

CMH-17 TUTORIALS

GENERAL AGENDA – CERTIFICATION

A six-hour tutorial session will be presented as part of the next CMH-17 meeting emphasizing Volume 3, Chapter 3. This chapter has been developed to provide general information on the regulatory and technical issues that need to be addressed when showing compliance with certification requirements relating to composite aircraft structure. To achieve aviation safety, certifying agencies require certification of design, production, maintenance and operation at different stages in the aircraft program development. Certification of design and production are to ensure the initial airworthiness of the aircraft. The compliance with maintenance requirements is necessary to ensure the continued airworthiness of the aircraft.

The tutorial provides an overview of the subjects of certification, regulations, design substantiation, and essentials of production and maintenance delivered by subject experts, with an emphasis on structural substantiation. Design substantiation covers many discussion points, including, for example, survivability, the importance of achieving repeatable results, and lightning protection requirements. The linkage among design, production, and maintenance functions in the context of unique material properties of composite materials has long been recognized as a critical part of safe and efficient certification. Developing an awareness of regulations and their role is another essential understanding for practitioners engaged in certifying aircraft.

The tutorial begins with general certification topics related to product development, continued airworthiness, product modification, and the need for a qualified workforce working in a team environment. This discussion is followed by a summary of regulations associated with attaining production approval, structural design and maintenance and repair. Two other segments of the tutorial include production and maintenance, addressing important topics such as production substantiation and implementation, quality control, and defect disposition requirements. The importance of various aspects of maintenance in order to maintain the same performance requirements as the base aircraft structure is presented.

INTRODUCTION Background, organization, purpose and scope of Volume 3, Chapter 3.

CERTIFICATION This section will give the student a review of general certification topics related to product development, continued airworthiness, product modification, and workforce qualifications.

REGULATIONS Students will be able to describe aviation regulations related to structure, design and construction. Regulations as related to production approval and continued airworthiness will be examined.

PRODUCTION This section will acquaint the student with the most important aspects of composite materials fabrication, including production substantiation. Critical elements associated with manufacturing quality control, defect disposition requirements, and procedures required for modifications in the production process will be discussed.

DESIGN SUBSTANTIATION Students will gain understanding of the critical technical issues associated with composite design substantiation. Documentation will be described which is required and associated

with designs and processes. Materials and adhesives qualification activities to support the control and reproducibility of manufactured composite materials to ensure adherence to type design will be addressed. Other topics will include aero-elastic stability, fire protection and flammability, lightning strike protection, and passenger survivability under aircraft impact conditions.

DESIGN SUBSTANTIATION This section focuses on the effects of environmental exposure, how process and design considerations are important to bonded structure, the achievement of repeatable results, defect detection, and inprocess conformity.

DESIGN SUBSTANTIATION Students will understand the process of and issues associated with structural substantiation.

MAINTENANCE Students will be able to describe why maintenance is essential to assuring continued airworthiness, and how substantiated repair designs and processes must meet the same performance requirements as the base aircraft structure. An overview of the importance of teamwork in proper composite materials maintenance including damage detection, and bonded and bolted repair processes. This section will conclude with a brief summary of where to access guidance and reports by the major regulatory bodies.

GENERAL AGENDA – STATISTICS

In support of Handbook objectives, the handbook includes methodology for performing a number of engineering processes associated with the design, manufacture and continued operational safety of composite materials. These processes use rigorous statistical analysis requirements to confirm acceptability. These statistical procedures are sometimes intricate and confusing to individuals that are not familiar with them.

In order to provide clarity to these procedures, a six (6) hour tutorial session will be presented as part of the next CMH-17 meeting.

This tutorial is a comprehensive treatment of the CMH-17 methods for statistical analysis and their importance to proper development of design information. Students will participate in an interactive session on the CMH-17 statistical methods, including practical example problems.

Students will receive a copy of all computer programs used during the tutorial.

Students need to bring a laptop computer with EXCEL to participate in the interactive sessions as they will be focused on using the specialized software available: Stat17, ASAP and HYTEQ.

LECTURE: STATISTICS FOR ALLOWABLE GENERATION

Understanding A- and B-basis values and related statistical tests This section focuses on the concepts of A- and B-basis values, what they represent and why they are important. Students will leave with a clear statistical understanding of A- and B-basis values, and an in-depth appreciation of the significance of these values in engineering applications. In addition, a user-friendly flowchart that outlines the material property basis value generation process for the CMH STATS program will be presented. The flowchart, which was jointly created by Statistics Working Group and Data Review Working Group, emphasizes engineering rationale while ensuring statistical validity.

INTERACTIVE TUTORIAL: STATISTICS FOR ALLOWABLE GENERATION

Includes Practical Example Problems

This interactive tutorial section will include practical example problems on how to compute engineering basis values as outlined in CMH-17. CMH STATS program computes A- and B-basis values as well as other statistics. The use of engineering judgment in interpreting the software results in arriving at a final decision will be discussed.

LECTURE: EQUIVALENCY DATA ANALYSIS

Understanding material equivalency and acceptance testing (material specification limits). This section focuses on the concepts of equivalency testing, including the null hypothesis, Type I and Type II errors, the test statistics and the power of the test. Students will leave with a clear understanding of the purpose and criteria for material equivalency and acceptance testing. A modified co-efficient of variation approach for the purpose of generating interim basis values and specification limits will be explained and discussed.

INTERACTIVE TUTORIAL: EQUIVALENCY DATA ANALYSIS

Includes Practical Example Problems

This interactive tutorial section will include practical example problems on how to compute equivalency test statistics outlined in CMH-17. HYTEQ (HYpothesis Testing of EQUivalence) computes the hypothesis test results for equivalency data. The use of engineering judgment to interpret the plethora of equivalency test results in arriving at a final decision will be discussed.