

# FAA National Software Conference, May 2002

## Software Changes in Legacy Systems

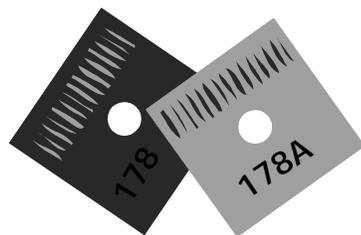
### SOFTWARE CHANGES IN LEGACY SYSTEMS

FAA SOFTWARE  
STANDARDIZATION CONFERENCE

Dallas, Texas.

May 14 - 17, 2002

Jorge Castillo - FAA/ASW-110



**"Approval of Software  
Changes in Legacy Systems  
Using RTCA/DO-178B"**  
**Draft FAA Order 8110.SW,  
Chapter 10**

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## Software Changes in Legacy Systems

### Purpose & History - 1/2

- Purpose:
  - Provide Guidelines for Transitioning From DO-178/178A To DO-178B



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### Purpose & History - 2/2

- History:
  - Notice N8110.53 - 1994
  - N8110.53 Was Confusing To Many
  - Legacy Notice Written to Clarify
  - Legacy Notice 8110.78 Completed - Oct 1998
  - Legacy Notice Number Changed from 8110.78 to 8110.89 - Nov. 2000
  - Notice 8110.89 Incorporated into Draft Order 8110.SW, Chapter 10

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## Software Changes in Legacy Systems

### Changes Between Notice & Draft Order

- Paragraph Numbering changes
- Minor editorial changes
- The words "small, simple" previously found in Notice changed to "minor".
- Deleted Conclusion section

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### Technical Information

- Legacy System Is a System Whose Software Was Approved Prior to Issuance of DO-178B
- Legacy System Already Has a TC, STC, ATC, TSO, PC, and/or PMA Approval
- Legacy System Specifically Applies to Systems That Had Software Approved Using DO-178 or DO-178A

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## Software Changes in Legacy Systems

### Technical Information Example of Legacy Systems

- Nav Unit Approved Using DO-178A and Originally Installed on a Citation II
- Installation of That Same Nav Unit Onto a Citation V, Learjet 45, or Raytheon Premiere → Legacy Systems
- Basically--Legacy Systems Concerns Arise Anytime a DO-178 or DO-178A System is Considered for Installation Onto an Aircraft or Engine

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### Draft Order 8110.SW Outline

- Section 10-1: General
- Section 10-2: Discussion
- Section 10-3: Procedures

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## Software Changes in Legacy Systems

### Background (Section 10-1) - 1/2

- Comparison of DO-178B to DO-178/178A
  - DO-178B Hinges on Objectives Rather Than Goal Statements
  - Software Testing is More Thorough in DO-178B
  - Software Level Classification Differs
    - (5 levels vs. 3 levels)
  - Tool Qualification Addressed in DO-178B

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### Background (Section 10-1) - 2/2

- Since AC 20-115B “cancels” DO-178A and DO-178, New Programs Should Meet DO-178B Objectives
- This Notice Explains How to Make the Transition from DO-178/178A Without Re-engineering all of the Data

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## Software Changes in Legacy Systems

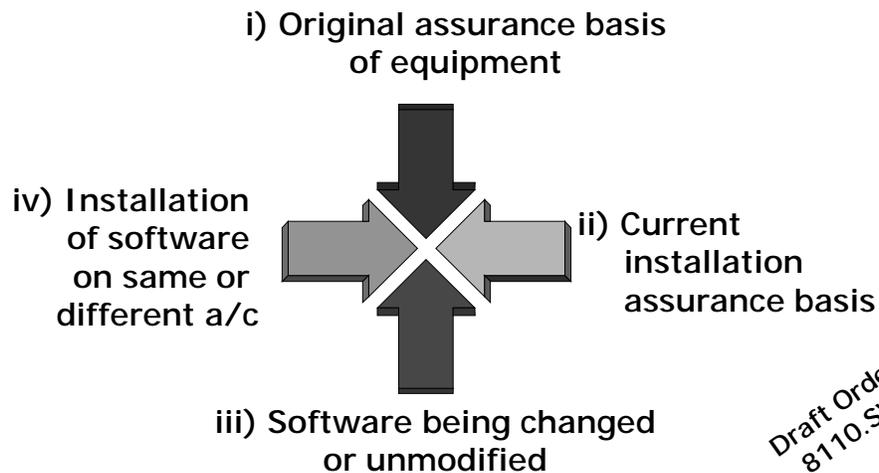
### Equivalence of SW Levels (Section 10-2)

- Software Level Must Be Shown to be Equivalent or Better; Otherwise, Use 12.1.4

Table 10-1  
Software Level Equivalence

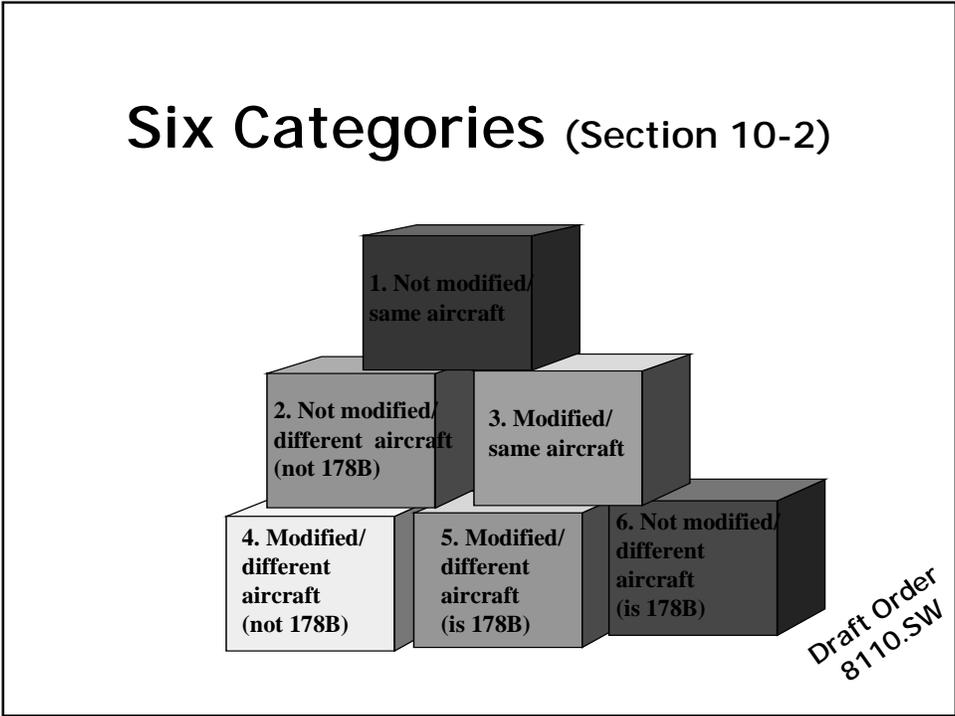
DO-178B SW Level Required by the Installation	Legacy System Software Level per DO-178/DO-178A		
	<i>Critical/Level 1</i>	<i>Essential/Level 2</i>	<i>Non-essential/Level 3</i>
A	YES/Analyze	NO	NO
B	YES	NO/Analyze	NO
C	YES	YES	NO
D	YES	YES	NO
E	YES	YES	YES

### 4 Variables (Section 10-2)



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## Software Changes in Legacy Systems



### Applicability (Section 1--2)

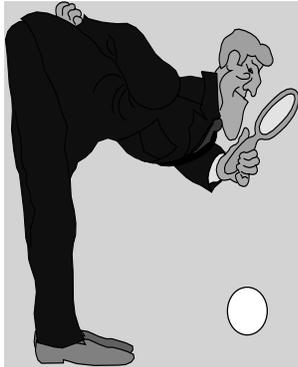
- Notice Not Directly Applicable to TSOs
- May be Applied to TSOs, at Discretion of the ACO

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## Software Changes in Legacy Systems

### Minor Change (Section 10-2) 1/2



- Minor Change-- New Terminology
- Intended to Address the Changes That Have Little or No Effect on Installation
- System to Be Used the Same
- Shouldn't Apply if Service Difficulties Exist
- Must Be Agreed Upon With the ACO Engineer

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### Minor Change (Section 10-2) 2/2

- Once Agreed Upon, Treated as Systems Under the Original Approval Basis
  - I.e., Like Pre-178B Changes
- Examples: Change to Already Tested Gain Setting, Maintenance Data , ...

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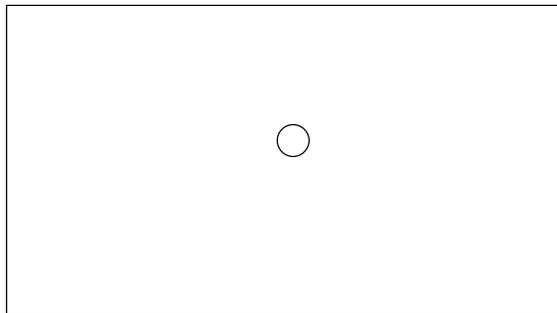
## Software Changes in Legacy Systems

### Handling Changes With 178B As Part of Cert Basis (Section 10-2) - 1/4

- If It's Not a Minor Change:
  - Use DO-178B to Evaluate:
    - Processes Used to Make the Change
    - Changed Components
    - Components Affected by the Change
  - Unaffected Portions Require No Further Analysis

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### Handling Changes With 178B As Part of Cert Basis (Section 10-2) - 2/4



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## Software Changes in Legacy Systems

Handling Changes With 178B As Part of Cert Basis (Section 10-2) - 3/4

DO-178B

DO-178 or DO-178A

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Handling Changes With 178B As Part of Cert Basis (Section 10-2) - 4/4

DO-178B Compliant

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## Software Changes in Legacy Systems

### Equivalency (Section 10-3)

- Start With Equivalency Determination
- If Equivalency Not Established, Use 178B 12.1.4

Table 10-1  
Software Level Equivalence

DO-178B SW Level Required by the Installation	Legacy System Software Level per DO-178/DO-178A		
	Critical/Level 1	Essential/Level 2	Non-essential/Level 3
A	YES/Analyze	NO	NO
B	YES	NO/Analyze	NO
C	YES	YES	NO
D	YES	YES	NO
E	YES	YES	YES

### Six Categories (Section 10-3)

Evaluate project based on 6 categories (10-2.b):	Section 6 Correlation
1. Not modified/same aircraft	
2. Not modified/different aircraft (not 178B)	➤ Section 10-3.b
3. Modified/same aircraft	
4. Modified/different aircraft (not 178B)	➤ Section 10-3.c
5. Modified/different aircraft (is 178B)	➤ Section 10-3.d
6. Not modified/different aircraft (is 178B)	➤ Section 10-3.e

Correlation Between Section 10-2.b and 10-3.b-e

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## Software Changes in Legacy Systems

### An Example (Section 10-3.b-e)

- Assume A TCAS II Unit Is To Be Evaluated for Multiple Installations
- The Original TCAS II Unit Was Developed Using DO-178A, Level 2
- Assume the Original TCAS II Unit Was Installed on a Citation V, That Required DO-178A

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### SW Not Modified/ Same or Different Non-178B Aircraft (Section 10-3.b)

- Example: Original TCAS II Unit Installed on Citation V Upgrade or Citation II Aircraft (Both Aircraft Are Non-178B)
- Accept Original Assurance Process (I.e., Use Pre-178B Process)
- Applies Only if System is Used Exactly the Same As In Original Cert
- Applies Only if System Has Not Experienced Service Difficulties

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## Software Changes in Legacy Systems

### SW Modified/ Same or Different Non-178B Aircraft (Section 10-3.c)

- Example: Assume TCAS II Unit Modified To Add a Special Pop-up Feature and Will Be Re-installed on Both the Citation V and Its Upgrade
- Assess If TCAS II Unit Is Used In The Same Manner
- Use Original Assurance Method of Aircraft or System (I.e., Use Pre-178B Process)

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### SW Modified/ Different Aircraft Requiring 178B (Section 10-3.d) 1/2

- Example: Assume TCAS II Unit is Modified to Add a Special Pop-up Feature and will be Installed on a Citation XXX (With 178B As Part of the Cert Basis)
- Assess if the Change is a Minor Change

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## Software Changes in Legacy Systems

### SW Modified/ Different Aircraft Requiring 178B (Section 10-3.d) 2/2

- If Change is Minor:
  - Handle Change As If DO-178B Didn't Exist (I.e., Follow the Already Established 178A Process)
- If Change is not Minor:
  - Make Changes Using DO-178B as Described in Section 10-2.f

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### SW Not Modified/ Different Aircraft Requiring 178B (Section 10-3.e)

- Example: Assume Original TCAS II Unit Installed on a Citation XXX (With 178B As Part of the Cert Basis)
- Original Approval May Be Accepted, If There are No Significant Operational Differences
- Significance of Operational Changes is at Discretion of ACO or Delegated DER

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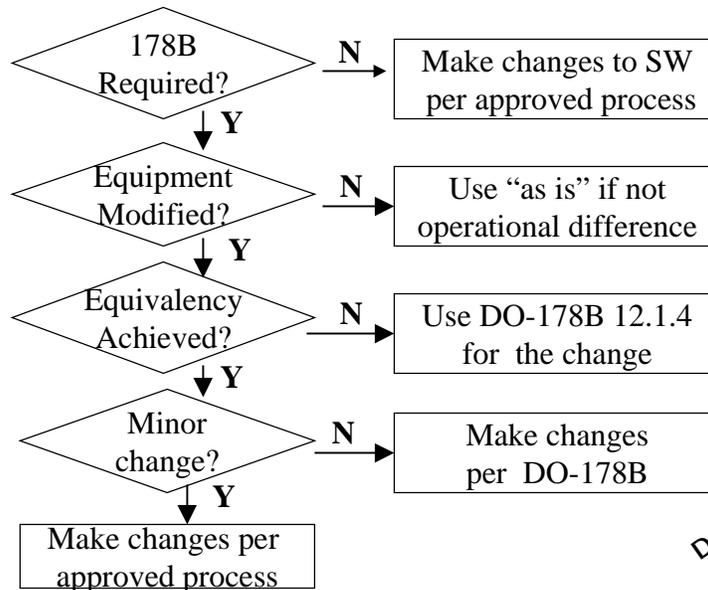
## Software Changes in Legacy Systems

### Documentation & Further Changes (Section 10-3.f and 10-3.g)

- Changes To Legacy Systems And Their Processes, Should Be Documented in PSAC, CID, and/or SAS
- Any Further Changes to the System? Use the Notice Again

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### Summary



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