CHANGE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

National Policy

ORDER 8110.49 Chg 1
Effective Date: 9/28/11

SUBJ: Software Approval Guidelines

1. Purpose. This change transmits revised pages to Order 8110.49, *Software Approval Guidelines.* This change is issued to:

a. Incorporate policy from Notice 8110.110, *Software Approval Guidelines, Continued.* Notice 8110.110 was written to supplement RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*, to give you assistance in approving airborne software, and to help you ensure that an applicant establishes appropriate processes and procedures that result in compliance to RTCA/DO-178B objectives. The four chapters of the notice have been appended to this order (as chapters 13-16) in their entirety.

b. Update document references to reflect current versions, where applicable.

c. Revise chapter 3 to reflect current policy regarding use of DERs in TSO authorization.

2. Who this change affects. Managers and staff of the FAA Aircraft Certification Service, including any persons designated by the Administrator, and organizations associated with the certification process required by 14 CFR.

3. Disposition of Transmittal Paragraph. Retain this transmittal sheet until the directive is cancelled by a new directive.

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Susan J. M. Cabler
Acting Manager, Aircraft Engineering Division
Aircraft Certification Service

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Chapter 1. Introduction

1-1. Purpose. This order guides Aircraft Certification Service (AIR) field offices and Designated Engineering Representatives (DER) on how to apply RTCA/DO-178B, "Software Considerations in Airborne Systems and Equipment Certification," for approving software used in airborne computers. AC 20-115B, "RTCA, Inc. Document RTCA/DO-178B," recognizes RTCA/DO-178B as an acceptable means of compliance for securing the FAA approval of software in airborne systems and equipment. This order establishes guidelines for approving software in compliance with RTCA/DO-178B. The guidelines are applicable to the approval of airborne systems and equipment and the software aspects of those systems related to type certificates (TC), supplemental type certificates (STC), amended type certificates (ATC), amended supplemental type certificates (ASTC), and technical standard order (TSO) authorizations.

1-2. Distribution. Distribute this order to the branch level in Washington headquarters Aircraft Certification Service, section level in all aircraft certification directorates, all chief scientific and technical advisors (CSTA), all aircraft certification offices (ACO), all manufacturing inspection offices (MIO), all manufacturing inspection district or satellite offices (MIDO/MISO), and all flight standards district offices (FSDO). Make additional limited distribution to delegated organization authorized representatives, designated engineering representatives, air carrier district offices, the aeronautical quality assurance field offices, and the FAA Academy.

1-3. Suggestions for Improvement. If you find deficiencies, need clarification, or want to suggest improvements on this order, send a copy of Federal Aviation Administration (FAA) Form 1320-19, Directive Feedback Information (written or electronically), to the Aircraft Certification Service, Administrative Services Branch, AIR-510, Attention: Directives Management Officer, for consideration. If you urgently need an interpretation, you may contact the Aircraft Engineering Division, Software Specialist, AIR-120, for guidance. You should also use the FAA Form 1320-19 as a follow-up to verbal conversation. FAA Form 1320-19 may be found in Appendix 5 and electronically at https://employees.faa.gov/tools_resources/forms/.

1-4. Related Publications. The latest amendments of the following publications are the primary reference materials for this order:

a. Code of Federal Regulations. 14 CFR part 21, *Certification Procedures for Products and Parts*.

b. FAA ACs and Orders. Copies of the following ACs and orders are available from the FAA website at http://www.faa.gov/regulations_policies.

(1) AC 20-115, *RTCA, Inc. Document RTCA/DO-178B.*

(2) AC 20-153, *Acceptance of Data Processes and Associated Navigation Databases.*

(3) AC 21-33, *Quality Assurance of Software Used in Aircraft or Related Products.*

(4) AC 23.1309, *System Safety Analysis and Assessment for Part 23 Airplanes.*

(5) AC 25.1309, *System Design and Analysis.*

(6) AC 27.1309, *Equipment, Systems, and Installations* (see AC 27-1, *Certification of Normal Category Rotorcraft*).

(7) AC 29.1309, *Equipment, Systems, and Installations* (see AC 29-2, *Certification of Transport Category Rotorcraft*).

(8) AC 33.28, *Guidance Material for 14 CFR 33.28, Reciprocating Engine, Electrical and Electronic Engine Control Systems.*

(9) AC 120-64, *Operational Use & Modification of Electronic Checklists.*

(10) AC 120-76, *Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices.*

(11) Order 8110.4, *Type Certification Process.*

(12) Order 8110.42, *Parts Manufacturer Approval Procedures.*

(13) Order 8110.55, *How to Evaluate and Accept Process for Aeronautical Database Suppliers*.

c. Other FAA Policy Documents.

(1) FAA Job Aid, *Conducting Software Reviews Prior to Certification,* Revision 1, dated January 16, 2004. A copy of this FAA Job Aid is available from the FAA website at http://www.faa.gov/aircraft/air_cert/design_approvals/air_software.

d. RTCA, Inc. Documents. Copies of RTCA documents may be purchased from RTCA, Inc., 1828 L Street, NW, Suite 805, Washington, D.C. 20036. Alternatively, copies may be purchased on-line at http://www.rtca.org. RTCA documents referenced in this order are:

(1) RTCA, Inc., document RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification,* dated December 1, 1992.

(2) RTCA, Inc., document RTCA/DO-200A, *Standards for Processing Aeronautical Data,* dated September 28, 1998.

(3) RTCA, Inc., document RTCA/DO-248B, *Final Report for Clarification of DO-178B Software Considerations in Airborne Systems and Equipment Certification,* dated October 12, 2001.

e. SAE Documents. Copies of SAE documents may be purchased from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Alternatively, copies may be purchased on-line at www.sae.org. SAE documents referenced in this order are:

(1) Aerospace Recommended Practice ARP4754a, *Development of Civil Aircraft and Systems*.

(2) Aerospace Recommended Practice ARP4761, *Guidelines and Methods for Conducting the Safety Assessment Process on Civil Airborne Systems and Equipment.*

1-5. Cancellation. This order cancels and supercedes the following notices:

a. Notice 8110.85, *Guidelines for the Oversight of Software Change Impact Analyses Used to Classify Software Changes as Major or Minor*, dated March 11, 2000;

b. Notice 8110.86, *Guidelines for Software Conformity Inspection and Software Conformity Review*, dated August 4, 2000;

c. Notice 8110.87, *Guidelines for Determining the Level of Federal Aviation Administration (FAA) Involvement in Software Projects*, dated August 4, 2000;

d. Notice 8110.89, *Guidelines for the Approval of Software Changes in Legacy Systems Using RTCA/DO-178B*, dated January 16, 2001;

e. Notice 8110.90, *Guidelines for the Software Review Process*, dated January 16, 2001;

f. Notice 8110.91, *Guidelines for the Qualification of Software Tools Using RTCA/DO-178B*, dated January 16, 2001;

g. Notice 8110.92, *Guidelines for Applying the RTCA/DO-178B Level D Criteria to Previously Developed Software (PDS)*, dated January 16, 2001;

h. Notice 8110.93, *Guidelines for the Approval of Field-Loadable Software by Finding Identicality through the Parts Manufacturer Approval Process*, dated January 16, 2001;

i. Notice 8110.94, *Guidelines for the Approval of Airborne Systems and Equipment Containing User-Modifiable Software*, dated January 16, 2001;

j. Notice 8110.95, *Guidelines for the Approval of Field-Loadable Software*, dated January 16, 2001;

k. Notice 8110.97, *Guidelines for Approving Reused Software Life Cycle Data*, dated February 5, 2002; and

l. Notice 8110.110, *Software Approval Guidelines, Continued*, dated January 27, 2010.

1-6. Background. Between 1998-2002, the FAA produced a number of software-related notices to provide guidelines for FAA Aviation Safety Engineers (ASE), Aviation Safety Inspectors (ASI), and DERs in various areas of software approval. This order combines those notices into a single document, implements improvements to the policy based on lessons learned, and improves consistency between the technical topics. Notice 8110.110, published in 2010, is also included in this order.

1-7. Software Topics Covered In This Order.

a. On January 11, 1993, the FAA issued AC 20-115B which recognizes RTCA/DO-178B as a means of demonstrating compliance to regulations for the software aspects of airborne systems and equipment certification. This order assumes that RTCA/DO-178B is the means of compliance proposed by the applicant for software approval (except for chapters 8 and 10, where previously developed software and legacy systems are addressed). If the applicant proposes other means, additional policy and FAA guidance may be needed on a project-by-project basis.

b. This order addresses a variety of software-related topics and is supplemental to RTCA/DO-178B. Guidelines in the following areas are addressed:

(1) The software review process (chapter 2),

(2) The level of FAA involvement in software projects (chapter 3),

(3) Software conformity inspections (chapter 4),

(4) Field-loadable software (chapters 5 and 6),

(5) User-modifiable software (chapter 7),

(6) Level D previously developed software (chapter 8),

(7) Software tool qualification (chapter 9),

(8) Software changes in legacy systems (chapter 10),

(9) Software change impact analysis (chapter 11),

(10) Reuse of software life cycle data (chapter 12),

(11) Properly overseeing suppliers (chapter 13),

(12) Software problem reporting (chapter 14),

(13) Assuring airborne system databases and aeronautical databases (chapter 15), and

(14) Managing the software development or verification environment (chapter 16).

1-8. Definitions. For purposes of this order, the following definitions apply:

a. Certification authority is the aviation authority that accepts and/or approves software life cycle data. For the FAA, the certification authority is typically the ACO ASE responsible for the software approval in a project.

b. Certification credit is the acceptance by the certification authority that a software process, software product, or demonstration satisfies a certification requirement (see RTCA/DO-178B, Glossary; and RTCA/DO-248B, Section 3.47).

c. Chief Scientific and Technical Advisor (CSTA) is an executive-level technical expert in the FAA. Previously, a CSTA was referred to as a "National Resource Specialist" (NRS).

d. Configuration item is (1) one or more software components treated as a unit for software configuration management purposes, or (2) software life cycle data treated as a unit for software configuration management purposes (see RTCA/DO-178B, Glossary; and RTCA/DO-248B, Section 3.46).

e. Field-loadable software (FLS) is software that can be loaded without removal of the equipment from the installation. FLS can refer to either executable code or data (see RTCA/DO-178B, Section 2.5). FLS might also include software loaded into a line replaceable unit at a repair station or shop.

f. Finding is the identification of a failure to show compliance to one or more of the RTCA/DO-178B objectives.

g. Observation is the identification of a potential software life cycle process improvement. An observation is not an RTCA/DO-178B compliance issue and does not need to be addressed before software approval.

h. Option-selectable software is software that contains approved and validated components and combinations of components that may be activated by the user, either through selection by the flight crew or activation by ground personnel (see RTCA/DO-178B, Section 2.4).

i. Original certification project is the first use of the software life cycle data in a completed certification project.

j. Reuse is the subsequent use of unaffected, previously approved software life cycle data.

k. Review is the act of inspecting or examining software life cycle data, software project progress and records, and other evidence to assess compliance with RTCA/DO-178B objectives. Review is an encompassing term and may consist of a combination of reading documents, interviewing project personnel, witnessing activities, sampling data, and participating in

briefings. A review may be conducted at your own desk, at an applicant's facility, or at an applicant's supplier's facility.

l. Sampling is selecting a representative set of software life cycle data for inspection or analysis. The purpose is to determine the compliance of all software life cycle data developed up to that point in time in the project. Sampling is the primary means of assessing the compliance of the software processes and data. Examples of sampling may include the following:

(1) Inspecting the traceability from system requirements to software requirements to software design to source code to object code to test cases and procedures to test results.

(2) Reviewing analyses used to determine system safety classification, software level, or RTCA/DO-178B objective compliance (for example, timing analysis).

(3) Examining the structural coverage of source code modules.

(4) Examining software quality assurance (SQA) records and configuration management records.

m. Software is computer programs and, possibly, associated documentation and data pertaining to the operation of a computer system (see RTCA/DO-178B, Glossary).

n. Software Configuration Index (SCI) identifies the configuration of the software product. It can contain one configuration item or a set of configuration items (see RTCA/DO-178B, Section 11.16).

o. Software library is a controlled repository of software and related data and documents designed to aid in software development, use, or modification (see RTCA/DO-178B, Glossary).

p. Software life cycle data are data produced during the software life cycle to plan, direct, explain, define, record, or provide evidence of activities (see RTCA/DO-178B, Section 11.0). Sections 11.1 through 11.20 of RTCA/DO-178B describe different kinds of software life cycle data.

q. Software Life Cycle Environment Configuration Index identifies the configuration of the software life cycle environment. It is written to aid reproduction of the hardware and software life cycle environment (see RTCA/DO-178B, Section 11.15).

r. Software plans and standards are a set of data that directs the software development processes and integral processes (see RTCA/DO-178B, Sections 4.0 and 11.1 through 11.8).

s. Software tool is a computer program used to help develop, test, analyze, produce, or modify another program or its documentation (see RTCA/DO-178B, Glossary).

t. Subsequent certification project is the follow-on project in which software life cycle data from the original certification project is reused.

u. Test for certification credit is system certification test conducted under a FAA-approved test plan for the purpose of showing compliance to the regulations.

v. Tool qualification is the process necessary to obtain certification credit for a software tool within the context of a specific airborne system (see RTCA/DO-178B, Section 12.2 and Glossary).

w. User-modifiable software (UMS) is software intended for modification by the aircraft operator without review by the certification authority, the airframe manufacturer, or the equipment vendor. Modifications by the user may include modifications to data, modifications to executable code, or both (see RTCA/DO-178B, Section 2.4).

1-9. Acronyms. The following is a list of acronyms used in this order:

AC	Advisory Circular
ACO	Aircraft Certification Office
AIR	Aircraft Certification Service
ASE	Aviation Safety Engineer
ASI	Aviation Safety Inspector
ASTC	Amended Supplemental Type Certificate
ATC	Amended Type Certificate
CFR	Code of Federal Regulations
CMR	Certification Maintenance Requirements
CRC	Cyclic Redundancy Check
CSTA	Chief Scientific and Technical Advisor
DER	Designated Engineering Representative
FAA	Federal Aviation Administration
FLS	Field-Loadable Software
LOFI	Level of FAA Involvement
MEL	Minimum Equipment List
MIDO	Manufacturing Inspection District Office
MISO	Manufacturing Inspection Satellite Office
PDS	Previously Developed Software
PMA	Parts Manufacturer Approval
PSAC	Plan for Software Aspects of Certification
SAS	Software Accomplishment Summary
SCI	Software Configuration Index
SCMP	Software Configuration Management Plan
SOI	Stage of Involvement
SQA	Software Quality Assurance
STC	Supplemental Type Certificate
TC	Type Certificate
TIA	Type Inspection Authorization

TSO	Technical Standard Order
TSR	Total Score Result
UMS	User-Modifiable Software

1-10. Records Management. Refer to Orders 0000.1, 1350.14, and 1350.15, or your office Records Management Officer (RMO)/Directives Management Officer (DMO) for guidance regarding retention or disposition of records.

	Criteria	Scale	MIN.		MAX.	Score
3.4	Company stability and commitment to safety.	Scale: Stability:	0 Low	3 Med	6 High	
3.5	Success of past company certification efforts.	Scale: Success:	0 None	3 > 50%	6 All	
4.	**The Current System and Software Application**					
4.1	Complexity of the system architecture, functions, and interfaces.	Scale: Complex:	0 High	5 Med	10 Low	
4.2	Complexity and size of the software and safety features.	Scale: Complex:	0 High	5 Med	10 Low	
4.3	Novelty of design and use of new technology.	Scale: Newness:	0 Much	5 Some	10 None	
4.4	Software development and verification environment.	Scale: Environ:	0 None	3 Older	6 Modern	
4.5	Use of alternative methods or additional considerations.	Scale: Standard:	0 Much	3 Little	6 None	
5.	**Designee Capabilities**					
5.1	Experience of DER(s) with RTCA/DO-178B.	Scale: Projects:	0 < 5	5 5-10	10 > 10	
5.2	Designee authority, autonomy, and independence.	Scale: Autonomy:	0 None	5 Self-starter	10 Outgoing	
5.3	Designee cooperation, openness, and issue resolution effectiveness.	Scale: Effectiveness:	0 Non-Responsive	5 Responsive	10 Cooperative & Outgoing	
5.4	Relevance of assigned DER's experience.	Scale: Related:	0 None	5 Somewhat	10 Exact	
5.5	Designees' current workload.	Scale: Workload:	0 High	5 Medium	10 Low	
5.6	Experience of DER(s) with other software standards (other than RTCA/DO-178[]).	Scale: Projects:	0 < 5	3 5-10	5 > 10	

Total Score Result (TSR): _____

c. An Exception. If a software project has issues that may require new FAA policy (such as, new technology, new design methods, or unusual tools) the LOFI may be higher. Typically, if a policy issue is involved for Level A and B systems, the LOFI is HIGH. For Level C and D systems involving a policy issue, the LOFI is typically MEDIUM.

3-3. How to Use Figure 3-1 and Figure 3-2 Criteria. This paragraph discusses how to use figure 3-1 and figure 3-2 criteria for a TC, ATC, STC, or ASTC project to determine the FAA involvement in the software aspects of certification.

> **Note:** TSO projects are discussed in paragraph 3-4a, since there are special considerations regarding FAA oversight of TSO projects.

a. At the beginning of a TC, ATC, STC, or ASTC project involving software, the certification authority, project DER (if applicable), and applicant should work together to assess the project's needs and the LOFI. The software level is typically determined early in the

program and provides an idea of the project's safety needs. Figure 3-1 shows a typical relationship between software level and FAA involvement; however, the software level provides only a rough indicator. There are other criteria that help fine-tune the LOFI assessment.

b. If the figure 3-1 assessment leaves uncertainty in the LOFI (for example, it's a Level A, B, or C system), use figure 3-2 to further assess the LOFI. The scale for scoring each of the criteria in figure 3-2 has weighted minimum and maximum values. Any value within the scaled range can be selected for scoring the applicant or developer for the criteria. For example, criteria 1.2, "Experience with RTCA/DO-178B," is more critical (that is, weighted higher) than criteria 1.4, "Experience with other software standards," and the applicant or developer could be scored with any value in the range from "0" (zero projects using RTCA/DO-178B) to "10" (5 or more completed projects with RTCA/DO-178B), as compared to criteria 1.4 where the range of values is only "0" to "4."

c. For projects where the software level is A, B, or C, the criteria in figure 3-2 is used to calculate a TSR for the project. To assess the project using figure 3-2, a number of means may be used either alone or in combination:

(1) The certification authority that is most familiar with the applicant or developer may perform an assessment.

> **Note:** The developer is the company, not necessarily the applicant, where the software development will be taking place.

(2) The certification authority may research past performance of the applicant and/or developer based on previous project successes and problems, past reviews and audits, in-service problems, and other certification authority experiences.

(3) The DER assigned to the project may conduct an assessment of the project and developer.

d. A combined assessment of the applicant and the developer project may work for most projects. However, it may be necessary to perform a separate assessment for the applicant and the software developer. If the determination of the LOFI for the applicant and for the developer differs, then use the higher determination (that is, more involvement).

e. To determine the LOFI for a specific software project, score the applicant and/or developer for each of the criteria according to the scale provided and record the score in the Score column in figure 3-2. After recording these scores, total the values in the score column to determine the TSR. Use this TSR to determine the LOFI (that is, HIGH, MEDIUM, or LOW) by applying the score to figure 3-3.

Figure 3-3. Level of Involvement Determination

Total Score Result (TSR) (from figure 3-1)	Software Level A	Software Level B	Software Level C	Software Level D
TSR $\leq$ 80	HIGH	HIGH	MEDIUM	LOW
80 < TSR $\leq$ 130	HIGH	MEDIUM	MEDIUM	LOW
130 < TSR	MEDIUM	MEDIUM	LOW	LOW

Note 1: If the TSR is close to the TSR boundary values (that is, 80 or 130), use the software level and engineering judgment to determine the most appropriate LOFI.

Note 2: If any criterion in figure 3-2 is not applicable, the assessor may use the average value or adjust the figure 3-3 boundaries.

f. As mentioned in paragraph 3-2c of this chapter, projects with policy issues require special consideration. Typically, Level A or B projects with policy issues require HIGH LOFI, regardless of the figure 3-3 outcomes. Also, Levels C or D projects typically require at least MEDIUM LOFI, if policy issues exist.

g. Once the LOFI assessment has been performed, the specifics of the FAA involvement should be documented using appendix 1. Figure 3-4 provides example FAA involvement for HIGH, MEDIUM, and LOW levels. The specifics of the FAA involvement should be documented using the appendix 1 worksheet, provided to the FAA project manager (for inclusion in the Certification Project Plan (CPP) or equivalent planning document), and shared with the applicant.

Figure 3-4. Example Program Decisions Based on LOFI Outcome

Level of FAA Involvement	Typical Program Decisions
HIGH	• Minimal delegation to Designated Engineering Representatives (DERs) (for example, DERs recommend approval of data). • Chief Scientific and Technical Advisor (CSTA), Technical Specialist, Directorate staff, and/or Headquarters staff involvement is likely. • FAA involvement throughout the software life cycle, including mentoring, on-site reviews, and desk reviews (recommend no less than two on-site reviews). • Submittal of all software plans. • Submittal of Software Accomplishment Summary (SAS), Software Configuration Index (SCI), and Verification Results. • Recommend submittal of RTCA/DO-178B Objectives Compliance Matrix (that is, mapping of data and processes to RTCA/DO-178B objectives, which may be included in SAS).
MEDIUM	• Moderate delegation to DERs (for example, DER may recommend approval of Plan for Software Aspects of Certification (PSAC) and SAS; DER may approve SCI; and DER may approve other plans and data). • Moderate FAA involvement initially (planning, regulation and policy interpretation, and some mentoring) and toward the end of the project (final compliance). • CSTA, Technical Specialist, Directorate staff, or Headquarters staff involvement may be needed. • Conduct at least one on-site review but mostly desk reviews of data. • Submittal of PSAC, SCI, SAS. • Potential submittal of Software Verification Plan, Software Quality Assurance Plan, Software Configuration Management Plan, and Software Development Plan.
LOW	• Maximum delegation to DERs (that is, DER may recommend approval of PSAC and DER may approve all other data/documents). • Minimal FAA involvement (for example, no on-site reviews, little or no desk reviews). • Rarely need CSTA, Technical Specialist, Directorate staff, or Headquarters staff involvement. • Submittal of PSAC, SCI, and SAS.

3-4. Special Considerations. There are a number of special considerations that may need to be considered on a program:

a. TSO Projects. Since DERs are not used in their authorized capacity in TSO software development projects, criteria 5.1 through 5.6 in figure 3-2 may not seem applicable for TSO projects. However, criteria 5.1 through 5.6 may still be applied even though a DER is not

involved in the project. The applicant should have at least one individual who has qualifications similar to those of the software DER (such as, having experience with RTCA/DO-178B and experience in software development). In many cases, this person may be part of the SQA staff or certification liaison group. This will provide an independent view of the project and ensures that the RTCA/DO-178B objectives are satisfied. For TSO projects, the process in paragraph 3-3 may still be applied; however, the "DER" in figure 3-2 may be replaced with "applicant personnel responsible for software oversight." If the applicant does not have such qualified personnel involved in their TSO projects, the scores for criteria 5.1-5.6 will be zero.

> **Note:** Some TSO applicants do not inform the FAA of their project activities until submittal of the data package. This can lead to problems for both the FAA and applicant. Every effort should be made by both the FAA and the applicant to address software issues early in the program. This typically leads to fewer problems and more rapid approval when the data are submitted.

b. Mid-Project Adjustments. The LOFI criteria are based primarily on an assessment and determination in the early part of the certification program. During the course of the certification program and software development, both the applicant and developer should be monitored. If unforeseen problems arise, it may be necessary to re-evaluate the LOFI determination and to adjust the involvement level. Likewise, some applicants may make changes in a project that will lower the LOFI (for example, add experienced DERs, change proven technology, and so forth). The worksheet in appendix 1 provides a place to document mid-project adjustments.

c. Project Risk. If during the course of the project, project risks such as schedule slides or reduced or deferred functionality occur, it may be necessary to evaluate the applicant's and/or developer's risk management strategy and adjust the LOFI.

d. FAA Workload. FAA personnel involved in multiple projects should base their decisions for the amount of their involvement in a particular project on all their commitments for project involvement and other job activities. Committing to multiple HIGH level of involvement projects, especially if several involve visits to remote sites, may not be practical. Generally, the software level and system novelty will be the crucial determinants for which projects get more involvement and which get less (for example, on-site reviews for Level A systems, and desk reviews or no reviews for Level D systems). Excessive workload should be reported to management to determine the best course of action and identify additional staffing needs. It may be necessary to utilize personnel from other offices in some cases (for example, Headquarters, Directorates, and other ACOs).

> **Note:** These same workload considerations should be addressed for DERs involved in the project.

Chapter 13. Properly Overseeing Suppliers

13-1. When To Apply This Chapter. This policy applies when an applicant uses suppliers and sub-tier suppliers to perform system and software development, verification, and certification activities. The degree to which you use this policy may depend on the size and complexity of a particular certification project. Because it's impractical to cover all situations or conditions that may arise, supplement this policy with good judgment in handling the situation or condition. Confer with FAA system and software specialists as required.

13-2. Contemporary Issues.

a. Many TC/STC/TSOA applicants have shifted system and software development, verification, and certification activities onto their aircraft system suppliers and sub-tier suppliers. In the past, these suppliers participated in compliance activities only at their respective system, subsystem, or component levels. With airborne systems becoming increasingly more complex and integrated, and suppliers and sub-tier suppliers accepting these new responsibilities, we are concerned that their lack of expertise could result in incomplete or deficient certification activities.

b. Each responsibility that the applicant delegates to a supplier creates an interface with that supplier that needs to be validated and verified to ensure that the transition from the supplier's processes to the applicant's processes (or vice-versa) is accomplished correctly and accurately. Lack of proper validation and verification of life cycle data at the transition point has resulted in issues with regard to requirements, problem reporting, changes, etc.

c. Some certification tasks and activities may be performed in a foreign country. We can review the bilateral agreement with that country to determine if the certification authority may be able to help us in making a determination of compliance to the applicable FAA regulations. We can't, however, request the certification authority of a country with which we do not have a bilateral agreement in place to assist us in making a determination of compliance to FAA regulations. We would consider it an undue burden on us if we were required to oversee compliance activities at foreign supplier facilities in non-bilateral countries (including conducting on-site reviews). You may contact the International Policy Office, AIR-40, for additional information regarding bilateral agreements.

d. Finally, retention of substantiating data, such as software life cycle data and other certification and compliance data, is a critical part of the certification process. When this data is retained by a foreign supplier, it may not be readily available to us. This may also affect the continued operational safety of the aircraft and its systems, especially with regard to in-service problems (service difficulties), problem resolution (service bulletins), and mandatory corrections (airworthiness directives).

13-3. Supplier Oversight Plans and Procedures

a. The applicant should create oversight plans and procedures that will ensure all suppliers and sub-tier suppliers will comply with all regulations, policy, guidance, agreements, and standards that apply to the certification program. The applicable publications include, but are not limited to:

(1) 14 CFR;

(2) ACs;

(3) FAA orders and notices;

(4) Issue papers;

(5) Special conditions;

(6) Applicant designee procedures, partnership for safety plans, memoranda of agreement;

(7) Applicant standards for system, hardware, and software development (including requirements, design, and coding standards);

(8) Applicant quality assurance plans, procedures, and processes;

(9) Applicant configuration management plans, procedures, and processes;

(10) System supplier standards, plans, procedures and processes; and

(11) Applicant process for software change impact analysis.

b. The applicant's planning documents, such as certification plans and PSACs, should describe how the applicant will have visibility into their suppliers' and sub-tier suppliers' activities. This includes commercial off-the-shelf software component suppliers and vendors. The applicant should submit these plans for your review and approval, preferably early in the program. The applicant should avoid making changes to the plans late in the program. If late changes are unavoidable, the applicant must allow adequate time for your review and consideration.

13-4. Supplier Oversight: Review the Applicant's Plans.

a. The applicant should address the following concerns in a supplier management plan or other suitable planning documents. As a project engineer, you review the plan(s) and see that the following areas are addressed to your satisfaction:

(1) Visibility into compliance with regulations, policy, plans, standards, and agreements. The plan should address how the applicant will ensure that all applicable regulations, policy, plans, standards, issue papers, partnership for safety plans, and memoranda of agreement are conveyed to, coordinated with, and complied with by prime and sub-tier suppliers.

(2) Integration management. The plan should address how the system components will be integrated, and who will be responsible for validating and verifying the software and the integrated system. The plan should address:

(a) How requirements will be implemented, managed, and validated; including safety requirements, derived requirements, and changes to requirements;

(b) How the design will be controlled and approved;

(c) How the integration test environment will be controlled;

(d) How the software build and release process will be controlled (reconcile any differences between the supplier's and the applicant's release strategies);

(e) What product assurance activities that support the certification requirements will be conducted and who will be conducting them; and

(f) The applicant's strategy for integrating and verifying the system, including requirements-based testing and structural coverage analysis.

(3) Designee tasks and responsibilities. The plan should identify who the designees are and what their responsibilities are, who the focal points are, and how their activities will be coordinated and communicated. It should identify who will approve or recommend approval of software life cycle data.

(4) Problem reporting and resolution. The plan should establish a system to track problem reports. It should describe how problems will be reported between the applicant and all levels of suppliers. The problem reporting system should ensure that problems are resolved, and that reports and the resulting changes are recorded in a configuration management system. The plan should describe how the designee(s) will oversee problem reporting.

(5) Integration verification activity. The plan should identify who will be responsible for ensuring that all integration verification activities between all levels of suppliers comply with applicable guidance. It should describe how the designee(s) will oversee the verification process.

(6) Configuration management. The plan should describe the procedures and tools to aid configuration management of all software life cycle data. It should describe how configuration control will be maintained across all sub-tier suppliers, including those in foreign locations, and how designees will oversee configuration management.

(7) Compliance substantiation and data retention. The plan should describe how the applicant will ensure that all supplier and sub-tier supplier compliance findings are substantiated and retained for the program. The plan should address, at minimum, the following certification data:

(a) Evidence that compliance has been demonstrated;

(b) Verification and validation data; and

(c) Software life cycle data.

b. The applicant's supplier management plan (or equivalent plans) should address the concern identified in paragraph 13-2.b. regarding the transition of life cycle data between the applicant's processes and the suppliers' processes. The plan should address the validation and verification of data with regard to all processes, including requirements management, problem reporting, use of standards, change impact, reviews, etc.

c. The plans should state that certification data will be retained at a facility in the United States, and that the data will be in English, since non-English certification data may create ambiguities when translated to English. Data located in a facility outside the United States may present an undue burden on us.

Chapter 14. Software Problem Reporting

14-1. When to Apply This Chapter. This policy applies when an applicant's suppliers and sub-tier suppliers will be responsible for managing problems detected during the development of aircraft systems implemented with software. This chapter also discusses your involvement with assessing unresolved problems before certification. The degree to which you use this policy may depend on the size and complexity of a particular certification project. Because it's impractical to cover all situations or conditions that may arise, supplement this policy with good judgment in handling the situation or condition. Confer with FAA system and software specialists as required.

14-2. Supplier Involvement in Problem Reporting.

a. The software development and verification phases of complex and highly integrated systems are likely to result in a large number of problem reports produced by the applicant and their suppliers. This brings about the following concerns:

(1) The applicant's suppliers and sub-tier suppliers may not have the expertise to determine whether problems with their component(s) will have safety, functional, or operational impacts on the aircraft or airborne system in which they are used;

(2) The applicant may not have adequate visibility into supplier and sub-tier supplier problem reporting processes; and

(3) There may be a large number of open problem reports, indicating a lack of software maturity and assurance at TIA or certification.

b. Due to these concerns, the applicant will need to actively participate in the oversight of problem reporting processes to ensure that problems are properly identified, reported, and resolved.

c. RTCA/DO-178B, sections 7.2.3 through 7.2.7 and Table 7-1, provide guidance on problem reporting and resolution. Additionally, section 11.20 (j) states that the Software Accomplishment Summary should contain a summary of problem reports unresolved at the time of certification, including a statement of functional limitations.

14-3. Oversight of Problem Reporting

a. In order to ensure that software problems are consistently reported and resolved, and that software development assurance is accomplished before certification, the applicant should discuss in their Software Configuration Management Plan, or other appropriate planning documents, how they will oversee their supplier's and sub-tier supplier's software problem reporting process. As a project engineer, you review the plans and verify that they address the following to your satisfaction:

(1) The plans should describe each of the applicant's supplier's and sub-tier supplier's problem reporting processes that will ensure problems are reported, assessed, resolved, implemented, re-verified (regression testing and analysis), closed, and controlled. The plans should consider all problems related to software, databases, data items, and electronic files used in any systems and equipment installed on the aircraft.

(2) The plans should establish how problem reports will be categorized so that each problem report can be classified as follows:

(a) Categories should identify problems with a potential impact on safety, functionality, performance, operation, or design assurance;

(b) Categories should identify problems that should be resolved before certification, and problems that could be deferred beyond certification; and

(c) Each category should define the criteria for which deferring the problem is acceptable.

(3) The plans should describe how the applicant's suppliers and sub-tier suppliers will notify the applicant of any problems that could impact safety, performance, functional or operational characteristics, software assurance, or compliance.

(a) The supplier may enter such problems into their own problem reporting and tracking system, and then transfer them to the applicant's problem reporting system. If so, the plan needs to describe how this is accomplished. If the supplier's problem reporting system is not directly compatible with the applicant's system, the plan needs to describe a process for verifying the translation between problem reporting systems.

(b) The applicant may allow their suppliers and sub-tier suppliers to have access to the applicant's problem reporting system. Doing so may help the applicant ensure that they will properly receive and control their supplier's problem reports. If the applicant does allow the supplier to have access to their system, they should restrict who within the supplier's organization has such access in order to maintain proper configuration control, and these individuals should be trained on the proper use of the applicant's problem reporting system.

(c) The plans should describe any tools that the applicant's suppliers or sub-tier suppliers plan to use for the purpose of recording action items or observations for the applicant to review and approve prior to entering them into the applicant's problem reporting system.

(d) The plans should state that suppliers will have only one problem reporting system in order to assure that the applicant will have visibility into all problems and that no problems are hidden from the applicant.

(e) Any problems that may influence other applications, or that may have system-wide influence should be made visible to the appropriate disciplines.

(4) The plans should describe how flight test, human factors, systems, software, and other engineers of the appropriate disciplines will be involved in reviewing each supplier's and sub-tier supplier's problem report resolution process. They should also describe how these engineers will participate in problem report review boards and change control boards.

(5) The plans should establish the criteria that problem report review boards and change control boards will use in determining the acceptability of any open problem reports that the applicant will propose to defer beyond certification.

(a) These boards should carefully consider the potential impacts of any open problem reports on safety, functionality, and operation.

(b) Since a significant number of unresolved problem reports indicate that the software may not be fully mature and its assurance questionable, the applicant should describe a process for establishing an upper boundary or target limit on the number of problem reports allowed to be deferred until after type certification.

(c) The plan should establish a means of determining a time limit that unresolved problem reports deferred beyond certification will be resolved. This applies to problem reports generated by the applicant, suppliers, and sub-tier suppliers.

b. As a project engineer, you should be involved in certain decisions related to open problem reports prior to TIA and certification. You should:

(1) Review, as appropriate, any problem reports that are proposed for deferral beyond certification. This review may require FAA flight test, systems, and other specialists. You may need to ask for more information to make your assessment. If you have concerns that safety might be impacted, you can disallow the deferral of specific problem reports.

(2) If the applicant is using previously developed software, ensure that the applicant has reassessed any open problem reports for their potential impact on the aircraft or system baseline to be certified.

(3) Ensure that the applicant has considered the inter-relationships of multiple open problem reports and assessed whether any open problem report has become more critical when considered in conjunction with another related problem report.

(4) Ensure that the applicant has reviewed any open problem reports related to airworthiness directives, service bulletins, or operating limitations and other mandatory corrections or conditions. The applicant may need your help to determine which problems to resolve before certification.

(5) Review any open problem reports with potential safety or operational impact to determine if operational limitations and procedures are required before FAA test pilots participate in test flights. You may need to involve technical experts in making your determination.

(6) Ensure that the applicant has complied with DO-178B, section 11.20 (j).

Chapter 15. Assuring Airborne System Databases and Aeronautical Databases

15-1. When to Apply This Chapter. This policy applies when the applicant's airborne systems and equipment is utilizing aeronautical databases or airborne system databases. The degree to which you use this policy may depend on the size and complexity of a particular certification project. Because it's impractical to cover all situations or conditions that may arise, supplement this policy with good judgment in handling the situation or condition. Confer with FAA system and software specialists as required.

15-2. Databases and Their Design Assurance. There are three distinct types of databases used in airborne systems and equipment:

a. Aeronautical databases, which are used by an airborne system and whose development processes are typically approved using the guidance of RTCA/DO-200A, AC 20-153A, and Order 8110.55.

(1) Aeronautical databases should be demonstrated to comply with RTCA/DO-200A or other acceptable means. RTCA/DO-200A defines requirements and an acceptable means of compliance for participants processing aeronautical databases. If followed, it provides assurance that the production of aeronautical databases meets the integrity requirements for intended function, based on design assurance levels or software levels. It addresses specifics of the aeronautical data process, and assumes that participating organizations have an acceptable quality management system.

(2) AC 20-153A applies to navigation, terrain, obstacle, and airport map databases, and provides criteria for organizations to apply for a letter of acceptance (LOA) for their aeronautical data process. The LOA identifies organizations within the aeronautical data chain that demonstrate acceptable data processes, and formally documents that a supplier's databases are being produced according to RTCA/DO-200A.

(3) Order 8110.55 explains how you can evaluate and accept aeronautical data processes of a database supplier who complies with AC 20-153A and issue them an LOA.

b. Airborne system databases, which are used by an airborne system and approved as part of the type design of the aircraft or engine. These databases may influence paths executed through the executable object code, be used to activate or deactivate software components and functions, adapt the software computations to the aircraft configuration, or be used as computational data.

(1) Airborne system databases may consist of script files, interpretive languages, data structures, or configuration files (including registries, software options, operating program configuration, aircraft configuration modules, and option-selectable software).

(2) Assurance of these databases is typically achieved in the context of RTCA/DO-178B airborne system and equipment software processes.

c. Other applications and databases, which are not part of the type design of the aircraft or engine, and which are operationally approved by Flight Standards. This includes applications and databases defined as Type A and Type B in AC 120-76A, and electronic checklists addressed in AC 120-64. User-Modifiable Software is also in this category (refer to section 2.4 of DO-178B and chapter 7 of this order). These applications and databases have no design assurance requirements and therefore are not addressed in this chapter.

15-3. Assuring Aeronautical Databases. To ensure that the applicant and their airborne system suppliers have complied with all applicable regulations and FAA guidance for aeronautical databases, you should:

a. Ensure that the applicant has followed the guidance provided in AC 20-153A, or other acceptable means for aeronautical databases that comply with the requirements of RTCA/DO-200A. A current Type 2 LOA (refer to AC 20-153A) provides evidence that the aeronautical database complies with DO-200A in support of installation eligibility and operational authorization for use.

b. Ensure that any aeronautical databases meet the appropriate assurance level requirements using RTCA/DO-200A (Appendix B), AC 20-153A, or other acceptable means (refer to Order 8110.55).

15-4. Assuring Airborne System Databases. To ensure that the applicant and their airborne system suppliers have complied with all applicable regulations and FAA guidance for airborne system databases, you should:

a. Review the applicant's aircraft and system safety assessment(s) and verify that for each airborne system database:

(1) They have considered possible database errors and corruption for each system that will use each database;

(2) They have assigned appropriate software levels to each database (refer to AC xx.1309, AC 33.28, ARP 4754a, and ARP4761);

(3) They have based assigned database software levels on the worst-case potential hazard effect that errors or corruption could cause for the system and aircraft or engine; and

(4) You concur with the identified hazards and assigned software levels.

b. Ensure that each database is assured to the appropriate software level using RTCA/DO-178B or other acceptable means, and that they are verified in the context of the functional software, the system, and the overall aircraft use.

(1) A level of verification coverage appropriate for the database software level should be achieved. This may be achieved by a combination of requirements-based testing, data coupling analyses for data items that provide data only, and control coupling analyses for data items that influence software execution.

(2) Review the applicant's proposed verification coverage criteria for each database and either concur or provide rationale if you do not concur.

(3) Ensure that the applicant has applied robustness test conditions for databases, including those that influence software execution.

15-5. Actions Applicable to Aeronautical and Airborne System Databases.

a. Review any field-loadable software loading procedures for each database. Ensure that safeguards are established to detect database transmission and media errors, loading and content errors, mismatches between database part numbers and the aircraft systems or embedded software, and corruption of database contents or memory during use. Refer to chapters 5 and 6 of this order for more guidance on approving field-loadable software.

b. Ensure that maintenance instructions and appropriate limitations are provided for database updates if the contents of the database are valid for use only within a specified time.

c. Ensure that the applicant has provided a process for updating each database. The process should include a means for obtaining airworthiness approval and/or operational authorization for use, such as STC, minor modification (mod level change), system part number roll, or software part number roll, as appropriate. The process should address databases with their own part number assigned, as well as databases considered part of the operational software.

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Chapter 16. Managing the Software Development or Verification Environment

16-1. When to Apply This Chapter. This policy applies when the applicant is using a software development or verification environment that may not be completely representative of the target computer. In this chapter, we show you how to ensure that the applicant establishes and maintains configuration control of the software development and verification environment, and implements a structured problem reporting system for the environment. The degree to which you use this policy may depend on the size and complexity of a particular certification project. Because it's impractical to cover all situations or conditions that may arise, supplement this policy with good judgment in handling the situation or condition. Confer with FAA system and software specialists as required.

16-2. How Representative is the Environment? RTCA/DO-178B requires that the verification test activities take place on the target computer, a target emulator, or a host computer simulator. Software development and verification teams typically utilize an environment designed specifically to emulate the target computer to satisfy this requirement. Because the environment may go through several iterations during software development and verification, it may not be clear how representative the environment is of the actual production hardware at any point in time in the verification process. Additionally, the environment may not be identical to the final production version of the hardware to be installed in the aircraft. Therefore, the applicant should establish and maintain configuration control of the environment, and implement a structured problem reporting system for the environment available to users of the environment.

16-3. Controlling the Development and Verification Environment. The applicant should address the following aspects in their Software Development Plan, Software Verification Plan, and Software Configuration Management Plan as applicable. The applicant should convey these aspects to all participating software suppliers, and ensure that they comply with them. As a project engineer, you review these plans and assess their adequacy.

a. The Software Development Plan and Software Verification Plan should include:

(1) A description of the software development or verification environment, and an explanation of the differences between it and the production version of the system hardware and software to be installed on the aircraft.

(2) An explanation of how the software development or verification environment will be used by system software suppliers and what RTCA/DO-178B objectives it will be used to show compliance with.

(3) An explanation of how the software development or verification environment will be used to show compliance with RTCA/DO-178B objectives that involve verification of the software executable object code. This should address the entire executable object code, not just

individual functional software components. If development tools are being used in the integrated environment, then verification should also be performed in the integrated environment.

(4) A process for analyzing completed verification activities and assessing the need to repeat any of those activities after changes are made to the software development and verification environment. The process should ensure that all affected verification activities will be repeated, or ensure that a documented analysis is conducted showing why retesting is not required.

b. The Software Configuration Management Plan should include:

(1) A description of the configuration control system to be used for the software development and verification environment. The plan should identify the person who is responsible for administering this system.

(2) A problem reporting and assessing system for the software development and verification environment that is available to all users of the environment (refer to chapter 14 of this order).

Appendix 1. Level of FAA Involvement (LOFI) Worksheet

Applicant:_____ **Project Name/Number:**_____

Certification Authority Name:_____ **System Type:**_____

MIDO/MISO Inspector:_____ **Software Level:**_____

DER Name:_____ **Date of Assessment:**_____

TSR (from figure 3-2):_____ **Other Info:**_____

Resulting LOFI:_____ **Policy Issues:**_____

Plan Based on LOFI Assessment: (for example, number of FAA on-site reviews, number of FAA desk reviews, data to be submitted to the FAA, and delegation to DERs)

Mid-Project Adjustments: (based on project improvements or problems)

Actual Project Results: (for example, number of FAA on-site reviews, number of FAA desk reviews, data submitted to the FAA, and delegation to DERs)

Appendix 2. Level of FAA Involvement – Example 1

1. Company X Overview: Applicant Company X is applying for approval of a product that is usually approved for STC and installed on in-service aircraft. The product provides additional capability highly desired by airlines. Company X has prior STC approvals on a number of aircraft and recently upgraded the software aspects of their product to RTCA/DO-178B Level A criteria. In past programs, they consistently demonstrated their willingness to commit the necessary resources and change their processes to utilize new technologies while maintaining a quality product and satisfying certification requirements.

Company X's product service history indicates almost no in-service difficulties with their products and their technology and system architecture are fairly stable. Replacement of obsolete parts is planned and seemingly well managed. They appear to have a stable in-house process for managing changes, even though almost each different aircraft installation requires some software changes. The development and verification environment is state-of-the-practice and new tools are introduced when economically advantageous. The company contracts through job placement agencies for low-level software testers.

Company X has 3 company DERs on-site, 2 with software authority and 1 with electrical system authority, and the company occasionally contracts with a consultant DER for system approvals. One of the software DERs is very experienced and the other has been a DER for less than a year. The experienced software DER also is the manager for the software verification group, part of the engineering organization. The less experienced software DER is in the company's SQA organization, which is independent of the engineering organization and has highly qualified and experienced personnel.

2. Company X Assessment: An experienced software certification authority involved with several previous projects for the company, and having previously conducted 2 on-site reviews, assesses company X on a new project. The results of the assessment:

1 criteria score: 20	4 criteria score: 26
2 criteria score: 21	5 criteria score: 38
3 criteria score: 36	Total score result: 141

3. Level of FAA Involvement for Company X: Using figure 3-3 with a Level A system and TSR of 141 indicates that the minimum level of FAA involvement should be MEDIUM. There is no need for CSTA or Technical Specialist support, unless the company proposes to introduce some novel technology into their product, or new methods into their processes. For this project, the certification authority may elect to perform one on-site review and some desk reviews, depending on their workload. Much of the data approval could be delegated. However, because it is a level A software project in the system, approval of the SAS should be reserved by the certification authority.

Appendix 3. Level of FAA Involvement – Example 2

1. Company Y Overview: Applicant Company Y is applying for approval of equipment that is usually approved by TSO and then the installation by STC on new and in-service aircraft. The equipment provides additional capability highly desired by airlines. Company Y has prior TSO approvals and a number of subsequent aircraft installation approvals. The product was originally developed as a prototype. The company claims that they have upgraded the software aspects of their product to RTCA/DO-178B Level C criteria. In past programs, the company has hesitated to allow certification authorities to perform on-site reviews and seems to prefer discussion rather than committing resources and changing their processes to comply with certification requirements.

Their early product service history indicated nuisance shutdowns and questionable performance, but more recent service indicates almost no in-service difficulties. Each different aircraft installation requires significant changes to the software. However, the system technology and architecture appear fairly stable though somewhat complex. The company claims they cannot afford to address the parts obsolescence issue immediately but say they are looking into it. The results of several on-site reviews by various certification authorities were inconclusive. One of the certification authorities interviewed stated that the company used up the entire 3 days of the software review by having their managers and process focal points make unsolicited presentations. Company Y has been sold to three different parent companies in the past 7 years. It is rumored that if they do not turn profitable soon, they will be sold again or shut down. Project managers draw from a "pool" of company engineers not normally assigned to specific projects. Three years ago, the company received a Software Engineering Institute Capability Maturity Model assessment level of 2.

Company Y has two company DERs on-site, one with software authority and the other with electrical system authority. Both have been there for over 20 years and the system DER is good friends with the ACO manager. The manager of the SQA organization, who was very experienced and software competent, was recently fired. A successor has not yet been named.

2. Company Y Assessment: An experienced certification authority involved with two previous projects with the company assessed Company Y using figure 3-2. The results of the assessment:

1 criteria score: 11	4 criteria score: 24
2 criteria score: 8	5 criteria score: 27
3 criteria score: 15	Total score result: 85

3. Level of FAA Involvement for Company Y: Figure 3-3 indicates a MEDIUM level of FAA involvement for this company with some delegation. There would be no need for CSTA or Technical Specialist support, unless the company proposes to introduce some novel technology into their product or methods into their processes. Because the scores indicate inadequacies in their software experience and development capability and service history, FAA

Appendix 3. Level of FAA Involvement – Example 2 (Continued)

involvement is warranted. However, because the current product is a derivative of a previously TSO-approved system and the software is level C, a LOFI of MEDIUM is probably appropriate. The certification authority should be involved early in the project and state their expectations to the applicant very clearly. If possible, an on-site review should be performed midway through the project. When submitted with the TSO package, the certification authority should perform an extensive desk review of verification results, change management procedures and results, and the accomplishment summary. The TSO authorization should not be granted until all software data package deficiencies are resolved and review action items are completed.

Appendix 4. Level of FAA Involvement – Example 3

1. Company Z Overview: Applicant Company Z builds display devices, controllers and busses, which contain software and hardware digital devices. They have never applied for an FAA approval of any kind but would like to get their displays approved for use on the flight deck, which a preliminary safety assessment has indicated would be an essential system (Level C software). They are a small company but have investor financial support for this project. They have no SQA personnel. Their products were developed in-house by their company electronics wizards. They are novices to FAA certification but are willing and even eager to learn. They appear prepared to commit the appropriate resources to address the certification requirements and guidance. They do not have in-house DERs but plan to employ the services of a consultant DER. The system and software design complexity is about average, and the company has developed a new type of display device and controller.

2. Company Z Assessment: An experienced software certification authority assessed company Z using figure 3-2. The results of the assessment:

1 criteria score: 2	4 criteria score: 22
2 criteria score: 11	5 criteria score: 19
3 criteria score: 5	Total score result: 59

3. Level of FAA Involvement for Company Z: Figure 3-3 indicates a MEDIUM level of FAA involvement for this company. Because they are novices to the certification process, there may be need for CSTA, Technical Specialist, Headquarter staff, and/or Directorate staff support for mentoring the company and evaluating the new technology. The certification authority and DER can expect to guide the company through the entire certification process since they are novices, their software experience and development capability are unknown, and service history is non-existent. It is a new product and until the safety assessment is completed, the software level could be Level C, B or A, depending on the intended use of the display in the cockpit. The certification authority should be involved early and throughout the project. At least two on-site reviews should be conducted to ensure that the company understands RTCA/DO-178B compliance and other certification requirements and has implemented the processes to satisfy them. Approval of all software plans, design and verification data, and accomplishment summaries should be retained by the certification authority, or partially delegated only to a very qualified and experienced software consultant DER.

Appendix 5. FAA Form 1320-19, Directive Feedback Information

Directive Feedback Information

Please submit any written comments or recommendation for improving this directive, or suggest new items or subjects to be added to it. Also, if you find an error, please tell us about it.

Subject: Order 8110.49 Change 1

To: Directive Management Officer, AIR-510

(Please check all appropriate line items)

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____ .

☐ Recommend paragraph _____ on page _____ be changed as follows:
(attach separate sheet if necessary)

☐ In a future change to this order, please include coverage on the following subject
(briefly describe what you want added):

☐ Other comments:

☐ I would like to discuss the above. Please contact me.

Submitted by: _____ Date:_____

Telephone Number: _____ Routing Symbol: _____

FAA Form 1320-19 (10-98)