U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Using Electronic Modeling Systems as Primary Type Design Data	**Date:** 10/29/10 **Initiated by:** AIR-120	**AC No: 21-48** **Change:**

1. Purpose of this Advisory Circular (AC).

a. This AC provides information and guidance on developing procedures for using electronic modeling systems in design, manufacture, installation, and inspection processes. It applies to applicants for Type Certificates (TCs), Amended Type Certificate (ATCs), Supplemental Type Certificates (STCs), Parts Manufacturer Approval (PMA), Technical Standard Order Authorizations (TSOA), major alterations, and major repairs. In this AC, we explain how you can submit a proposal to use electronic modeling system data instead of (or in addition to) traditional paper format for the technical data required for initial and post certification activities. We identify the minimum criteria for using electronic type design data, and include requirements for how to access and present the data. In this AC, we define an "electronic modeling system" as a three-dimensional (3-D) modeling system.

b. For Federal Aviation Administration (FAA) certification applicants, this AC mirrors our procedures in Order 8000.79, *Use of Electronic Technology and Storage of Data*, and Guide FAA-IR-01-01A, *Aircraft Certification Guide for the Use of Electronic Technology and Alternative Methods of Storing Information.* This AC must be used in conjunction with Order 8000.79 and Guide FAA-IR-01-01A.

c. This AC is not mandatory and does not constitute a regulation. We describe acceptable means, though it is not the only means, for using electronic modeling systems in design, manufacture, installation, and inspection processes. If you use the means described in this AC, you must follow it in its entirety.

2. Applicability. We wrote this AC for certification applicants, approval holders, and aviation product owners.

3. Background. Using modern design software, a component can be manufactured, assembled and installed (in whole or part) by an electronic data system, using computer-aided design, engineering and manufacturing interfaces. These electronic data systems produce and store engineering data, like models and models with drawings.

4. Minimum Requirements for Electronic Submission of Type Design Data.

a. If you intend to use a 3-D modeling system as primary type design data, start by sending your proposal to your responsible FAA office. The FAA project manager will help you use this AC and the references in paragraph 1.b above to complete and submit your type design data package.

b. FAA Order 8110.4, *Type Certification*, requires us to sign a Memorandum of Agreement (MOA) with each applicant before we accept type design data in any format other than on paper. The MOA will help us determine compliance with the regulations and the applicant/certificate holder's ability to produce, inspect, and reproduce the type design data.

c. Title 14 of the Code of Federal Regulations (14 CFR), 14 CFR §21.31 lists the required elements of type design data. 14 CFR § 21.33(b) requires applicants to make all inspections and tests necessary to determine that the product meets the type design specifications.

5. Requirements for an Electronic Storage System.

a. Our criteria for electronic storage of certification and production data are prescribed in Order 8000.79.

b. Submitted 3-D modeling systems must include an electronic data storage capability that satisfies the requirements of Order 8000.79. We must approve a procedures manual written by an applicant or approval holder before implementing the electronics storage system. Your responsible FAA office will use FAA-IR-01-01A to show you how to write the manual.

6. Additional Requirements for the Procedures Manual.

a. If you intend to use a 3-D modeling system, your responsible FAA office will use this AC, Order 8000.79, and Guide FAA-IR-01-01A, to evaluate your completed manual.

b. To use a 3-D modeling system, you must include answers to the following questions in your procedures manual. These extra procedures ensure that the data created by a 3-D modeling system continue to meet all the minimum requirements for using a paper format for the data, including access and usability.

(1) **How will the data integrity be assured throughout its life cycle?** Include a process to verify and ensure that data integrity and continued access is maintained during hardware and software upgrades and conversions, system maintenance, and other life-cycle activity. Once the data is approved by the FAA, it must not be altered. This doesn't prevent amendments to the design if the amended design is separately identified, approved, and maintained. Type design data must be retained and accessible for the lifespan of the product. It is possible that technical support for the original software will be terminated during the product lifespan, so your procedures manual must explain how access to the data will be retained or transitioned to a new software system.

(2) **How will users access the electronic data at the point of use?** Describe how engineering, production, and inspection users will have ready access to the data. Since the electronic data becomes FAA-approved type design data, all inspections must be performed using the electronics data. Applicants and/or certificate holders may not convert the 3-D data to a paper drawing or different format to conduct an inspection without first receiving FAA approval of the reformatted data or conversion routine. However, this does not preclude using a screenshot of the model from the 3-D modeling system. The 3-D modeling system should provide access to the electronics type design data in a way functionally similar to that provided by paper data, at the place where the work or inspection occurs, whether on a bench or inside an airplane on the ramp. Your procedures should describe the availability of remote data access for certain users, such as FAA or National Transportation Safety Board (NTSB) inspectors (see paragraph 6.b(9) below).

(3) **How will the user determine the approval status of the electronic type design data?** Your electronic type design data must indicate FAA approval is a similar way as shown when using a paper format. Your procedures manual must describe how the user will be able to tell if the data is FAA approved. FAA designees must continue to use FAA Forms 8110-3, 8100-9, and others as evidence of approval.

(4) **How will the configuration of the final product be established?** Design data using a paper format employs top drawings, drawing lists, and next assembly notes on drawings, among other methods, to define a complete product. Your procedures manual must identify how the 3-D modeling system is equivalent to a paper format for defining the product configuration and structure.

(5) **How will the 3-D modeling system ensure that the FAA approved data and released data available to manufacturing and inspection personnel are easily distinguished from other data?** Describe how any unapproved data will be controlled to ensure it is not mistaken for approved data. Describe and demonstrate the process for ensuring that users will know that the electronic type design data is approved, and that manufacturing personnel are using appropriately signed and released data.

(6) **How will the electronic type design data be transferred to the FAA when the certificate is surrendered or the holder ceases to operate?**

(a) When an FAA TC holder surrenders a certificate (14 CFR §21.51), Order 8110.4 requires the certificate holder to transfer all the data associated with that TC to the FAA. Describe how you'll execute this transfer. Consider that a certificate holder may be in financial difficulty and lack the resources to convert the electronic type design data to an alternative format acceptable to the FAA. There should be no additional costs imposed on the FAA for accepting data for a surrendered TC. Finally, you must show how you will transfer the electronic medium we'll need to read and access the electronic type design data.

(b) If the certificate is transferred, the new holder must complete an agreement with the FAA before the transfer can be completed and the data transferred. Your procedures manual

must state that the electronic type design data cannot be transferred to a new holder until the FAA and the new holder have completed a separate agreement. The new holder's procedures manual must describe in detail how the data will be transferred, and how the FAA will have continued access.

(7) **How will the electronic type design data be transferred to suppliers and other outside users?** Production certificate holders increasingly use multiple suppliers in the production process. You must ensure they have access to the latest applicable type design data to manufacture and inspect the components they produce. Describe how the electronic type design data will be transferred to all suppliers or other outside users, and how you'll ensure that suppliers or other outside users have the latest approved version.

(8) **How will the electronic type design data be used to support continued airworthiness?** Instructions for Continued Airworthiness (ICA) must be provided with products whose application was made after January 28, 1981, per 14 CFR § 21.50. Your procedures manual must show the role of electronic type design data in developing the ICA. Certificate holders must show how they will ensure all required parties have access to the latest approved version of the ICA.

(9) **How will FAA, National Transportation Safety Board (NTSB), and other regulatory agency personnel get access to the electronic type design data?** You must provide the FAA full and unrestricted 24/7 access to the electronic type design data. The FAA personnel may use the applicant or certificate holder's data for reference or evaluation of any subsequent applicant's submitted data, if the data is used solely for that purpose. (see Order 8110.4C, Chapter 2-6K (2)). Describe how we can access the data for purposes such as PMA design verification, technical oversight of delegated organizations, design review and approval, and continued operational safety investigations. You must also describe access requirements for the NTSB, other Civil Aviation Authorities (CAA), and FAA offices, other than your responsible FAA office.

(10) **How does the characteristics of the electronics type design data correspond to the original paper format?**

(a) All electronic type design data must describe the product sufficiently to reproduce the product. The procedures manual must show how the 3-D modeling system will describe all finishes, welds, and other required features that are usually captured on the paper drawing media. Describe how all the required features not depicted in the 3-D model will be incorporated in the type design data.

(b) Show how the product's manufacturing processes are based on the FAA-approved type design data. Electronic data systems now permit users to query the model to determine any possible design parameter. While this feature is useful, if a user inappropriately applies tolerances to available dimensions, it could result in non-conforming parts. Because not all these dimensions were provided on paper, manufacturing employees and inspectors need

precise guidance on the required dimensional checks. Your procedures manual must ensure that the descriptive data addresses over-dimensioning.

(11) **How will users be trained in using the 3-D modeling system?** Describe the training requirements for all users, including FAA personnel and designees, in your procedures manual. To do their jobs, users must be able to access and interpret the required data. You do not need to provide a mandatory minimum training program for each employee, but you do need to establish a minimum required level of user competence and a process for verifying compliance.

(12) **What attributes are required in the data file?**

(a) If the system has only electronic type design data, each data file must show:

1. Company name and address,

2. Title of the data set,

3. Number of the data set,

4. Checking indicators and checking dates,

5. Approval indicators and dates, and

6. Preparer's name and date.

(b) If the system uses *both* electronic and original paper format type design data (even if stored electronically), each data file must show all the information in 6.b (12) (a), *plus* for the data in the original paper format:

1. Complete definition of the product, containing a model and drawing, including orthographic views, axonometric views or a combination thereof;

2. Product definition data, created or shown in the 3-D model and subsequently shown on the drawing, must agree;

3. A drawing with a drawing border and title block information, and;

4. All applicable models and data for the product are specified on the drawing.

7. Related References.

a. To view Orders 8000.79, 8110.4 and Guide FAA-IR-01-01A, see the websites at http://www.faa.gov/regulations_policies/orders_notices/ and http://www.airweb.faa.gov/rgl .

b. Order copies of 14 CFR, Part 21 from the Superintendent of Documents, Government Printing Office, P.O. Box 979050, St. Louis, MO 63197-9000, telephone (202) 512-1800, or fax (202) 512-2250. You can also order copies online at www.access.gpo.gov. Select "Access," then "Online Bookstore." Select "Aviation," then "Code of Federal Regulations."

Susan M Cahler

for David W. Hempe
Manager, Aircraft Engineering Division
Aircraft Certification Service