



Federal Aviation Administration

Memorandum

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To: All Directorate Managers
All Aircraft Certification Office Managers

From: *For* David W. Hempey, Manager, Aircraft Engine Division, AIR-100

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Subject: INFORMATION: Acceptance of Composite Specifications and Design Values Developed using the NCAMP Process

Memo No.: AIR100-2010-120-003-003

Regulatory Reference: §§23.603, 23.605 and 23.613
§§25.603, 25.605 and 25.613
§§27.603, 27.605 and 27.613
§§29.603, 29.605 and 29.613
§33.15 & §33.17

Summary

This policy memorandum provides clarification on the applicability of material specifications and allowables developed by the National Center for Advanced Performance (NCAMP) for composite materials. NCAMP has completed a standard operating procedure detailing the organization that will use to work with material suppliers and regulatory bodies to develop composite material specifications and related material allowables. These procedures are based on experience gained from the Advanced General Aviation Transport Operations (AGATE) and NCAMP. Throughout this timeframe, AGATE and NCAMP have had a strong influence on the high performance regulatory oversight

occurring in related certification programs and special projects. In addition, the National Institute of Aviation Research (NIAR) at Wichita State University in Wichita, Kansas oversees the ACATE and NCAMP programs, performed a supporting role in the FAA development of related guidance for composite material qualification and material process specifications with the associated procedures for the tools, shared databases, quality control, and equivalency sampling tests. Material specifications developed within the NCAMP standard operation procedures are compliant with the U.S. title 14 Code of Federal Regulations (CFR) Parts 23, 25, 27 and 29 in regard to §§ 23.603(a) & (b). Applicants who wish to use associated NCAMP databases and material allowables need to validate the applicability of that data to their project with a limited test program to be compliant with §§ 23.605 and 23.613(a) & (b). In addition, NCAMP certifications are acceptable for showing compliance with § 33.15 and § 35.17 for materials used in engine and propeller applications.

Current Regulatory and Advisory Material

Sections 23.603(a) & (b), 23.605, and 23.613(a) & (b) of CFR parts 23, 25, 27 and 29 relate to the control of procuring and processing of composite materials along with the development of associated design allowables. The relevant advisory material includes the following documents:

- Advisory Circular (AC) 25-613-1, "Material Strength Properties and Material Design Requirements," dated August 6, 2003
- AC 20-107D, "Composite Aircraft Structures," dated September 8, 2000
- AC 23-20, "Acceptance Guidance on Material Procurement and Process Specifications for Polymer Matrix Composite Systems," dated September 19, 2003
- AC 27-1, "Certification of Normal Category Rotorcraft," dated September 20, 2003
- AC 29-2, "Certification of Transport Category Composite Aircraft," dated September 30, 2008
- PS-ACE 100-2003-000, "Material Qualification and Equivalency for Polymer Matrix Composite Material Systems," dated September 11, 2003

Reference Material

- DOT/FAA/AR-03/19, "Material Qualification and Equivalency for Polymer Matrix Composite Material Systems," dated November, 2003
Link = <http://www.tc.faa.gov/its/worldpac/tecm/psar03-19.pdf>
- NCAMP Standard Operation Procedures (SOP), DOT/FAA/AR-03/19, dated March 11, 2010

Relevant Past Practice

Non-proprietary material specifications for composite materials have not been made public like those currently available for metallic materials. This is due in large part to the inability of suppliers to spare materials and test data and to specifications which are relevant to more than one manufacturer and production processes. For the relatively short time period over which composite materials have been used in aircraft, each manufacturer has typically developed their own specifications and design allowables. In contrast, specifications and allowables for metallic materials are available to the aerospace industry. The result has been that for metallic designs individual manufacturers generally have not had to expend their resources

The National Center for Advanced Materials Performance (NCAMP) authorized by the FAA and industry. The goal of NCAMP is to develop material specifications and allowables for composite materials similar to what is now available for metallic materials.

Discussion

The final mechanical behavior of composite structures is extremely dependent on both the materials and the production processes controlled by the manufacturer. In an effort to reduce the costs of using composites, the National Aeronautics and Space Administration (NASA), industry, and the Small Airplane Directorate of the Federal Aviation Administration (FAA) formed the Advanced General Aviation Transport Experiment (AGATE) research consortium. AGATE developed an approach for sharing composite material property data from multiple sources. This allowed the development of tools which permitted the creation of non-proprietary material allowables for composite materials. The AGATE process has become accepted practice in the general aviation industry.

The AGATE process is being used by the National Center for Advanced Materials Performance (NCAMP). The objective of NCAMP is to take the experience gained from the AGATE program and develop acceptable standards for developing common material specifications and basic material property data suitable for general use in the certification of general aviation, transport category airplanes, and other aircraft product types. To achieve that goal, NCAMP has adopted procedures that allow the development of non-proprietary specifications and material design values similar in their industry use to those currently used for metallic materials. NCAMP is working closely with the Committee on Materials Handbook 17 (CMH-17) consortium to develop a standard methodology for using the CMH-17 methodology. It is also the intention of NCAMP to work closely with the Society of Automotive Engineers (SAE) to convert NCAMP specifications developed into SAE specifications. This memorandum will provide information to certification offices on the availability of composite material specifications and allowable values derived using NCAMP methods.

Policy

Material specifications and related databases developed using the NCAMP process as described in NCAMP Standard Operation Procedures (SOP) # NSP 100 are compliant with §§2x.603(a) & (h) of 14 CFR parts 21.21, 21.22 and 21.30. Additionally, NCAMP specifications are acceptable for showing compliance with §§ 23.15 and 23.17 for materials used in engine applications. However, to demonstrate compliance with the requirements of §§ 23.25, 23.27, 23.29, 23.31, 23.33, 23.35, and 23.37, production material allowables published by NCAMP must be validated as being applicable for each applicant's application by the following provisions:

- Procure materials per the specifications developed using NCAMP procedures.
- Applicants who develop the original data following NCAMP procedures may use the resulting allowables.
- If not the original applicant (person developing the original data), applicants wishing to utilize existing NCAMP allowables, must conduct a validated test program to validate the equivalency of materials, production processes and the associated material process controls being used on their program to the NCAMP allowables. Guidance on what testing is needed is provided in technical report; DOT/FAA/ATR-03/19.

Note that the allowables provided by the NCAMP process are not intended to fulfill all the design needs of every project. In general, NCAMP allowables only cover basic lamina and limited radial rate data associated with the lower levels of the building block approach (see CMH-17(f) Volume 3, Chapter 4 for more explanation of the building block approach). Applicants have to assess the applicability of the provided allowables to the specific properties, environments, laminated architecture, and loading situations needed for their individual projects. In particular, applicants must be able to demonstrate that material allowables are compatible with their validated analytical tools and design methodology. If additional allowables are needed to support higher levels of the building block approach for their designs, it is the applicant's responsibility to supplement the NCAMP data with an appropriate test program for their project to be fully compliant with §2x.613.

Data generated by the NCAMP organization following the procedures as defined in NCAMP Standard Operation Procedures (SOP) # NSP 100 are acceptable for use by FAA without further showing. Any testing conducted by NCAMP or organizations must be performed per a FAA approved test program or processes.

Effect of Policy

The general policy stated in this document does not constitute a new regulation. The FAA individual who implements policy should follow this policy when it is applicable to a specific project. Whenever a proposed method of compliance is outside this established policy, that individual has to coordinate possible approval with the appropriate directorate. The appropriate directorate must notify the policy issuing office of any

appropriate director to be approved, the office must coordinate its response with the policy issuing office.

Applicants should expect that certifying officials will consider this information when making findings of compliance relevant to new certificate applications. In addition, as with all advisory material, this statement of policy identifies one means, but not the only means, of compliance.

Implementation

This policy discusses compliance methods that should be applied to type certificate, amended type certificate, supplemental type certificate, unamended supplemental type certificate, and DMA programs. The compliance methods apply to those programs with an application date that is on or after the effective date of the policy. If the date of application precedes the effective date of the final policy, and the methods of compliance have already been coordinated with and approved by the FAA or its designees, then the applicant may choose to follow either the already approved methods of compliance or follow the guidance contained in this policy.

Conclusion

Composite material specifications derived from FAA-approved data documented in NCAMP Standard Operation Procedures are compliant with the requirements of §§2x.603(a) & (b) of CFR parts 23, 25, 27 and 29. In addition, FAA-approved specifications are acceptable for substituting compliance with §§23.1315 and 23.1317 for the materials used in engine and propeller applications. Applicants who have developed proprietary data following the FAA DMA process may derive material allowables for the properties required compliant to § 2x.613 (a) & (b). Applicants who want to use already published NCAMP allowables need to follow the procedures provided in our reports referenced in this memorandum to demonstrate the applicability of those allowables to their application.

For questions regarding this notice, please contact Mark Freisthler at (425) 227-1110, or by email at mark.freisthler@faa.gov.