

# FAA Advisory Circular

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**FAA**

Larry Ilcewicz  
FAA CS&TA,  
Composites

and

Lester Cheng  
FAA ACE

(Regulations & Policy)

- Background
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  - Related regulations & guidance materials
  - Development timeline
- Technical content
  - Material procurement specification
  - Process specification
- Synopsis of data and process requirements



# Purpose of the Advisory Circular

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To provide acceptance guidance on what should be included in material procurement and process specifications, or other documents, to ensure sufficient control of composite prepreg materials

- It helps *control and stabilize raw material*, which is needed for continued safe & reliable use of composites in aircraft products
  - Expanding applications, including the use of composites in other industries, is driving material supplier developments
- It promotes *consistent engineering practices*, which support requirements essential for base material control
- It prepares the FAA for *composite databases and specs shared throughout industry*, with the end result being the improved efficiency of suppliers, users and regulators



# Related Regulations & Guidance Materials

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- Related federal regulations
  - Section 23.601 General
  - Section 23.603 Materials and workmanship
  - Section 23.605 Fabrication and methods
  - Section 23.613 Material strength properties & design values
- Related advisory circulars
  - AC 20-107A Composite Aircraft Structure
  - AC 21-26 Quality Control for the Manufacture of Composite Structures
- Related ACE policy statements
  - "Material Qualification and Equivalency for Polymer Matrix Composite Material Systems" [PS-ACE100-2002-006, September 2003]
  - "Static Strength Substantiation of Composite Airplane Structure" [PS-ACE100-2001-006, December 2001]



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# Development Timeline

- Draft policy (Sep 2002)
- FAA internal process (Oct 2002)
- FAA meeting on desired conversion to AC (Jan 2003)
- Mil-17 Forum and Review (Feb/Mar 2003)
- Convert to AC (Mar/Apr 2003)
- Federal Registrar process (Apr/May 2003)
- Resolve comments (July 2003)
- Finalize AC for printing by FAA Headquarters (Sep 2003)



US Department of  
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**ACCEPTANCE GUIDANCE ON MATERIAL  
PROCUREMENT AND PROCESS SPECIFICATIONS  
FOR POLYMER MATRIX COMPOSITE SYSTEMS**



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# Regulatory Guidance for the Material Procurement Specification

- Documentation and databases for material characteristics of each unique material
- Material supplier establishes a process control document (PCD) or equivalent to ensure repeatable raw material production
  - PCD lists all critical raw material ingredients and the associated suppliers
  - PCD defines “key characteristics (KC)” & “key process parameters (KPP)”
  - Property drift (including upward shifts) in KC & KPP, minimized by Statistical Process Control (SPC)
  - Reduced test sampling rates may be adopted if KC and KPP data indicate necessary levels of process control



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# Regulatory Guidance for the Material Procurement Specification

- Material spec includes requirements that define specific raw constituents (resin and fiber)
  - One resin formulation
  - Single fiber class (i.e., specific fiber type, manufacturer)
- Requirements for uncured prepreg and cured prepreg are defined and identified in the material specification
- Qualification procedures and methods to initially characterize the material are documented in the material specification



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# Regulatory Guidance for the Material Procurement Specification

- Use qualification data as a statistical basis for both equivalency (to evaluate new users or changes in material) & acceptance requirements (quality assurance)
- Outline methods to evaluate different levels of change in material and processes
- Document material packaging and shipping procedures needed to maintain material control through delivery
- Distributors in supply chain follow requirements of the material spec (and applicable portions of process spec)



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## Regulatory Guidance for Process Info Needed for Material Control & Procurement

- Procedures to fabricate quality laminates are detailed in the process specification\* to ensure consistent & stable processes
  - i.e., details for tool preparation, material handling, laminate layup, panel bagging, cure cycle, panel identification, inspection and machining
  - Qualified technicians for each major fabrication process step
- Document process parameters, material records, and tooling used to fabricate each specific panel

\* The terminology "process specification" is used throughout the AC for instructions and controls used in test panel fabrication (as applied for material requirements).





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## Regulatory Guidance for Process Info Needed for Material Control & Procurement

- Materials, equipment, facilities and tooling required for fabrication are specified and controlled
- Quality assurance procedures are needed to monitor fabrication processes, equipment, materials, facilities and tooling
- Recommendations are given to investigate corners of the process window and demonstrate scaled manufacturing trials at the time of M&P spec development to help define related material controls



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# Data and Process Requirements for Each Unique, Stable Composite Material

- Process control document, PCD, used for raw material production (usually proprietary to the supplier)
  - Specify ingredients, quality controls and change policies
- Process specification applicable to the material
  - Portions of a process specification crucial to material control
- Test reports for properties measured in qualification
- Quality control acceptance criteria
  - Benchmark key characteristics based on a representative population (i.e., multi-batch, qualification databases )
  - Incorporated into the material specification
- Storage and shipping limitations
- Material specification used for procurement