Federal Aviation Administration

Memorandum

Date:	SEP 20 2010
To:	All Directorate Managers All Aircraft Certification Office Managers
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Subject:	INFORMATION: Acceptance of Composite Specifications and Design Values Developed using the NCAMP Process
Memo No.:	AIR100-2010-120-003
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 & §35.17

Summary

This policy memorandum provides clarification on the acceptability of material specifications and allowables developed by the National Center for Advanced Materials Performance (NCAMP) for composite materials. NCAMP has published a standard operating procedures document detailing the organization, methods and processes they will use to work with material suppliers, manufacturers, and regulatory bodies to develop composite material specifications and limited associated material allowables. These procedures are based on experience gained from the Advanced General Aviation Transport Experiment (AGATE) and NCAMP. Throughout this timeframe, AGATE and NCAMP have had a strong interface with the FAA, including the regulatory oversight

occurring in related certification programs and special projects. In addition, the National Institute of Aviation Research (NIAR) at Wichita State University (WSU), which oversees the AGATE and NCAMP programs, performed a supporting role in the FAA development of related guidance for composite material qualification and material & process specifications and the associated protocol for methods, shared databases, quality control, and equivalency sampling tests. Material specifications developed following 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 §2x.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 §§2x.605 and 2x.613(a) & (b). In addition, NCAMP specifications 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 2x.603(a) & (b), 2x.605, and 2x.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 is found in the following documents:

- Advisory Circular (AC) 25.613-1, "Material Strength Properties and Material Design Values," dated August 6, 2003
- AC 20-107B, "Composite Aircraft Structure," dated September 8, 2009
- 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 30, 2008
- AC 29-2, "Certification of Transport Category Rotorcraft", dated September 30, 2008
- PS-ACE 100-2002-006, "Material Qualification and Equivalency for Polymer Matrix Composite Material systems," dated September 15, 2003

Reference Material

- DOT/FAA/AR-03/19, "Material Qualification and Equivalency for Polymer Matrix Composite Material Systems: Updated Procedure," dated September 2003 Link - http://www.tc.faa.gov/its/worldpac/techrpt/ar03-19.pdf
- NCAMP Standard Operation Procedures (SOP), Doc. # NSP 100 (F), 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 share material property data and associated specifications, which are relevant to more than one manufacturer's 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 readily available to the aerospace industry. The result has been that for metallic designs individual manufacturers generally have not had to expend their resources in this area.

The National Center for Advanced Materials Performance (NCAMP) is supported by the FAA and industry. The goal of NCAMP is to establish a source of non-proprietary 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 cost of using composite materials 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 program has since evolved to 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 methods 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 documented procedures that allow the development of non-proprietary specifications and material design values similar in their industry-wide applicability as what is now available for metallic materials. NCAMP is working closely with the Composite Material Handbook 17 (CMH-17) consortium to incorporate NCAMP procedures into the CMH-17 methodology. It is also the intention of NCAMP to work closely with the Society of Automotive Engineers (SAE) to convert NCAMP specification developed into SAE specifications. This memorandum provides guidance to the aircraft certification offices on the acceptability of composite material specifications and allowables values derived using NCAMP methods.

Policy

Material specifications and related databases developed using the NCAMP process as described in NCAMP Standard Operation Procedures (SOP), Doc. # NSP 100, are compliant with §§2x.603(a) & (b) of CFR parts 23, 25, 27 and 29. In addition, NCAMP specifications are acceptable for showing compliance with §33.15 and §35.17 for materials used in engine and propeller applications. However, to show compliance with the requirements of the §§2x.605, 2x.613 (a) & (b), 33.15, and 35.17 regulations, 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 limited test plan to validate the equivalency of materials, production processes and the associated material & process controls being used on their program to those used to derive NCAMP allowables. Guidance on what testing is needed is provided in technical report; DOT/FAA/AR-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 laminate 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, laminate 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 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 defined in NCAMP Standard Operation Procedures (SOP), Doc. # NSP 100 is acceptable to the FAA without further showing. Any testing conducted by non-NCAMP 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 an

approved method of compliance outside of this established policy. Similarly, if the appropriate directorate becomes aware of reasons that an applicant's proposal that meets this policy should not be approved, the office must coordinate its response with the policy issuing office.

Applicants should expect that certificating officials would consider this information when making findings of compliance relevant to new certificate actions. 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, amended supplemental type certification, and PMA programs. The compliance methods apply to those programs with an application date that is on or after the effective date of the final 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 designee, the applicant may choose to either follow the previously acceptable methods of compliance or follow the guidance contained in this policy.

Conclusion

Composite material specifications derived by the NCAMP process as 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, NCAMP specifications are acceptable for showing compliance with §33.15 and §35.17 for materials used in engine and propeller applications. Applicants who developed material property data following the NCAMP process may derive material allowables for the properties tested compliant to § 2x.613 (a) & (b). Applicants who want to use already published NCAMP allowables need to follow the procedures provided by technical reports referenced in this memorandum to demonstrate the applicability of those allowables to their application.

For questions regarding this memo, please contact Mark Freisthler at (425) 227-1119, or by email at mark.freisthler@faa.gov.