ADDITIONAL INFORMATION

The following is a list of useful SAE International Aerospace Recommended Practices (ARPS) and other documents.

3. AIR 4844C—Composites and Metal Bonding Glossary
4. ARP 4916—Masking and Cleaning of Epoxy and Polyester Matrix Thermosetting Composite Materials
5. AIR 4938—Composite and Bonded Structure Technician/Specialist Training Document
6. ARP 4977—Drying of Thermosetting Composite Materials
7. ARP 4991—Core Restoration of Thermosetting Composite Components
8. ARP 5089—Composite Repair NDT/NDI Handbook
9. ARP 5143—Vacuum Bagging Techniques of Thermosetting Composite Repairs
10. ARP 5144—Heat Application for Thermosetting Resin Curing
11. ARP 5256—Mixing Resins, Adhesives, and Potting Compounds
12. AIR 5278—Composite and Bonded Structure Engineers: Training Document
13. AIR 5279—Composite and Bonded Structure Inspector: Training Document
14. ARP 5319—Impregnation of Dry Fabric and Ply Lay-Up
15. AIR 5367—Machining of Epoxy and Polyester Matrix Thermosetting Composite Structures
16. ARP 5412—Aircraft Lightning Environment and Related Test Waveforms
17. ARP 5413—Certification of Aircraft Electrical/Electronic Systems for the Indirect Effects of Lightning
18. ARP 5414—Aircraft Lightning Zoning
19. AIR 5416—Maintenance Life Cycle Cost
20. AIR 5431—Tooling for Composite Repair
21. AIR 5496—Design and Application of Composite Repairs for Thermosetting Composites

22. ARP 5605—Solid Composite Laminate NDI Reference Standards

23. ARP 5606—Composite Honeycomb NDI Reference Standards

24. Advisory Circular No. 145-6—Repair Station for Composite and Bonded Aircraft Structures (published as a collaborative effort between IATA, ATA, and SAE)

**SAE Aerospace Material Specifications**

1. AMS 2960—Glass Fabric with Epoxy Resin Wet Lay-Up Repair Material
2. AMS 2960/1—Glass Fabric with Epoxy Resin Wet Lay-Up Repair Material. Part 1
3. AMS 2960/2—Glass Fabric with Epoxy Resin Wet Lay-Up Repair Material. Part 2
4. AMS 2960/3—Glass Fabric with Epoxy Resin Wet Lay-Up Repair Material. Part 3
5. AMS 2960/4—Glass Fabric with Epoxy Resin Wet Lay-Up Repair Material. Part 4
6. AMS 2960/4—Glass Fabric with Epoxy Resin Wet Lay-Up Repair Material. Part 5
12. AMS 3970—Carbon Fiber Repair Pre-Preg, 125°C Vacuum Curing
13. AMS 3970/1—Carbon Fiber Fabric Repair Pre-Preg, 125°C Vacuum Curing. Part 1—General Requirements
14. AMS 3970/2—Carbon Fiber Repair Pre-Preg, 125°C Vacuum Curing. Part 2—Qualification Program
15. AMS 3970/3—Carbon Fiber Repair Pre-Preg, 125°C Vacuum Curing. Part 3—Purchasing Specification for Epoxy Pre-Preg
16. AMS 3970/4—Carbon Fiber Repair Pre-Preg, 125°C Vacuum Curing. Part 4—Purchasing Specification for Film Adhesive

For additional information on these documents or a complete list, contact SAE International at 400 Commonwealth Drive, Warrendale, PA 15096-0001, U.S.A.; phone 724-776-4970; fax 724-776-0790; e-mail CustomerService@sae.org; website http://store.sae.org.
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Dr. Keith Armstrong is well respected for his many years of experience in advanced composite aircraft structures. He is best known for his involvement at British Airways in the development of carbon fiber/Nomex honeycomb floor panels. These panels were the first carbon fiber composites to fly on commercial aircraft, and most flooring in modern commercial aircraft meets specifications that evolved from these early composite structures.

Dr. Armstrong earned an M.Sc. in 1978 and a Ph.D. in 1990 in adhesion science from The City University in London, England. His career began in 1948 at Vickers-Armstrongs (Aircraft) Ltd., Weybridge, as an aviation apprentice and then as a design draftsperson. He subsequently served as a technical officer in the Royal Air Force and later as an experimental officer at the National Physical Laboratory in Teddington.

Dr. Armstrong spent the next 24 years of his full-time career with British Airways. In addition to his work on carbon fiber/Nomex honeycomb floor panels, he developed many new methods during the infancy of the industry. For many years, he was responsible for all composite and bonded metal repairs and for all windows in the British Airways fleet. He later served as a consultant to Du Pont on composite repairs using Nomex honeycomb and Kevlar and then as a quality audit engineer for Aerobond U.K. and a composite repair specialist for Monarch Airlines.

From 1988 to 1991, Dr. Armstrong chaired the International Air Transport Association (IATA) Composite Repair Task Force, and he continues to participate in the Training Task Group of the SAE International (SAE), IATA, Air Transport Association (ATA) Commercial Aircraft Composite Repair Committee (CACRC). He is a member of SAE International, the Society for the Advancement of Material and Process Engineering (SAMPE), and
Dr. Armstrong has written more than 30 technical papers and compiled the Composites and Metal Bonding Glossary published by SAE. He has lectured part time at Brunel, Bristol, and Plymouth universities and at Brooklands College and East Surrey College. He continues to work part time at Kingston University. He held a private pilot’s license for 28 years, is keen on family history, and has been a member of the Methodist Church for more than 50 years.

Graham Bevan has worked in or been associated with the aircraft industry most of his working life. His involvement with composites started in 1969 when he joined Rolls-Royce Composite Materials (RRCM) as a materials engineer, from the Structural and Materials Test Laboratories of the then British Aircraft Corporation. During the past 35 years, he has maintained this involvement with composites with a number of companies and has acquired considerable knowledge on the subject.

Mr. Bevan joined the In-Service Support Department of Airbus (U.K.) Ltd. in 1991 as a composites specialist and has remained at Airbus to the present day. His work at Airbus is now involved with composite repairs and other in-service issues. He has many years of experience related to the manufacture of Airbus composite components.

Mr. Bevan is a past member of the Airbus Industrie (AI) Composite Repairs Task Group, and he was and still is involved with providing input to the Airbus Structural Repair Manuals (SRMs). He also was closely involved with the draft preparation of data for the Airbus Industrie composite repair courses for airline engineers.

Mr. Bevan is a member of the Repair Task Group of the SAE/IATA/ATA Commercial Aircraft Composite Repair Committee (CACRC). He has worked closely with Dr. Keith Armstrong on the development and subsequent production of carbon fiber/Nomex floor panels while at RRCM. This was recognized in 1994 when Dr. Armstrong and Mr. Bevan both received an award from Du Pont for their pioneering development work related to the application of Nomex honeycomb in aircraft flooring. Fibrelam floor panels (now from Hexcel) also were qualified to the British Airways specification raised as the result of this work, and “these are now qualified by every aircraft manufacturer currently operating in the Western world.” [Quote taken from the Hexcel booklet, “Composite Materials for the Aerospace Industry,” May 2003.] In addition, Mr. Bevan has written and presented a number of papers on the fatigue properties of carbon fiber composites.
William F. Cole II is the chairman of the Commercial Aircraft Composite Repair Committee, a group committed to the standardization of materials, design, testing, and repair for commercial aircraft composites, as well as education about them. He is a routine contributor to multiple industry and FAA-sponsored working groups to define the best uses and regulatory needs for commercial aircraft composite structures.

Mr. Cole is the director of engineering at a corporation specializing in commercial aircraft maintenance, and he previously managed a large composite manufacturing program for a military surveillance aircraft. He also has managed engineering teams supporting heavy aircraft maintenance, component maintenance, and line maintenance. Mr. Cole has advanced degrees in both mechanical and aerospace engineering, with years of hands-on experience as an engineer supporting aircraft operations.

Mr. Cole is a routine guest lecturer at various colleges and universities, speaking on the topic of composite structures, composite repair, and engineering analysis. He also is the author of several articles and the co-author of three textbooks on the subject of composite aircraft design and composite repair design.