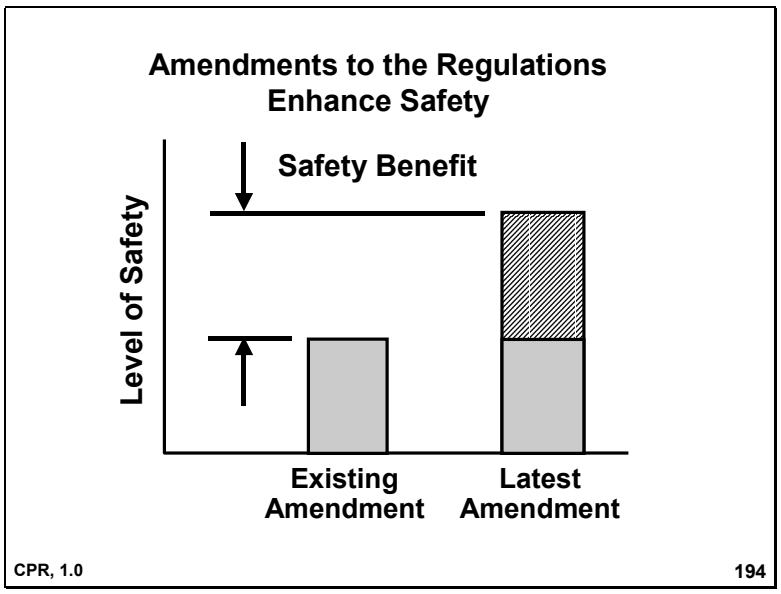
- By this point, we have determined that the change is **significant** and the **areas affected** by the change have been defined.

Figure 1 of AC 21.101-1 with 14 CFR 21.101(b)(3) Highlighted

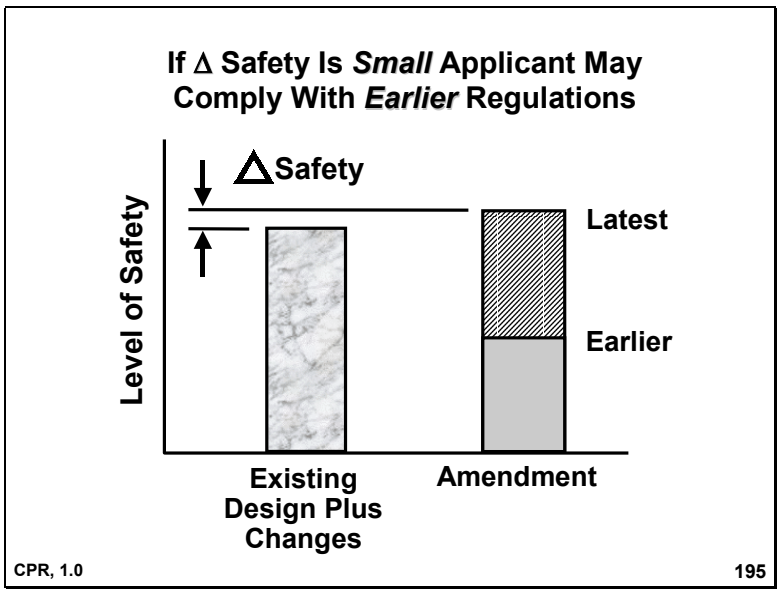


C. Defining the Exception, 21.101(b)(3)





- Rules and amendments to rules are fundamentally promulgated to address hazards, which are identified in the preamble to the NPRM.
- 21.101 requires the application of the latest amendments to all the areas affected by a significant change.
- 21.101(b)(3) recognizes that under some circumstances the level of safety achieved by the existing design, with the proposed design change included, would not be **MATERIALLY** enhanced by compliance with a latest amendment.
  - This is shown schematically in the following figure that compares the level of safety of the existing design with the change included with the level of safety mandated by the latest amendment.



- The applicant must show that the level of safety achieved by the existing design, incorporating the proposed design change, is **MATERIALLY** the same as the level reflected in the latest amendment.
- The emphasis is on the comparison of the levels of safety of the design and the level of safety achieved by the latest amendment.
- The applicant may comply with an earlier regulation if the **Δ Safety is small**, that is, if the increase in safety attained by complying with the latest regulation is small.

Objective of 21.101(b)(3)

- **Judging difference between latest standard and level achieved by proposed design**
  - ***Not*** **comparing level of safety of existing certification basis and level of safety of later amendment**
  - ***Not*** **a re-evaluation of safety benefits of later regulations**

CPR, 1.0 196

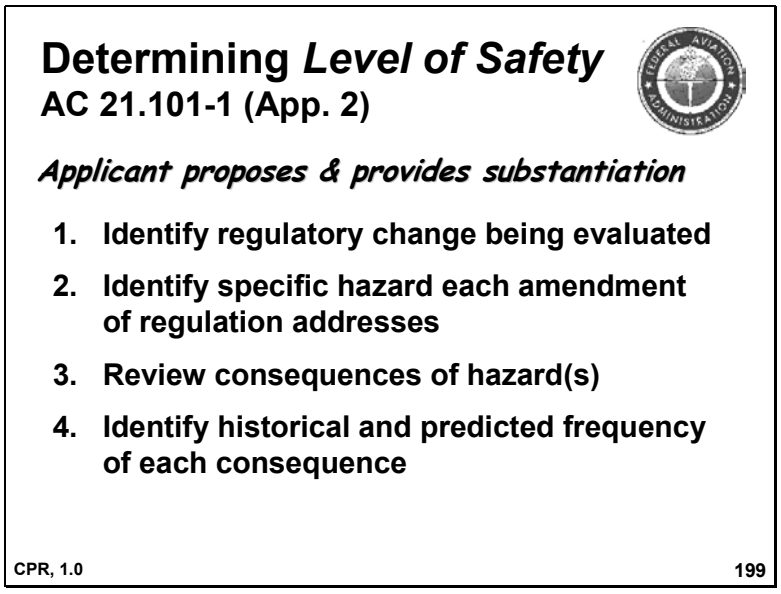
Does Not Contribute Materially to the Level of Safety

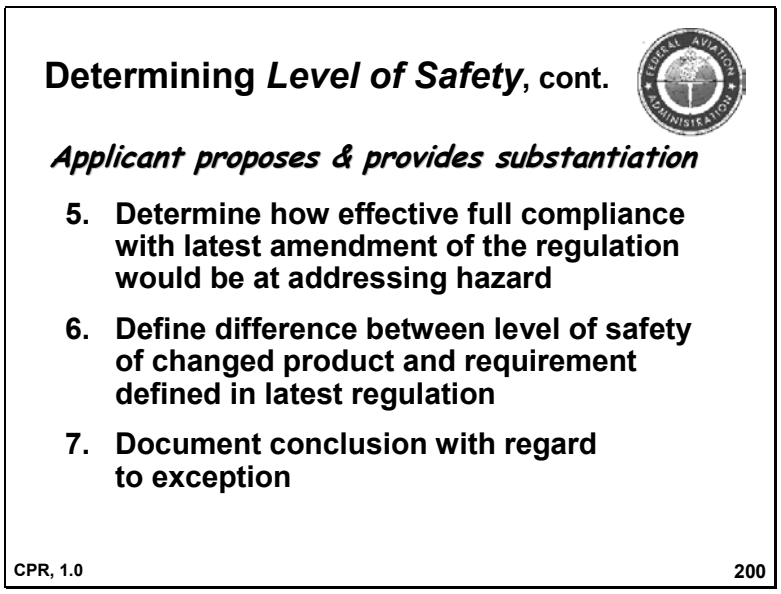
- **Not an equivalent level of safety finding**
  - **Equivalent level of safety finding indicates that product meets intent of rule**
  - **Equivalent level of safety finding gives credit for a specified amendment level**
- **Exception indicates product meets and gets credit for an earlier amendment**

CPR, 1.0 197

- The applicant may always apply for an equivalent level of safety finding. This provision of the rule does not take that option away.

- A seven step process may be used to apply this exception. This process is described in the AC in Appendix 2.



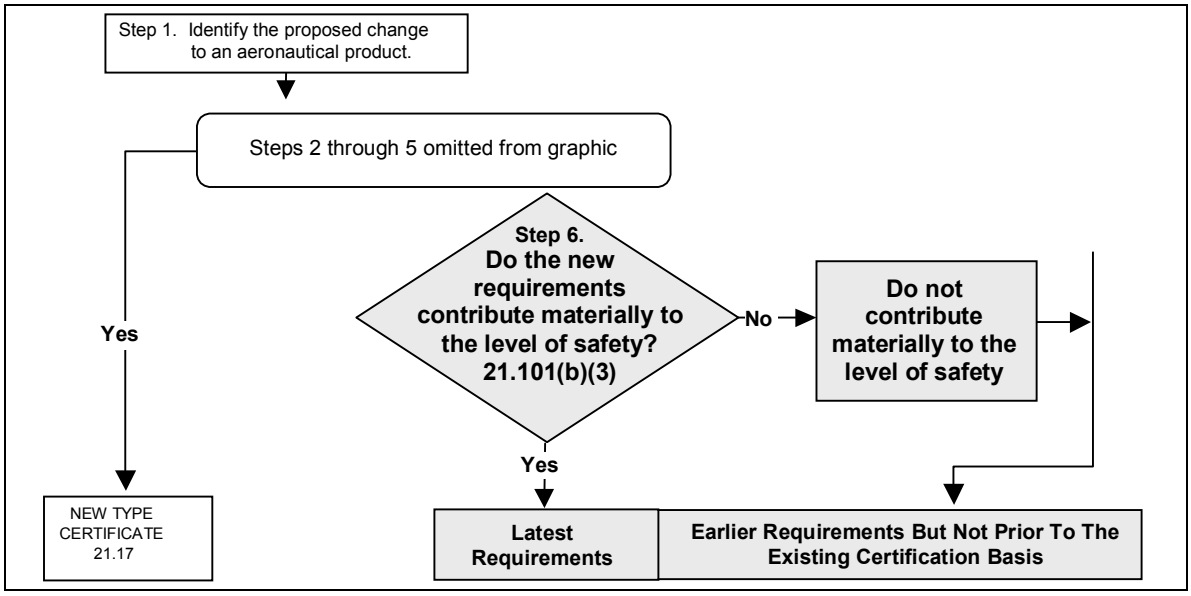


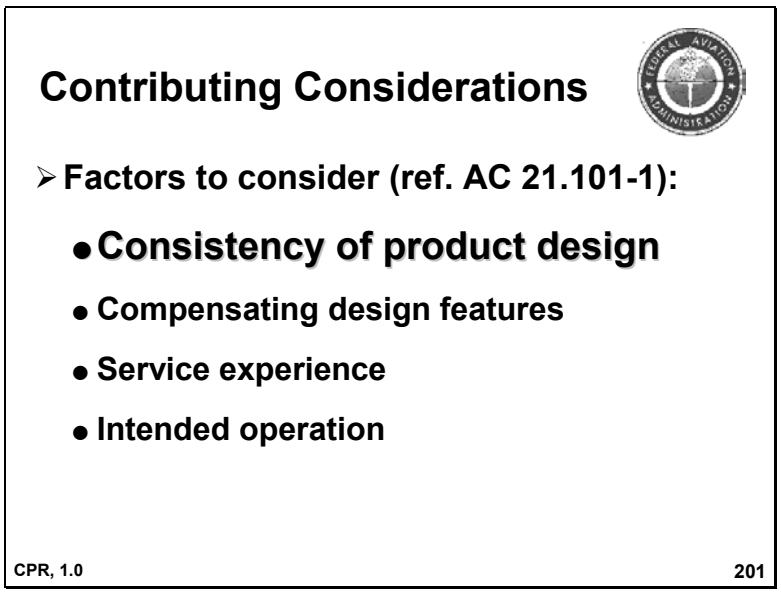
- All of the steps in this process, except for Step 6, are common to the *level of safety* and to the *impractical* exception.

D. What Must be Considered in Making This Determination?

- To apply this exception, compare the level of safety achieved by the existing design with the proposed design change to the level of safety achieved by compliance with the latest amendment. To be effective the applicant must demonstrate that the two levels are similar.

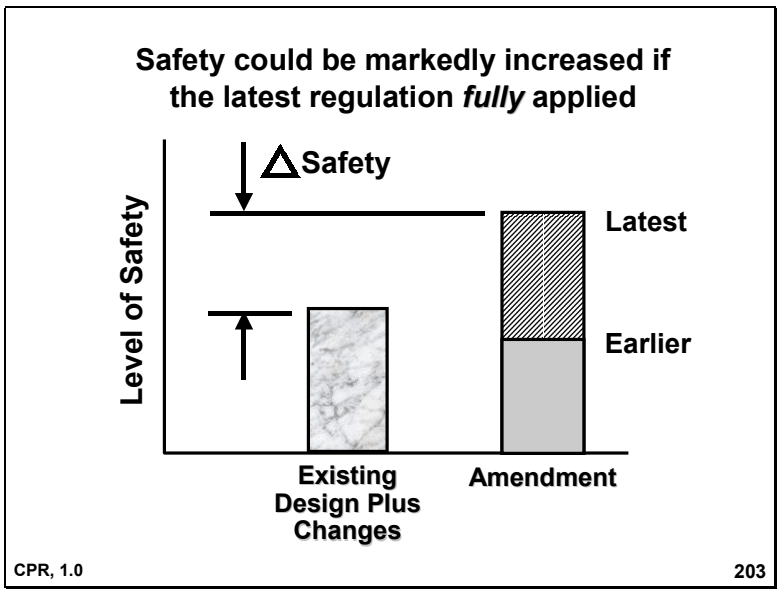
Detail from Figure 1 of AC 21.101-1



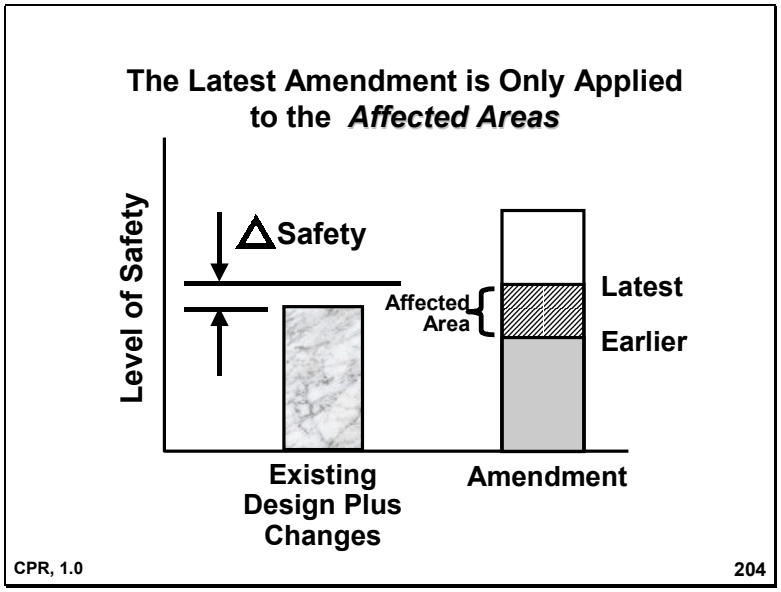


- It is **unlikely** that a determination of not contributing materially to the product's level of safety would be **based on one of these factors alone**.
- It is more **likely that a combination of these factors** could lead to that determination.

- **Consistency of Product Design**. AC 21.101-1 provides guidance.



– A significant safety benefit would be achieved if the latest amendment were fully applied.



– We are only applying the latest regulation to the **area affected by the change**. The safety benefit achieved is **reduced in proportion to the relative size of the affected area**.

Case Study – Transport Airplane Amended TC

Product Being Changed: Twin jet engine transport, existing certification basis at Amendment 25-41. Date of application: June 30, 2003, latest regulations at Amendment 25-109.

Description of Changes in the Application:

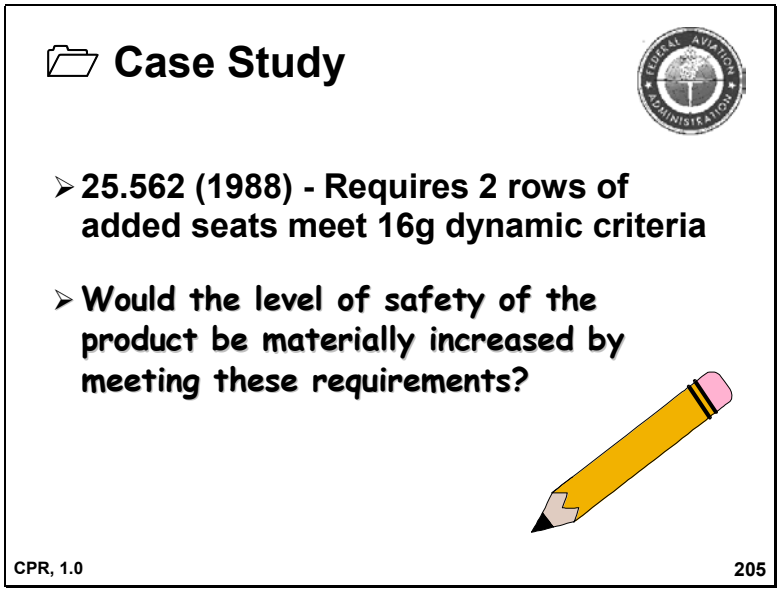
I. Lengthen Fuselage (same gross weight, trade payload for range) Determined to be Significant

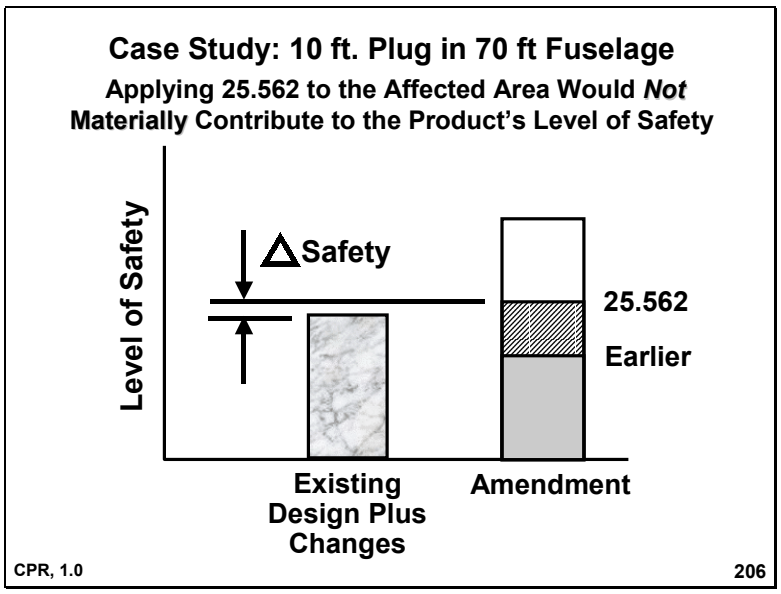
Physical Changes	Functional Characteristics
➢ Add 10 ft. fuselage plug; total fuselage length is now 80 ft ➢ Extend floor ➢ Add two row of seats ➢ Increase size of cargo compartment by 30% ➢ Add overhead bins **Secondary Changes** ➢ Lengthen control cable runs ➢ Extend services (O_2, plumbing, etc.) ➢ Increase local skin gauges at wing root	➢ Performance ➢ Handling qualities ➢ External air loads ➢ **Cabin safety (25.562, Emergency landing dynamic conditions)** ➢ Weight and balance

II. Increase Engine Thrust (takeoff on shorter runway) Determined to be Significant

Physical Changes	Functional Characteristics
➢ Increase engine thrust by 3% (9% previous increases without update of the certification basis) ➢ Redesign pylon to increase strength **Secondary changes** ➢ Change nacelle cooling flow	➢ Performance ➢ Flight characteristics ➢ Structural integrity

- The Case Study proposes adding two rows of seats.
  - We will look at regulation 25.562, Emergency Landing Dynamic Conditions, which was enacted in 1988 at amendment level 25-64 (after the aircraft's certification basis was established).





- This figure illustrates that applying the latest regulation to such a small relative area **would not** materially increase the product's level of safety.

Plug Addition Example

- **Applicant proposes to add 10 ft. plug to the 20 ft. long fuselage of part 25 business jet certificated in 1985**
  - **If extent of fuselage change is large relative to original structure, area affected by change could be defined as entire fuselage**
  - **From structures standpoint, addition of plug requires recalculation of external loads**

CPR, 1.0 207

Exercise VI-1

- What if a 10 ft. plug were added to a 35 ft. long fuselage of a part 25 business jet certificated in 1985?
  - Originally had 8 seats, adding 4 more

Given the two previous examples, would compliance with the latest regulations materially contribute to the product's level of safety?

208

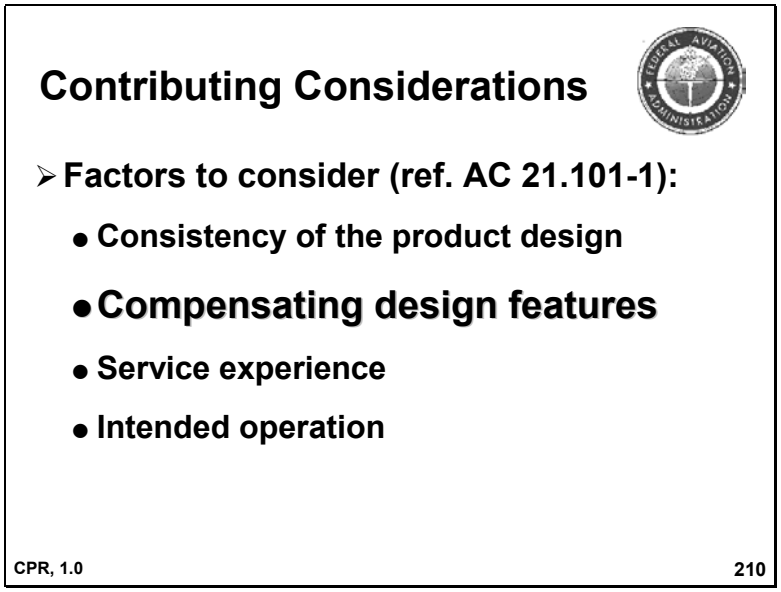
Consistency of Product Design: Summary

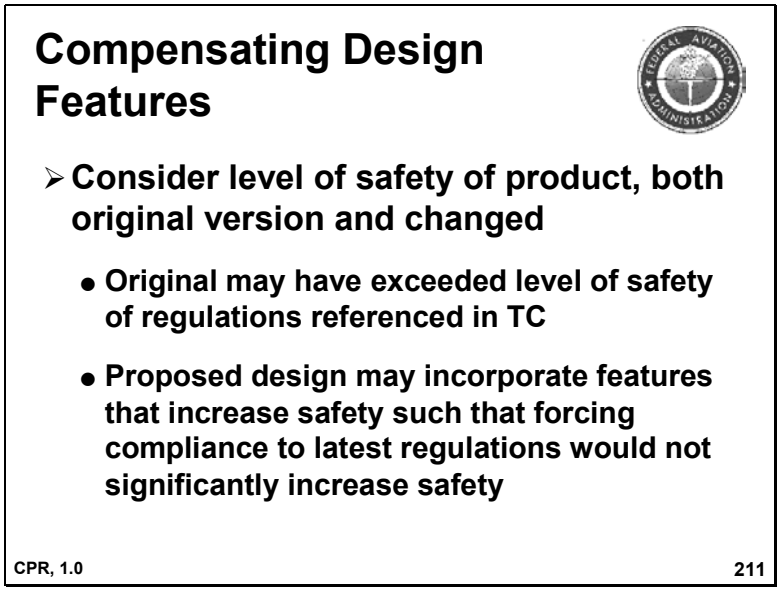
- Will applying the latest regulations to a relatively small section of an aircraft contribute *materially* to the product's safety?
  - Examine on rule-by-by rule basis
  - Consider affected area in relation to relative size of entire product
  - Consider impact of change on entire product

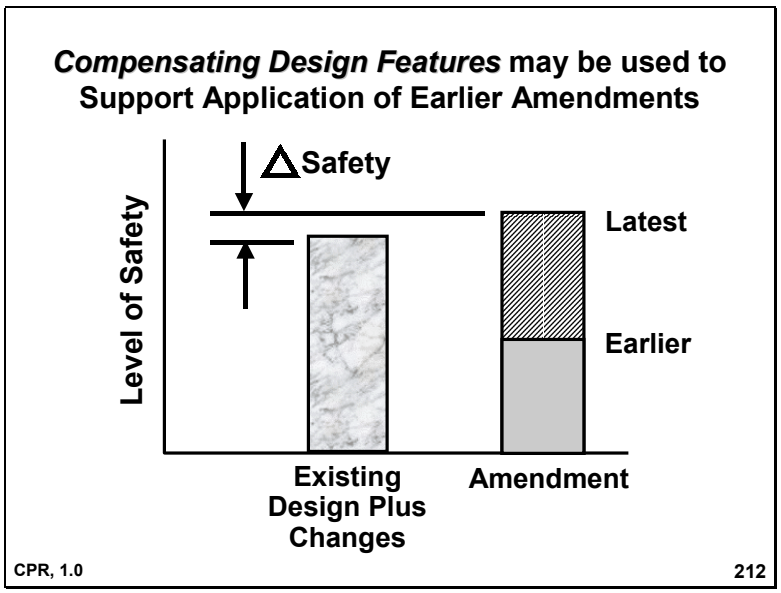
CPR, 1.0

209

- **Compensating design features.**







– This figure illustrates an example where the changed product's level of safety may be similar to the level mandated by the latest regulations. Compliance would NOT be required since it would not materially contribute to the product's level of safety.

- The next page of your Guide provides some background information for an exercise (this is *not* the Case Study).

Exercise - Change Auxiliary Power Units (APU)

Product Being Changed: Part 25 aircraft whose certification was the initial release of CFR part 25.

Description of Proposed Change:

- Install new APU
- Utilize fuel fire wall shut-off valve and actuator from previous design
- Improve the electronic control unit (ECU) in APU control system so it will indicate failure of proper valve operation to the flight crew

Note: The new APU is now considered essential equipment for extended over water operations. The assumptions used for certification have been changed as a result of proposed extended operations over water. **The change is, therefore, significant at the product level.**

The modified system has the following features:

- Monitor valve cycling at startup and shutdown (i.e., from closed to open at startup and from open to closed at shutdown).
- APU fault and caution lights illuminated to indicate any detected APU fuel shut-off valve malfunction along with any other major fault affecting the APU.

One of the **applicable regulations** to the affected area is § 25.1141, Powerplant Controls. Paragraph **(f)** was added to **25.1141** in 1977, after the aircraft was initially certificated. At issue is the requirement that:

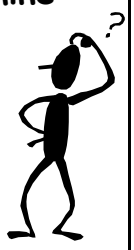
> *Powerplant valve controls located in the cockpit must have a means to indicate to the flight crew when a power-assisted valve —*
>
> *(i) Is in the fully open or fully closed position;* ***and***
>
> *(ii) Is moving between the fully open and fully closed position.*

- **Intent of §25.1141(f)**:
  - To provide immediate feedback to crew when command is given to open or close the valve, ***and***
  - To inform crew when operation is completed.
- This is an **important human factors consideration**. The goal is to maximize crew awareness and minimize crew workload. It could take 30 to 60 seconds for the valve to respond. Providing an immediate indication that the valve is responding permits crew to move on to other assignments.
- **The addition of the fault and caution lights** increased the system's functionality. The **system does not indicate** valve position or motion as required by §25.1141(f).

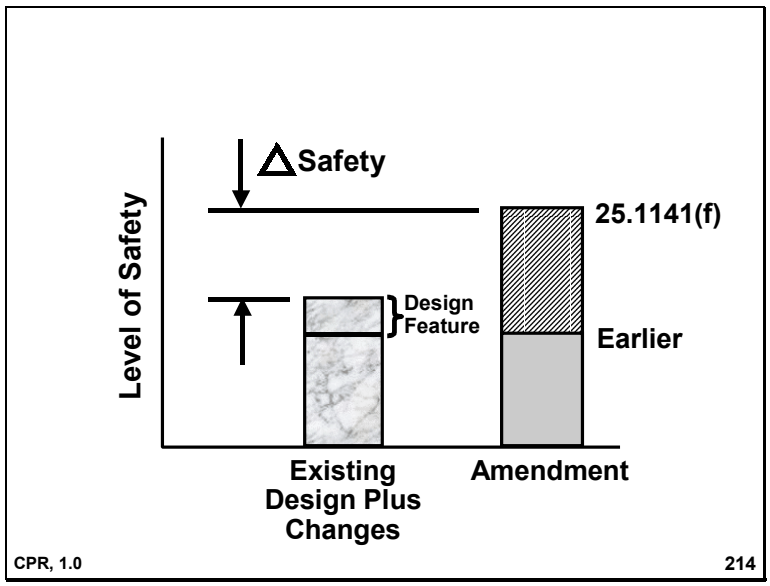
Exercise VI-2

Does the improvement of the ECU alone increase the level of safety to a degree that is sufficient to determine that compliance with the latest regulation would not materially increase the product's safety?

Justify your answer.



CPR, 1.0 213

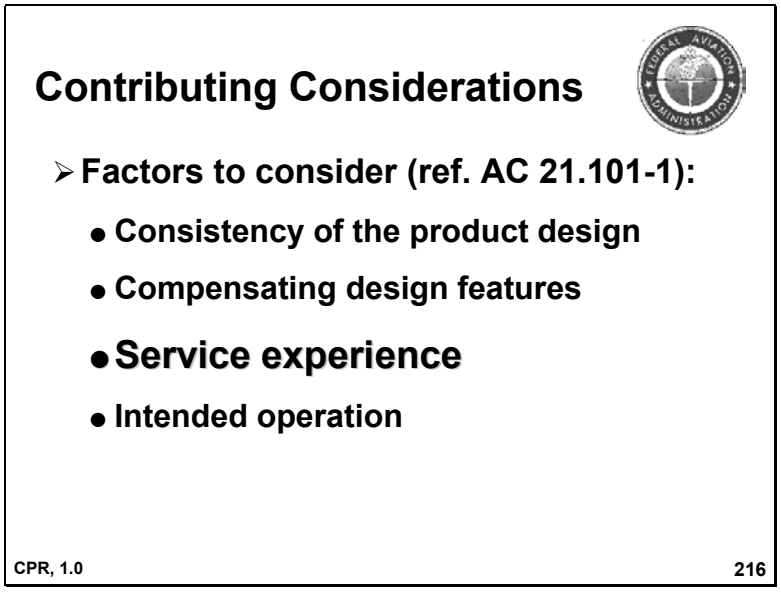


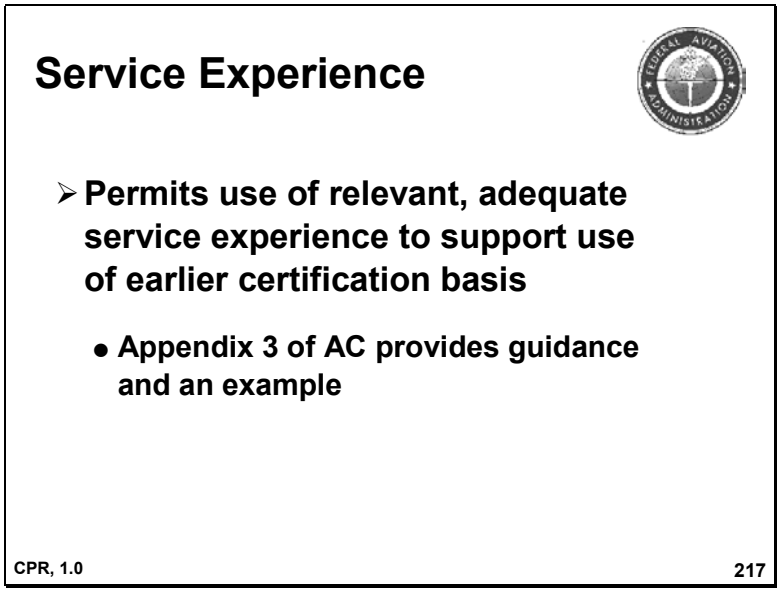
Compensating Design Features: Summary

- **Does changed product contain design features that achieve a level of safety *similar* to the latest regulations?**
  - **Examine on rule-by-by rule basis**
  - **Consider product's compensating design features; compare level of safety to that required by latest requirements**

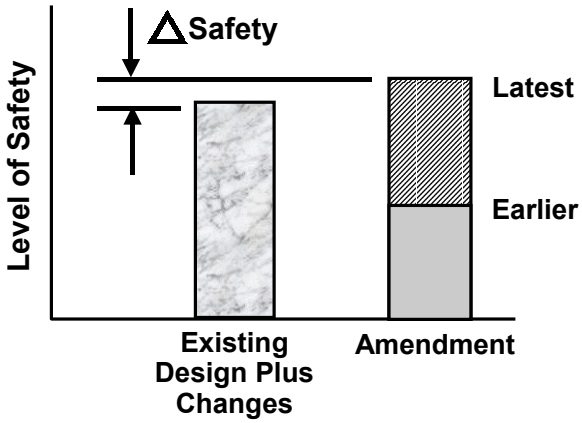
CPR, 1.0 215

- This brings us to the next consideration: **service experience**.





Relevant Service Experience **may be used to Support Application of Earlier Amendment**



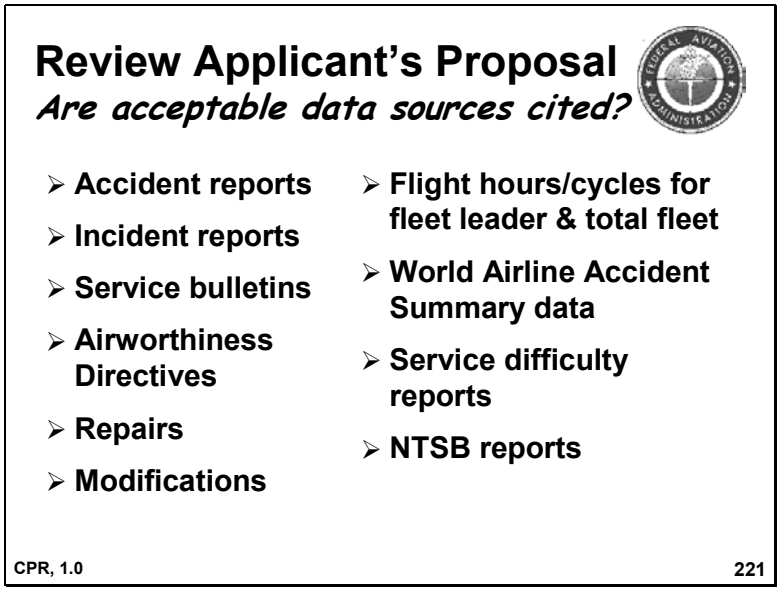
CPR, 1.0 218

Service Experience, cont.

- **Compliance with earlier regulations may be acceptable if**
  - **earlier certification basis +**
  - **applicable service experience *and* other relevant design considerations**
  - **= level of safety comparable to latest regulations**

CPR, 1.0 219

– **AC, Appendix 3, The Use of Service Experience in the Certification Process,** provides guidance and examples for applying this consideration.



Review Applicant's Proposal

Are data . . .

- Adequate?
  - All relevant service experience for product represented
    - ✓Includes results of operator surveys
- Representative?
- Relevant to the issue?

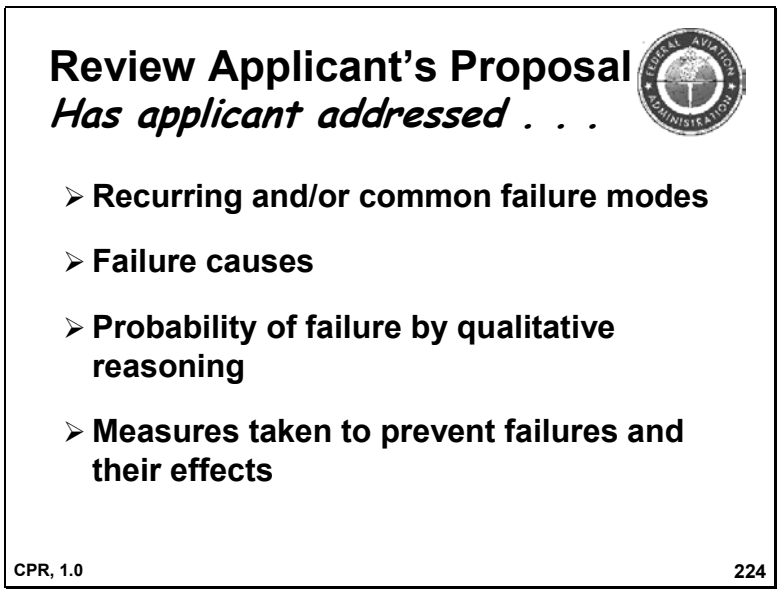
CPR, 1.0 222

Review Applicant's Proposal

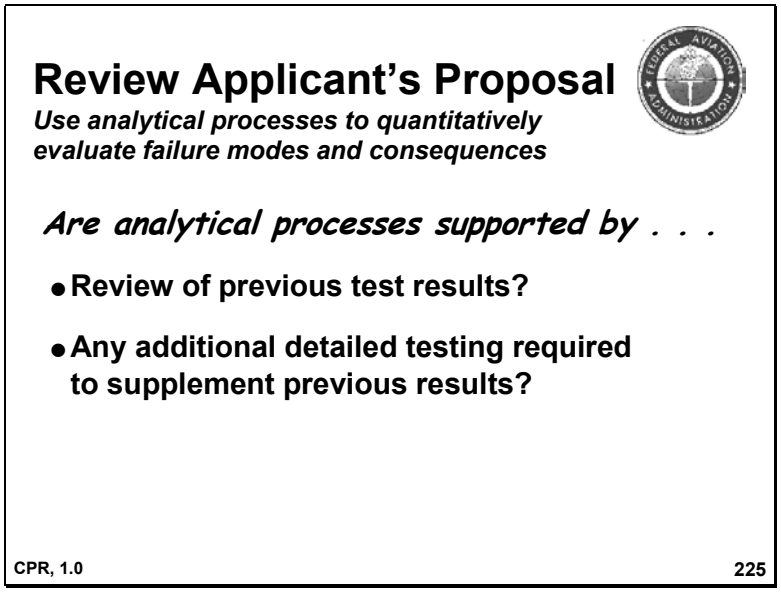
Has applicant demonstrated that service experience data are relevant?

- Applicant must
  - ***Identify*** main areas of concern of each applicable regulation
  - ***Demonstrate*** these areas of concern are addressed by analysis of service experience data

CPR, 1.0 223



– The applicant may cite relevant data pertaining to aircraft of similar design and construction.



– These guidelines are not intended to be limiting, either in setting required minimum elements or in precluding alternative forms of submission. Each case may be different based on the particulars of the system being examined and the rule to be addressed.

- To illustrate the use of service experience, we'll go back to the APU example. The next page will give you some of the product's service history. **The section in larger font is the new information.**

Exercise - Change Auxiliary Power Units (APU)

Product Being Changed: Part 25 aircraft whose certification was the initial release of part 25.

Description of Proposed Change:

- Install new APU
- Utilize fuel shut off valve and actuator from previous design
- Improve the electronic control unit (ECU) in APU control system so it will indicate failure of proper valve operation to the flight crew

Note: the new APU is now considered essential equipment for extended overwater operations. The change is significant at the product level.

The modified system has the following features:

- Monitor valve cycling at startup and shutdown (i.e., from closed to open at startup and from open to closed at shutdown).
- APU fault and caution lights illuminated when valve in improper position during operation.

Section 25.1141, Powerplant Controls, is applicable to the affected area. In 1977, amendment 25-40 added paragraph (f) to 25.1141. The regulation indicates that powerplant valve controls located in the cockpit must indicate fuel valve position (fully open or fully closed) or transition between open and closed.

Service history. The applicant submitted a report that included data, or referenced reports, documenting relevant service experience compiled from incident reports, fleet flight hour/cycle data, and maintenance records. The issue paper also discussed existing and proposed design details, failure modes, and analyses showing to what extent the proposed airplane complies with the latest amendment of §25.1141. Comparative data pertaining to aircraft of similar design and construction are also presented.

Since the proposed airplane is a derivative of a family of transport airplanes, the applicant presented data accumulated over millions of flight hours and flight cycles. If one assumes a complete APU cycle (i.e., start up and shutdown for each flight), the number of APU fuel shut off valve operations would be over 10^8 cycles.

The service history data indicated that the existing fuel shut off valve had acceptable reliability throughout its entire flight history.

Exercise VI-3

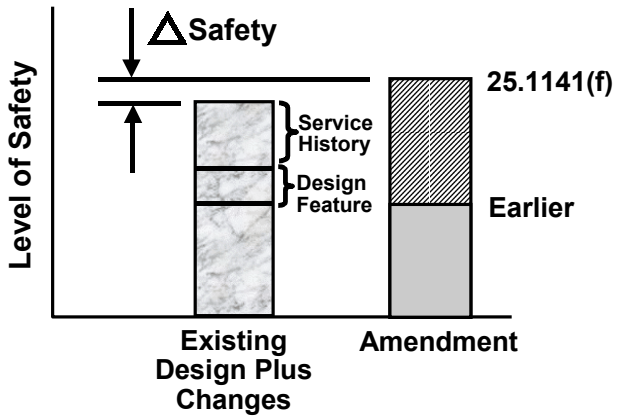
Do service history and compensating design features demonstrate that product's level of safety is sufficiently similar to level intended by latest regulations that compliance with these regs. would not contribute materially to level of safety?

Provide reasons for your answer.

CPR, 1.0

226

Answer:



CPR, 1.0 227

Service History: Summary

- Use Appendix 3 of AC 21.101-1 for guidance
- Review proposal to ensure that:
  - Acceptable data sources cited
  - Data are adequate, representative, relevant
  - Analysis addressed areas of concern

CPR, 1.0 228

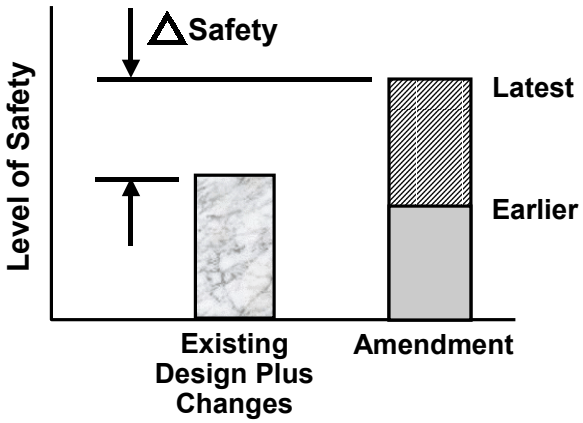
- **Level of safety for its intended operation.**

Contributing Considerations

- **Factors to consider (ref. AC 21.101-1):**
  - **Consistency of the product design**
  - **Compensating design features**
  - **Service experience**
  - **Intended operation**

CPR, 1.0 229

Level of Safety should be *Appropriate* for Product's Intended Operation



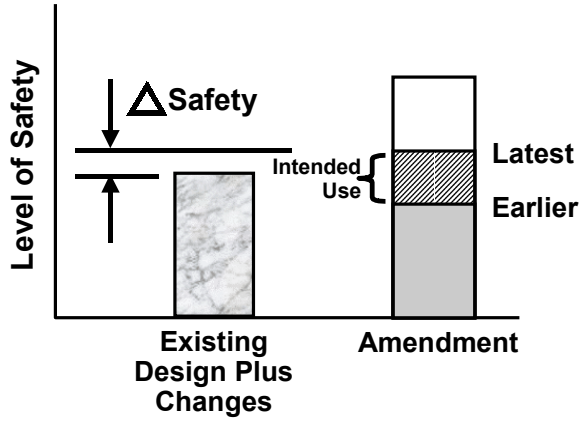
CPR, 1.0 230

Intended Operation

- **Goal is to establish level of safety appropriate for product's intended operation**
  - **Restrictions on aircraft in 21.101(f) permit reduced level of certitude**
  - **Especially true for restricted category aircraft under 21.25(a)(1) and (a)(2)**

CPR, 1.0 231

Consider *Intended Operation*: Restrictions *may* Permit Reduced Level of Certitude



CPR, 1.0 232

- **Consider product's intended use when determining if compliance with the latest regulation would contribute materially to the product's level of safety.**
- The FAA does not hold restricted category aircraft to the same level of safety as aircraft certificated in the transport category, for example.

Intended Operation, cont.

- Restricted category aircraft
  - In most cases, compliance would not contribute materially to the level of safety
  - Apply latest regulations when the regulations in TC do not provide appropriate level of safety

CPR, 1.0 233

Restricted Category Example 1

- DC-4 (C54) used for forest fire fighting
- Proposal to add equipment and external tankage for external slurry tank
- External tank is 70% of length of fuselage
- Change is significant at product level

CPR, 1.0 234

Restricted Cat. Example 1, cont.

- **Originally certificated under CAR 4b**
- **CAR 4b fatigue requirements became 25.571**
- **25.571 later amended to include requirements for damage tolerance**
- **Applicant proposes to meet fatigue requirements of CAR 4b, not damage tolerance requirements of 25.571**

CPR, 1.0 235

– The applicant believes that compliance with the damage tolerance requirements would not contribute materially to the aircraft's level of safety.

Restricted Cat. Example 1, cont.

- **Applicant justified their position through:**
  - **Consistency of product design – airframe itself doesn't meet damage tolerance requirements**
  - **Service experience – positive military and airline service experience**
  - **Compensating design features – DC-4 has 15% margin to required 1.5 structural safety factor**
  - **Instructions for Continued Airworthiness – expanded version as result of aircraft's extensive use by military and other firefighting operations**

CPR, 1.0 236

Restricted Cat. Example 1, cont.

- Prime consideration based on aircraft's intended use
- Operating limitations imposed as result of firefighting operations
- Aircraft minimizes exposure to public by limiting:
  - Flight over non-congested areas, and
  - Crew to essential personnel

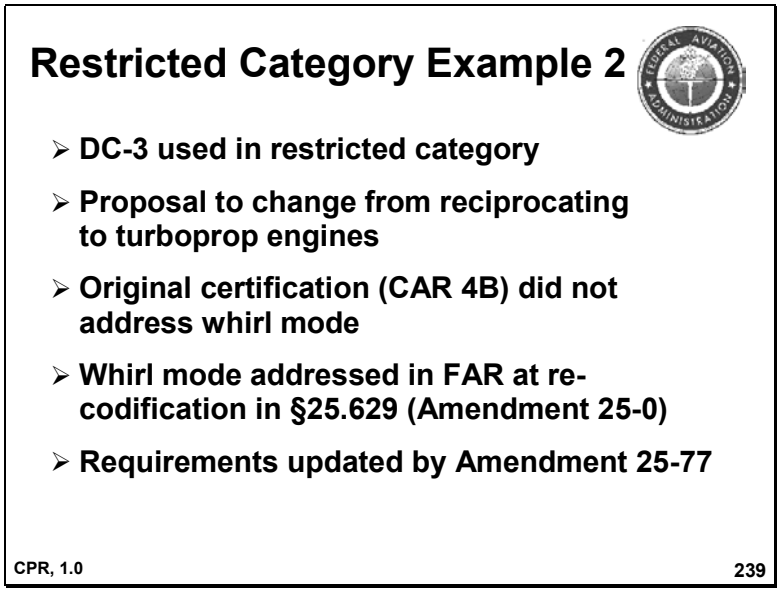
CPR, 1.0 237

Restricted Cat. Example 1, cont.

- Positive service experience, compensating design features, and Instruction for Continued Airworthiness substantiate DC-4's level of safety
- Slurry tank would *not* be required to comply with damage tolerance requirements
- Applying these requirements to only tank would not contribute materially to product's level of safety

CPR, 1.0 238

– Although compliance with the latest requirements would **not** ***normally*** contribute to a restricted category aircraft's level of safety, this is **not** a hard and fast rule.



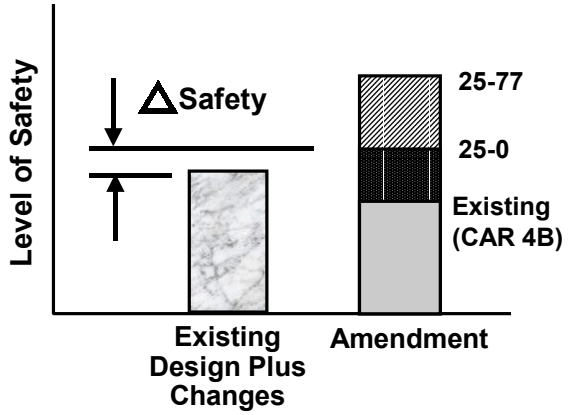
- This change is significant at the product level because it invalidates the assumptions used for certification and requires a new AFM to address performance and flight characteristics.
- Whirl mode is the flutter that can develop from the aerodynamic and gyroscopic forces associated with rotations and displacements in the plane of a propeller or large turboprop.

Restricted Category Example 2, cont.

To what amendment level do you think FAA would require compliance for this example?

CPR, 1.0 240

Answer:



CPR, 1.0 241

Intended Use: Summary

- Consider aircraft's intended use when determining contribution to level of safety
- Restrictions placed on a product's operation could permit a reduced level of certitude
- Goal is to establish a level of safety appropriate for product's intended use

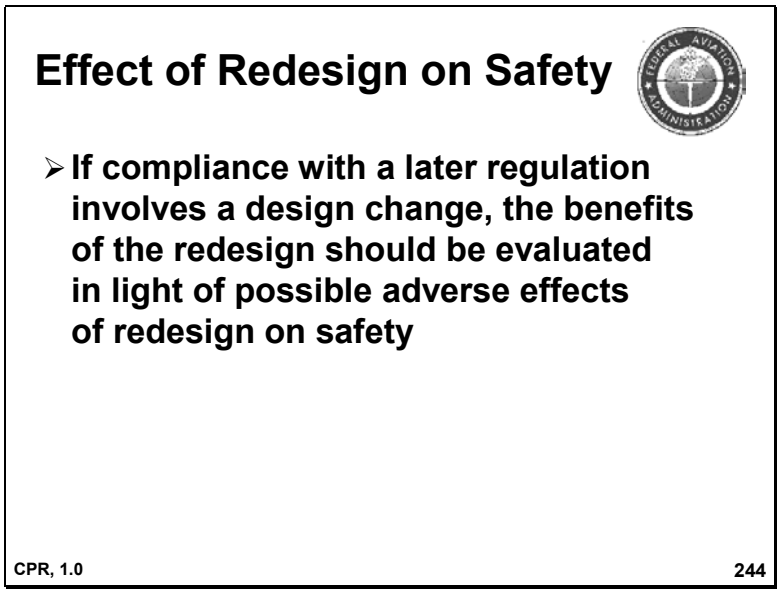
CPR, 1.0 242

Intended Use: Summary, cont.

- **For restricted category aircraft, often compliance with latest regs. won't contribute materially to level of safety**
  - **Some significant product-level changes will need to meet latest regulations because of safety issues**
  - **Applicant may still utilize other exceptions under 21.101**

CPR, 1.0 243

E. Effect of Redesign on the Level of Safety



- The ***Federal Register, June 7, 2000,*** final Changed Product Rule, on page 36247, provides more information —

  "It makes little sense to mandate changes to well understood designs, whose service experience has been acceptable, merely to comply with new standards. The clear exception to this premise is if the new standards were issued to address a deficiency in the design in question, or if the service experience is not applicable to the new standards."

- Again consider the case of the APU change. This is summarized on the next page and has no new material from the previous time we used this example.

Exercise - Change Auxiliary Power Units (APU)

Product Being Changed: Part 25 aircraft whose certification was the initial release of part 25.

Description of Proposed Change:

- Install new APU
- Utilize fuel shut off valve and actuator from previous design
- Improve the electronic control unit (ECU) in APU control system so it will indicate failure of proper valve operation to the flight crew

Note: the new APU is now considered essential equipment for extended overwater operations. The change is significant at the product level.

The modified system has the following features:

- Monitor valve cycling at startup and shutdown (i.e., from closed to open at startup and from open to closed at shutdown).
- APU fault and caution lights illuminated when valve in improper position during operation.

Section 25.1141, Powerplant Controls, is applicable to the affected area. In 1977, amendment 25-40 added paragraph (f) to 25.1141. The regulation indicates that powerplant valve controls located in the cockpit must indicate fuel valve position (fully open or fully closed) or transition between open and closed.

Service history. The applicant submitted a report that included data, or referenced reports, documenting relevant service experience compiled from incident reports, fleet flight hour/cycle data, and maintenance records. The issue paper also discussed existing and proposed design details, failure modes, and analyses showing to what extent the proposed airplane complies with the latest amendment of §25.1141. Comparative data pertaining to aircraft of similar design and construction are also presented.

Since the proposed airplane is a derivative of a family of transport airplanes, the applicant presented data accumulated over millions of flight hours and flight cycles. If one assumes a complete APU cycle (i.e., start up and shutdown for each flight), the number of APU fuel shut off valve operations would be over 10^8 cycles.

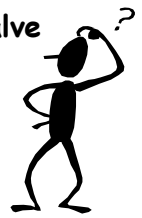
The service history data indicated that the existing fuel shut off valve had acceptable reliability throughout its entire flight history.

Exercise VI-4

- Existing valve has reliability of over 10^8
  - If compliance requires valve redesign, new valve has no service history

Is it better to have a redesigned valve with no service history that meets latest regulations, OR

Valve with proven reliability that falls short of latest regulations?

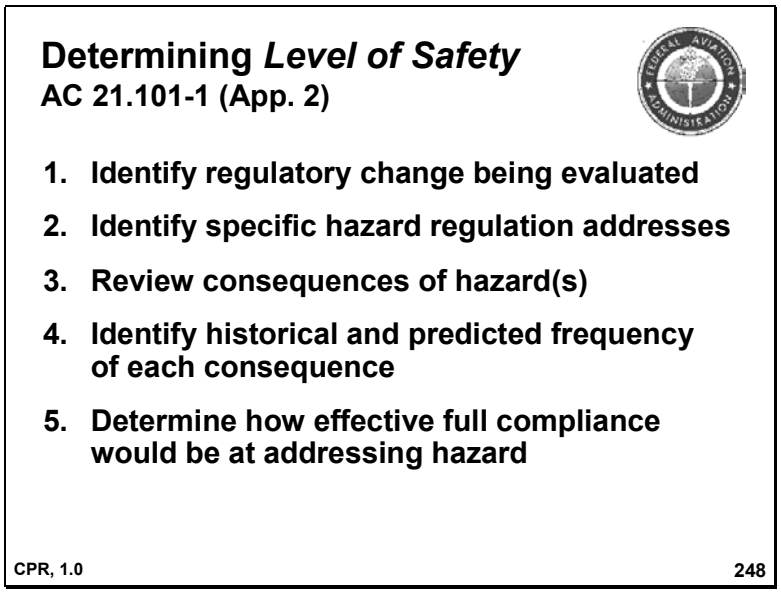


CPR, 1.0 246

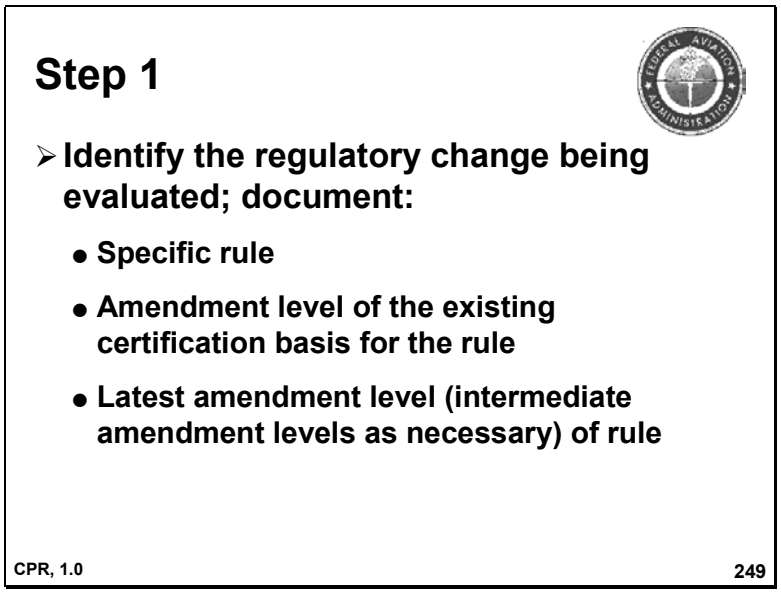
Exercise VI-4

CPR, 1.0 247

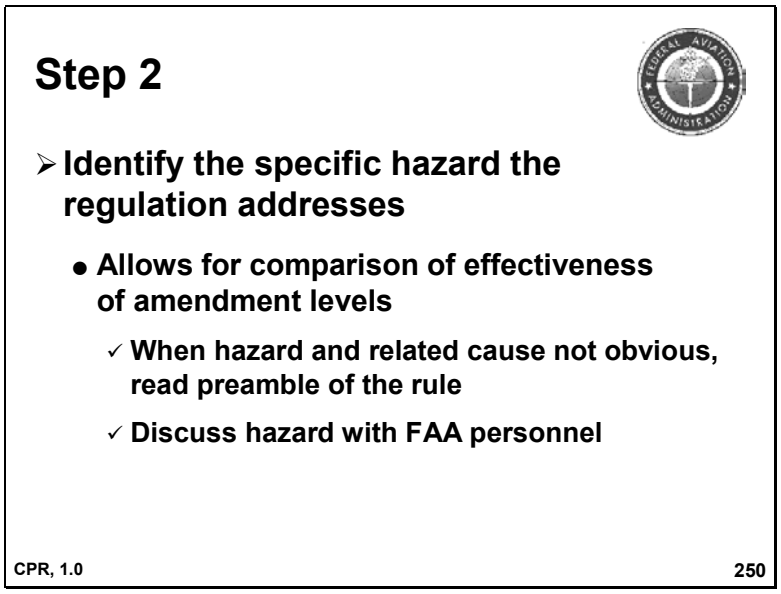
F. Process for Applying this Exception



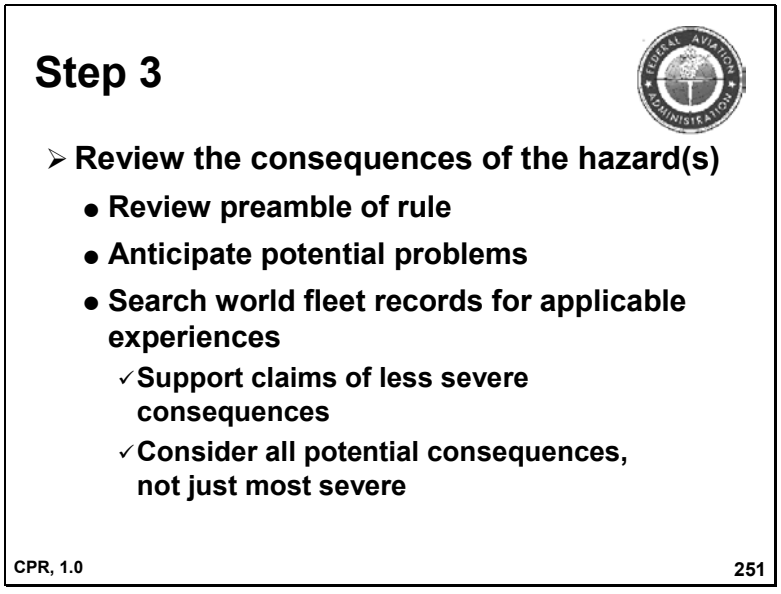
- **Step 1:** Identify the Regulatory Change Being Evaluated

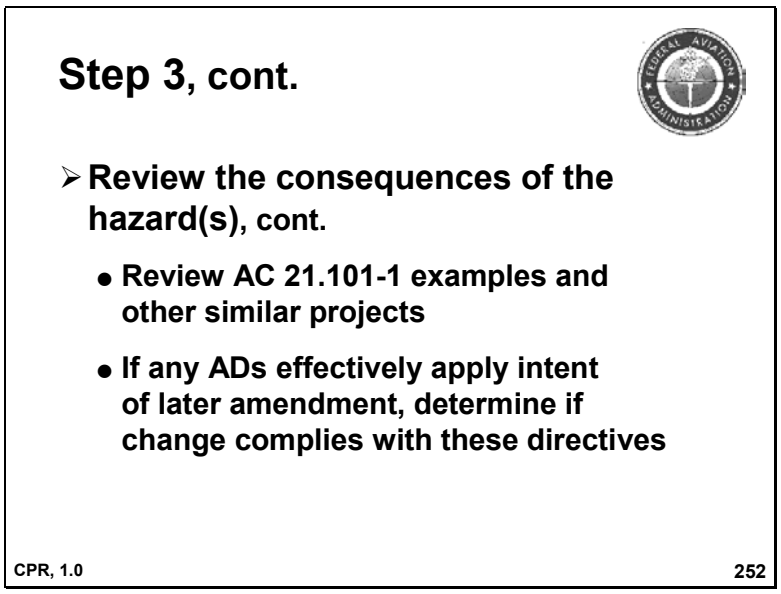


- **Step 2:** Identify the Specific Hazard the Regulation Addresses

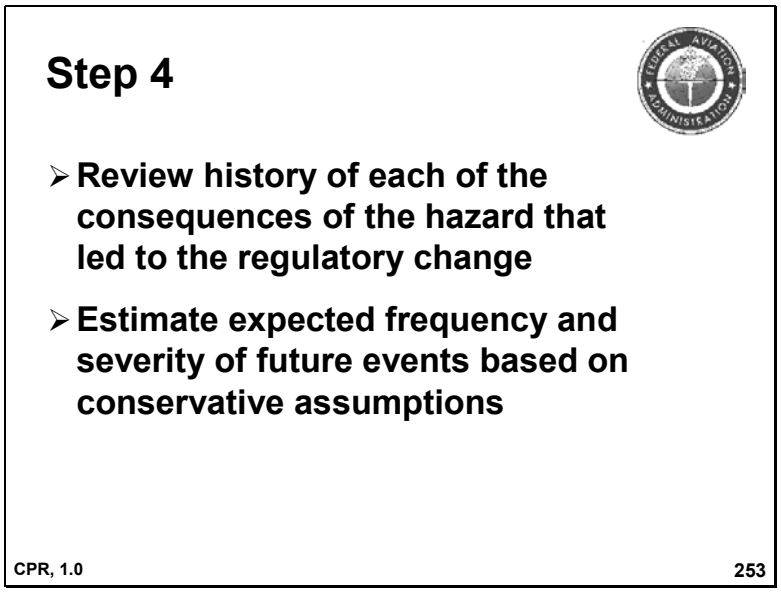


- **Step 3**: Review the Consequences of the Hazard(s)





- **Step 4:** Identify the Historical and Predicted Frequency of Each Consequence



– **Historical frequencies.**

Step 4, cont.

- **Applicant should identify historical frequencies for each consequence**
  - **Are acceptable data sources cited?**
  - **Are data**
    - ✓ **Adequate?**
    - ✓ **Representative?**
    - ✓ **Relevant?**
  - **Have all assumptions been identified?**

CPR, 1.0 254

– **Predicted frequencies**.

Step 4, cont.

- **Predicted frequency rate**
  - **Depends on whether all known *unsafe* conditions addressed through AD process and rule making**
    - ✓ **If corrective actions were required by ADs and rules addressed hazard, a lower accident rate may be predicted**
    - ✓ **If they did not, then assume future rate of accidents similar to historical record**

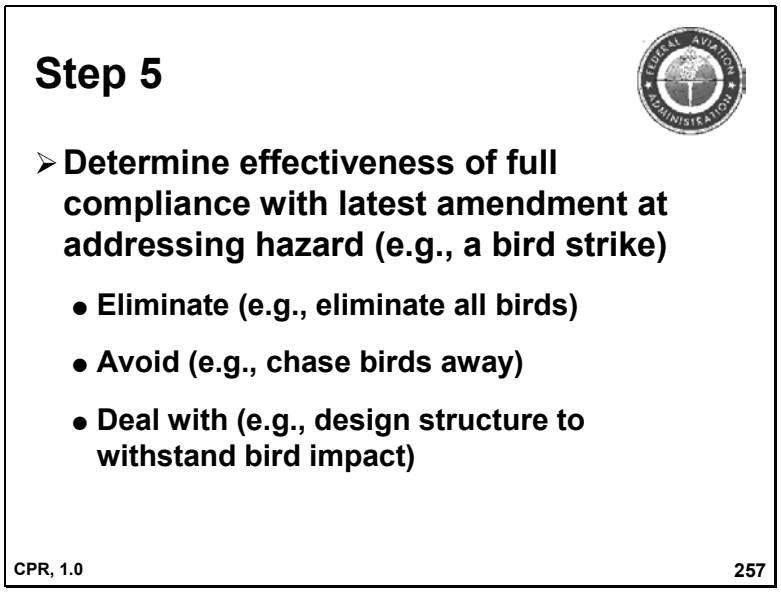
CPR, 1.0 255

Step 4, cont.

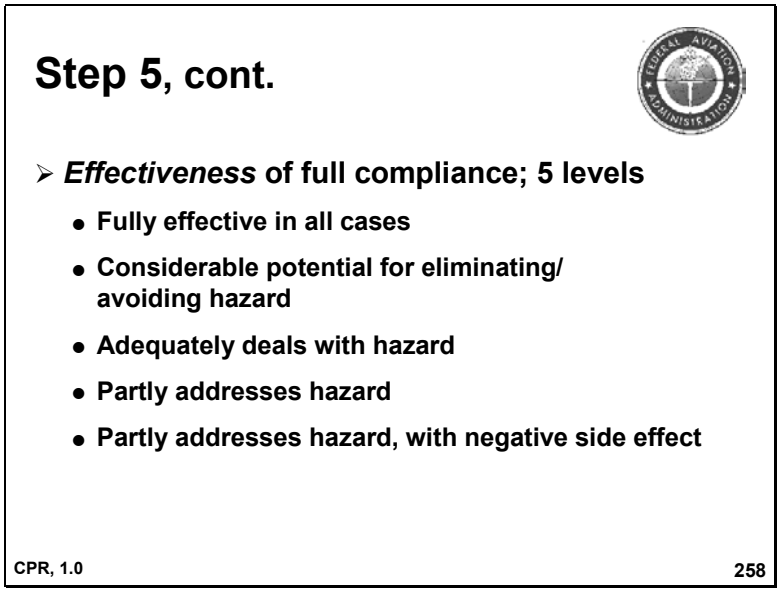
- **Predicted frequency rates, cont.**
  - **There may be other conditions, unknown at this time, that could provide similar hazards**
  - **Applicant presents predicted rate to FAA in the form of a proposal**

CPR, 1.0 256

- **Step 5:** Determine How Effective Full Compliance with the Latest Amendment of the Regulation Would Be at Addressing the Hazard.



  - As an example, let's say that the hazard is a bird strike. Therefore, one could **eliminate** all of the birds; **avoid** the hazard by chasing them away or flying around them; or **deal with** the hazard by designing the structure to withstand a bird impact.



- The FAA should review the applicant's proposal by using the five levels as guidance to assess the safety benefit of the various potential amendment levels. This will assist the FAA when weighing the safety benefit against the cost of compliance at each amendment level.

- By applying these five steps, we have identified the hazard and defined the level of safety established by the latest regulation.

- Now we'll go back to the Case Study (see the next page).
  - Remember that this exception is applied on a rule-by-rule basis. As such, we will look at one **regulation, §25.365, Pressurized compartment loads,** to determine if compliance with the latest amendment, 25-71, would materially contribute to the product's level of safety.
  - The product-level change would increase the number of passengers without an increase in gross design weight. In this example, the FAA found the **change to be significant** and therefore the latest amendments to the applicable regulations should be complied with, including the latest amendment of **§25.365**, **Pressurized compartment loads**.

Case Study – Transport Airplane Amended TC

Product Being Changed: Twin jet engine transport, existing certification basis at Amendment 25-41. Date of application: June 30, 2003, latest regulations at Amendment 25-109.

Description of Changes in the Application:

I. Lengthen Fuselage (same gross weight, trade payload for range) Determined to be Significant

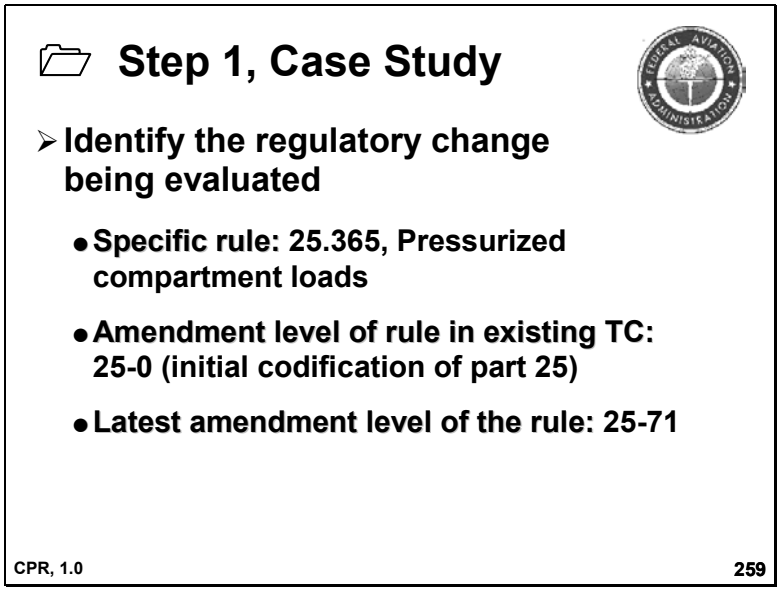
Physical Changes	Functional Characteristics
➢ Add 10 ft. fuselage plug; total fuselage length is now 80 ft. ➢ Extend floor ➢ Add two row of seats ➢ Increase size of cargo compartment by 30% ➢ Add overhead bins **Secondary Changes** ➢ Lengthen control cable runs ➢ Extend services (O_2, plumbing, etc.) ➢ Increase local skin gauges at wing root	➢ Performance ➢ Handling qualities ➢ External air loads ➢ **Cabin safety (25.365, Pressurized compartment loads)** ➢ Weight and balance

II. Increase Engine Thrust (takeoff on shorter runway) Determined to be Significant

Physical Changes	Functional Characteristics
➢ Increase engine thrust by 3% (9% previous increases without update of the certification basis) ➢ Redesign pylon to increase strength **Secondary changes** ➢ Change nacelle cooling flow	➢ Performance ➢ Flight characteristics ➢ Structural Integrity

- The applicant indicates that he can meet the latest amendment to 25.365 in all areas except one. The area in question is the cockpit wall.
- **The applicant proposes** that compliance with the latest amendment of §25.365 for this bulkhead would **not materially contribute** the product's level of safety.
- The process and details of evaluating the applicant's proposal are given in Appendix 2 of the AC.

- **Step 1**: Identify the Regulatory Change Being Evaluated



Step 1, Case Study, cont.

- **25.365, initial release, amendment 0**
  - **Interior structure of *passenger compartments* designed to withstand effects of a sudden release of pressure through an opening resulting from the failure or penetration of an external door, window, or windshield panel**

CPR, 1.0 260

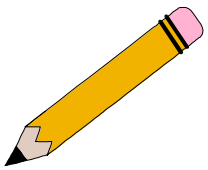
- **Step 2**: Identify the Specific Hazard the Regulation Addresses

Step 2, Case Study

- **Identify specific hazard the regulation addresses**

Q. What is the specific hazard addressed by 25.365, amendment 25-71?

A.



CPR, 1.0 261

Exercise VII-1

What are *potential* resources that *might* be useful in determining the intent and interpretation of a regulation at a specific amendment level, including a description of the specific hazard?

CPR, 1.0 262

- **Step 3**: Review the Consequences of the Hazard(s)

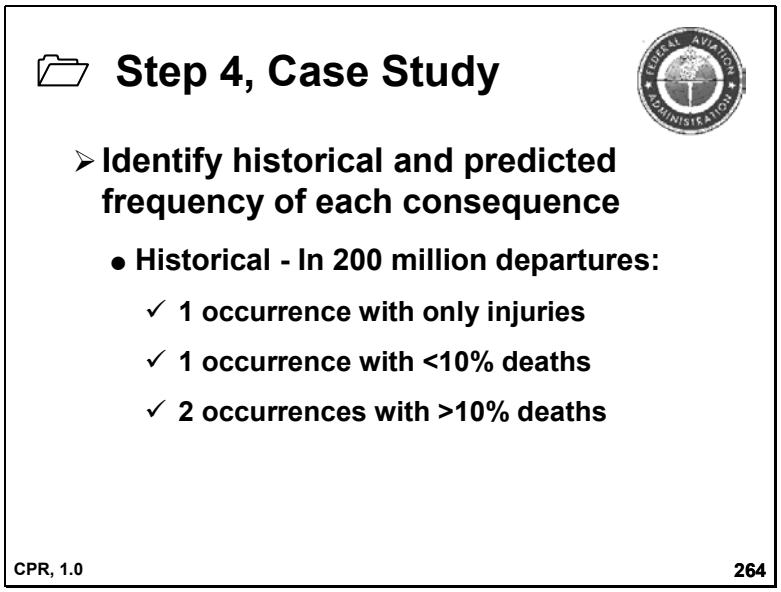
Step 3, Case Study

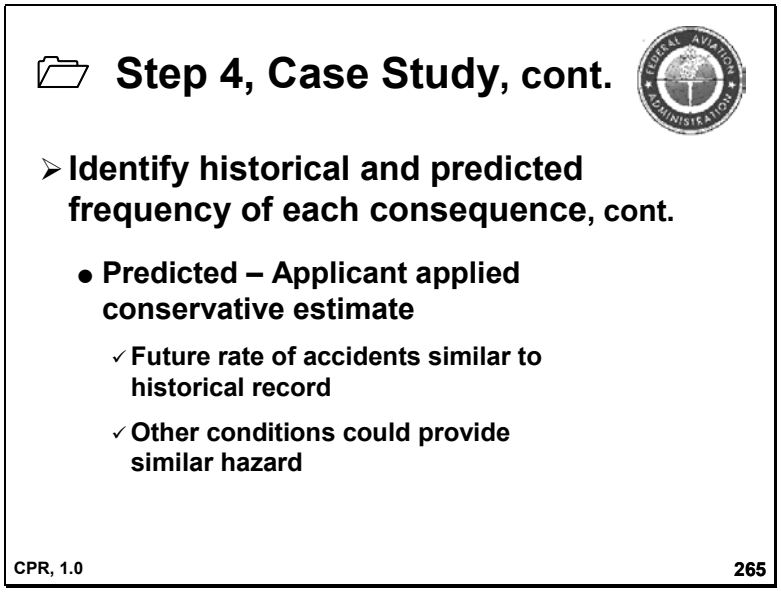
- **Review consequences of hazard(s)**
  - **Transport airplane data accident categories**
    - **Accidents resulting in total hull loss**
    - ✓ **Accidents with only injuries**
    - ✓ **Accidents with 10% deaths**
    - ✓ **Accidents with more than 10% deaths**

CPR, 1.0 263

  - Hazards being addressed are sudden depressurization of pressurized compartments and the sudden pressurization of unpressurized areas.

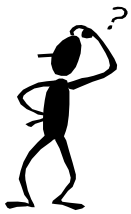
- **Step 4**: Identify the Historical and Predicted Frequency of Each Consequence





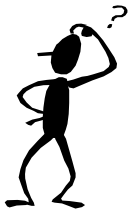
Exercise VII-2

From the information on hazard consequences about the Case Study, what aspects might you, as the FAA engineer or applicant, want more details on as you develop and evaluate the information?



CPR, 1.0 266

Exercise VII-2, Some Answers



CPR, 1.0 267

- **Step 5**: Determine How Effective Full Compliance with the Latest Amendment of the Regulation Would Be at Addressing the Hazard

Step 5, Case Study

- **Determine effectiveness of full compliance for addressing hazards of 25.365**
  - **25-71 - Fully effective; eliminates all known hazards**

CPR, 1.0 268

  - The specific hazard is a catastrophic structure and/or system failure produced by a sudden release of pressure through an opening in any compartment in flight.

Exercise VII-3

What would be useful for determining safety benefit of applying latest amendment to a particular project?

1. **Effectiveness of current product in addressing hazard in existing regulation.**
2. **Effectiveness of the application of proposed amendment at addressing hazard.**

269

Exercise VII-3

What would be useful for determining safety benefit of applying latest amendment to a particular project?

3. **Efficiency of applicant in incorporating the design change into the production line.**
4. **Effectiveness of applicant's proposed design change in addressing hazard.**

270

- Now we've advanced the Case Study through the first five steps that are common to both the ***level of safety*** **and** ***impractical*** **exceptions.** There are two more steps.

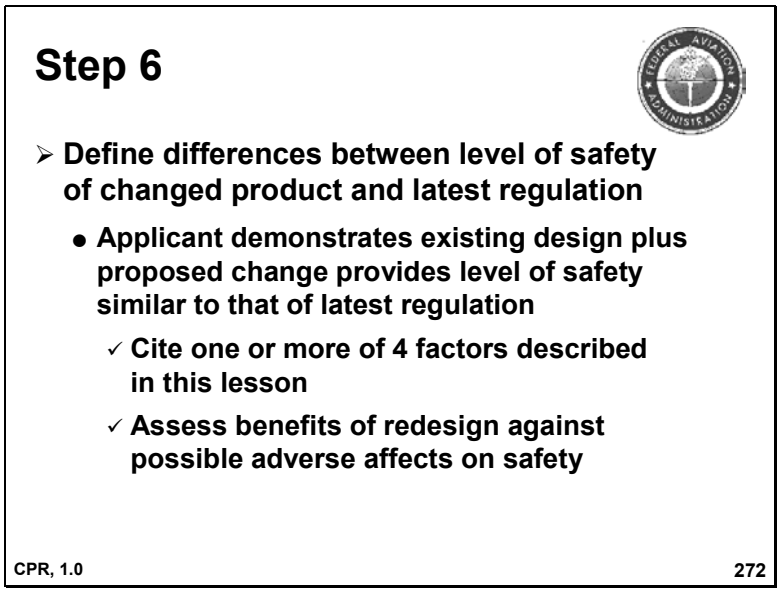
Determining *Level of Safety*, cont.

6. **Define differences between level of safety of changed product and that of latest regulation**
7. **Make and document final decision regarding contribution to product's level of safety**

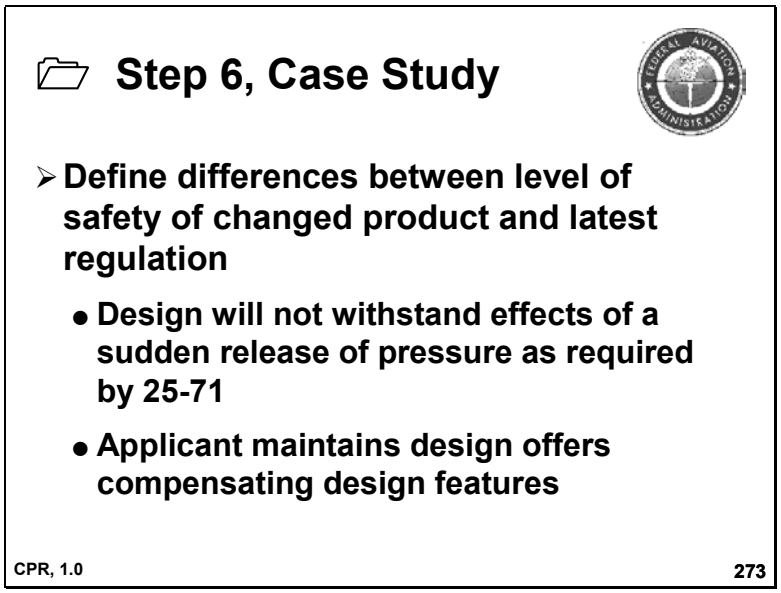
CPR, 1.0

271

- **Step 6**, Define the difference between the changed product's level of safety and the latest regulation's level of safety.



- Let's return to the Case Study to illustrate Steps 6 and 7.
- **Step 6**, Define The Difference Between The Changed Product's Level Of Safety And The Level Established By The Latest Amendment.



Step 6, Case Study, cont.

- **Analysis showed failure of bulkhead would have no impact on aircraft's continued safe flight and landing**
  - **No critical or essential systems would be affected by failure of the bulkhead**
  - **Would not affect passenger or crew egress**

CPR, 1.0 274

Step 6, Case Study, cont.

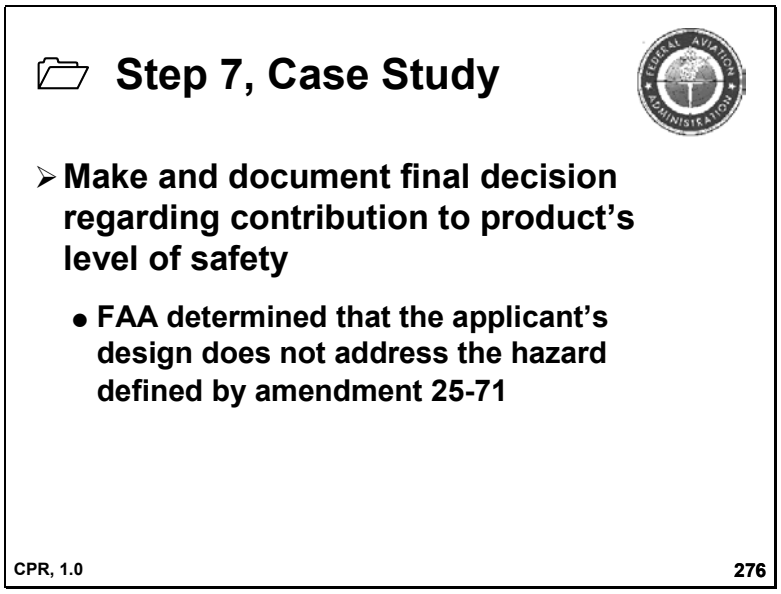
- **Cockpit wall in compliance with an intermediate amendment to 25.365, amendment 25-54, which says, in part:**

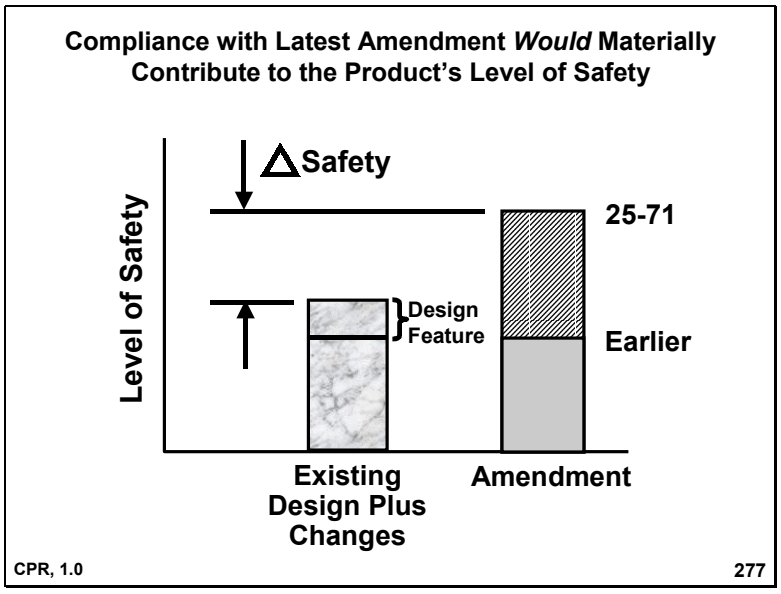
  "Any structure, component or part, inside or outside a pressurized compartment, the failure of which could interfere with continued safe flight and landing, must be designed to withstand the effects of a sudden release of pressure..."

CPR, 1.0 275

– Failure of an interior partition is **permissible** if safe flight and landing is **not compromised**.

- **Step 7**. Make And Document Final Decision Regarding Contribution To Product's Level Of Safety.



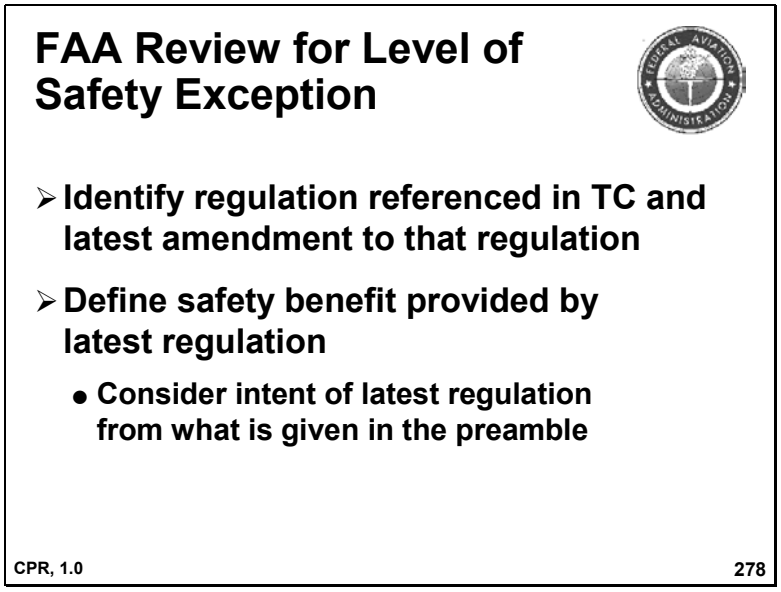


  - The existing design plus the changes did increase the level of safety of the product (the bar is raised), but not

enough to make the proposed design's level of safety SIMILAR to that of the latest amendment.

- The FAA recognized that the proposed design was in compliance with amendment 25-54 and that this compensating design feature increased the product's level of safety. However, the FAA determined that compliance with the latest amendment would materially contribute to the product's level of safety.
- The decision was documented in an issue paper.

- The process used to evaluate the applicant's proposal, which is very similar to the one used today.



FAA Review, cont.

- Determine level of safety provided by existing design with proposed change, using applicant's proposal for:
  - Consistency of product's design
  - Compensating design features
  - Service history
  - Level of safety for intended operation
  - Effect of redesign

CPR, 1.0 279

FAA Review, cont.

- Document and justify determination of appropriate regulation amendment level
  - Could be intermediate amendment level

CPR, 1.0 280

G. Summary of *Not Contribute Materially To The Level Of Safety* Exception

Summary Questions

- What is one major difference in how NCMLS differs from *not significant* and *not affected area*?

CPR, 1.0 281

Summary Questions, cont.

- Using NCMLS, applicant needs to show that the _____?_____ is comparable to the level of safety reflected in the latest amendment

CPR, 1.0 282

Summary Questions, cont.

- Is NCMLS the same as equivalent level of safety finding? Explain
- May an applicant who successfully requests a NCMLS exception apply for ELOSF?

CPR, 1.0 283

Summary Questions, cont.

- What are the four factors considered for NCMLS? Provide examples.

CPR, 1.0 284

Summary Questions, cont.

- Are the four factors to be used independently of each other?

CPR, 1.0 285

Summary Questions, cont.

- What steps would the FAA engineer follow in evaluating an applicant's proposal for NCMLS?

CPR, 1.0 286

Section VI, Summary

- **To demonstrate that compliance with latest regulation would not contribute materially to the level of safety:**
  - **Analyze safety features of existing design and proposed change**
  - **Analyze the safety concerns addressed by relevant amendment**
  - **Use engineering judgement**

CPR, 1.0 287

Section VI, Summary, cont

- **Factors to consider:**
  - **Consistency of the product design**
  - **Compensating design features**
  - **Service experience**
  - **Intended operation (restricted category)**
- **Usually not just one factor but a combination that leads to determination**

CPR, 1.0 288

- The Preamble to the NPRM and AC 21.101-1 provide guidance on the above factors.
- If compliance with a later regulation involves a **design change**, the benefits of the redesign should be evaluated in the light of possible adverse effects of the redesign on safety.