

FAA National Software Conference, June 2001

Legacy Systems

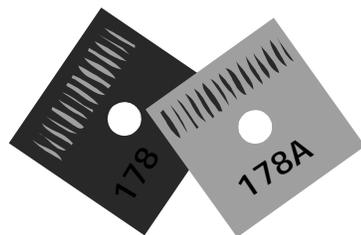
SOFTWARE CHANGES IN LEGACY SYSTEMS

FAA SOFTWARE
STANDARDIZATION CONFERENCE

Boston, Massachusetts.

June 5-7, 2001

Jorge Castillo - FAA/ASW-110



**"Guidelines for the Approval
of Software Changes in
Legacy Systems Using
DO-178B"**

FAA Notice N8110.78/89

N8110.89

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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 Routed For Comments - March 1998
 - Legacy Notice Completed - Oct 1998
 - Legacy Notice Number Changed from 8110.78 to 8110.89 - Nov. 2000

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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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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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Notice Outline

- Section 1: Purpose
- Section 2: Distribution
- Section 3: Related Publications
- Section 4: Background
- Section 5: Discussion
- Section 6: Procedures
- Section 7: Conclusions

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Background (Section 4) - 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 4) - 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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Equivalence of SW Levels (Section 5a)

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

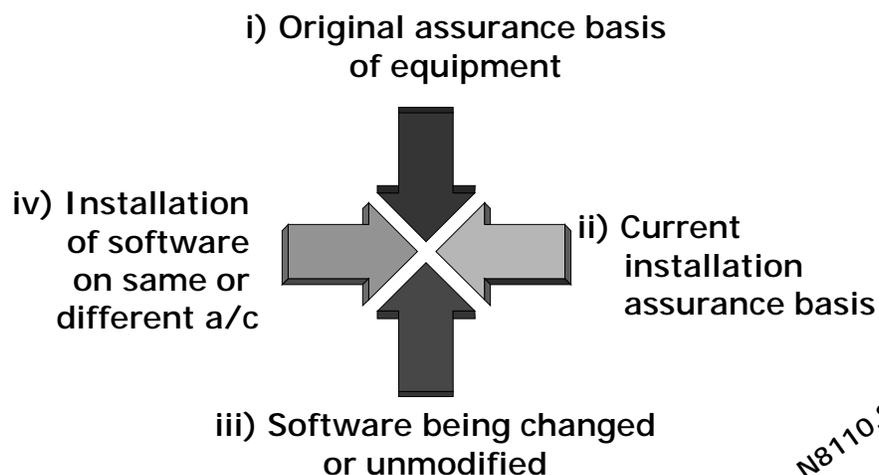
Table 1
Software Level Equivalence

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

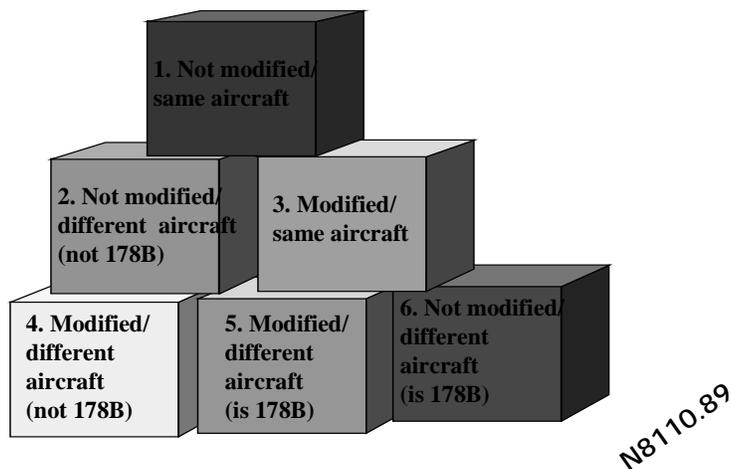
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4 Variables (Section 5b)



Six Categories (Section 5b)



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Applicability (Section 5c)

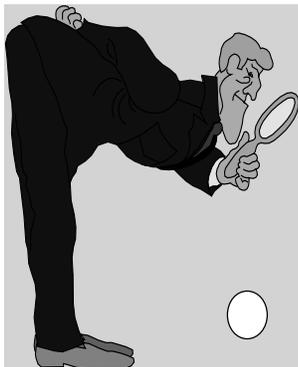


- Notice Not Directly Applicable to TSOs
- May be Applied to TSOs, at Discretion of the ACO

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Small, Simple Change (Section 5d)

1/2



- Small, Simple Change-- New Terminology
- Intended to Address the "Very Minor" 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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Small, Simple Change (Section 5d) 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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Handling Changes With 178B As Part of Cert Basis (Section 5e) - 1/4

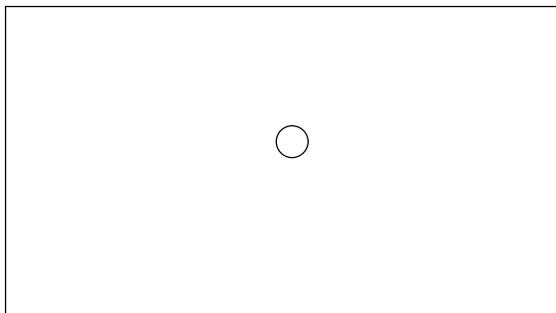
- If It's Not a Small, Simple Change:
 - Use DO-178B to Evaluate:
 - Processes Used to Make the Change
 - Changed Components
 - Components Affected by the Change
 - Unaffected Portions Require No Further Analysis

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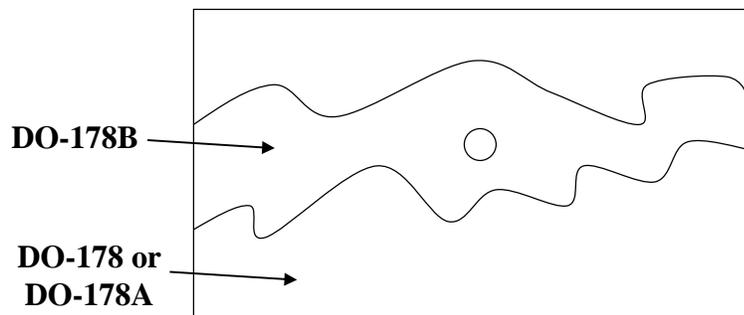
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Handling Changes With 178B As Part of Cert Basis (Section 5e) - 2/4



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Handling Changes With 178B As Part of Cert Basis (Section 5e) - 3/4

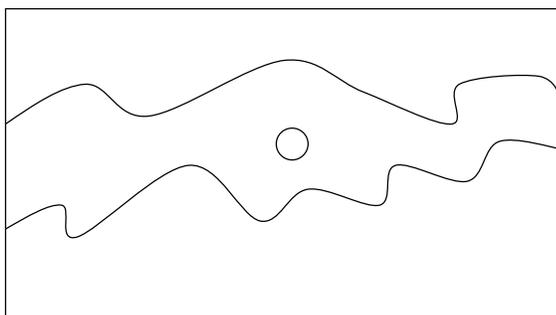


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Handling Changes With 178B As Part of Cert Basis (Section 5e) - 4/4



DO-178B Compliant

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Equivalency (Section 6a)

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

Table 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

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Six Categories (Section 6b-e)

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

Correlation Between Section 5b and 6b-e

An Example (Section 6b-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 6b)

- 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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SW Modified/ Same or Different Non-178B Aircraft (Section 6c)

- 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 6d) 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 Small, Simple Change

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**SW Modified/
Different Aircraft Requiring 178B
(Section 6d) 2/2**

- **If Small, Simple Change:**
 - Handle Change As If DO-178B Didn't Exist (I.e., Follow the Already Established 178A Process)
- **If Not Small, Simple Change:**
 - Make Changes Using DO-178B as Described in Section 5e

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SW Not Modified/ Different Aircraft Requiring 178B (Section 6e)

- 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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Documentation & Further Changes (Section 6f and 6g)

- 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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