

**BIO FOR MAXWELL JAMES DAVIS PSM**  
**B. Eng (Mech), M. Eng. (Mech), PhD (Eng. hc)**

**Max Davis** retired in 2007 as a Principal Research Scientist after almost 36 years of service with the Australian Department of Defence as a specialist in composites and adhesive bonding technology. His expertise covers repair design, repair application technology, design of bonded joints, bonding materials and processes, adhesive bond quality management and forensic investigation of adhesive bond failures. Max wrote an Australian Defence Forces Engineering Standard and two handbooks on *Composite Materials and Adhesive Bonded Repairs*. He has published widely in his field.



Max is the author of the FAA Technical Note DOT/FAA/AR – TN06/57, May 2007 *Best Practice in Adhesive Bonded Structures and Repairs*. In 2011, Max was engaged to develop the adhesive bonding content of the FAA Level II course on *Composite Structural Engineering Safety Awareness*.

As part of his career Max initiated and facilitated changes in adhesive bonded repairs to RAAF bonded structures that saw a reduction in the bonded repair failure rate at the RAAF major bonding facility at Amberley from over 40% in 1992 to almost zero (< 0.06%) repair failures up until 2007.

Max holds a Masters Degree in Mechanical Engineering and in 2003 was awarded a Public Service Medal in the Queen's Birthday Honours for his achievements in his field of endeavour. In September 2012 he was awarded an Honorary Doctorate in Engineering by the University of Central Queensland.

Since his retirement, Max has remained active in his field having specialised in adhesive bond failure forensics. He provided a supporting role in assessment of structural integrity issues in relation to the failure of a helicopter main rotor blade as part of the investigation by Prosolve NZ of the crash of an R-44 (DQ-IHE) in Fiji, on 05 Dec 2006. The investigation found some areas of weak adhesion failure, and extensive areas of mixed-mode failure which typically results from bonds experiencing degradation of the chemical bonds at the interface between the metal and adhesive. These findings were confirmed by the US NTSB (A-08-25-29 dated 09 Jun 2008).

Max has developed and delivered training in *Adhesive Bond Failure: Analysis and Prevention* for the EASA and FAA. He continues to collaborate with the FAA in the development of practices for management of ongoing structural integrity of adhesively bonded composite and metallic structures.

Max is currently the Director of Adhesion Associates Proprietary Limited based near Brisbane in Australia.



A short course on

## ***ADHESIVE BOND DAMAGE TOLERANCE AND FAILURE ASSESSMENT***

### **SUMMARY:**

The course *Adhesive Bond Damage Tolerance and Failure Assessment* was developed in response to perceived gaps in knowledge about adhesive bond failure characteristics during a helicopter crash investigation. The course is structured to provide training in identifying the various failure modes which occur in adhesive bonded joints and structures and explains the conditions necessary for formation of effective adhesive bonds and how over time adhesive bond strength may decay to unacceptable levels.

The influence of certification basis, design methodology materials, quality management and certification testing methods are addressed. The various types of production and service defects and their significance to strength loss are discussed. Of importance the course details how current reliance on damage tolerance analysis in conjunction with in-service NDI is only appropriate for a post-production defect types and may be a risk to flight safety for defects which occur in service. The course discusses failures of adhesive bonds in joints and sandwich structures made of metals and composite materials. A flow chart is provided as a guide for investigators such that from the various failure characteristics identified probable causes can be identified and corrective actions can be recommended as part of a safety management plan for the component.

### **COURSE INFORMATION:**

NOTE: Course notes are in “pdf” format on CD or USB. **Hard copies are not provided.** A significant proportion of the course material has additional information printed below the presentation slide. **Please bring a suitable device to download the files.**

### **COURSE STRUCTURE:**

#### **Introduction**

0800 Wed 01 Aug

#### **Module 1: Design and Certification**

A. Bonded Joints	0830 1000 Wed 01 Aug
B. Certification of surface preparation	1015 1045 Wed 01 Aug
C. NDT and Damage Tolerance	1045 1115 Wed 01 Aug

#### **Module 2: Repair**

A. Repair examples	1115- 1130 Wed 01 Aug
B. Mechanics of bonded repairs	1130 1215 Wed 01 Aug

<b>Module split to fit in Forensics Module</b>	
C. Judgement of significance	1700 1745 Wed 01 Aug
D. Structural Integrity Check	0800-0900 Thu 02 Aug

### **Module 3 Repair management**

A. Repair Quality Management	0900 0930 Thu 02 Aug
B. Adhesive bond training	0930-1000 Thu 02 Aug
<b>Boeing Tour</b>	

### **Module 4: Failure Forensics (NOTE: Limited to 20)**

A. Adhesive bond failure assessment	1330- 1500 Wed 01 Aug
B. Sandwich panel defects	15000 1530 Wed 01 Aug
C. Composite bond failures	1545 1615 Wed 01 Aug
D. Metallic structural defects	1615-1630 Wed 01 Aug
E. Applying Failure Forensics	1630 1700 Wed 01 Aug

**End of Course**