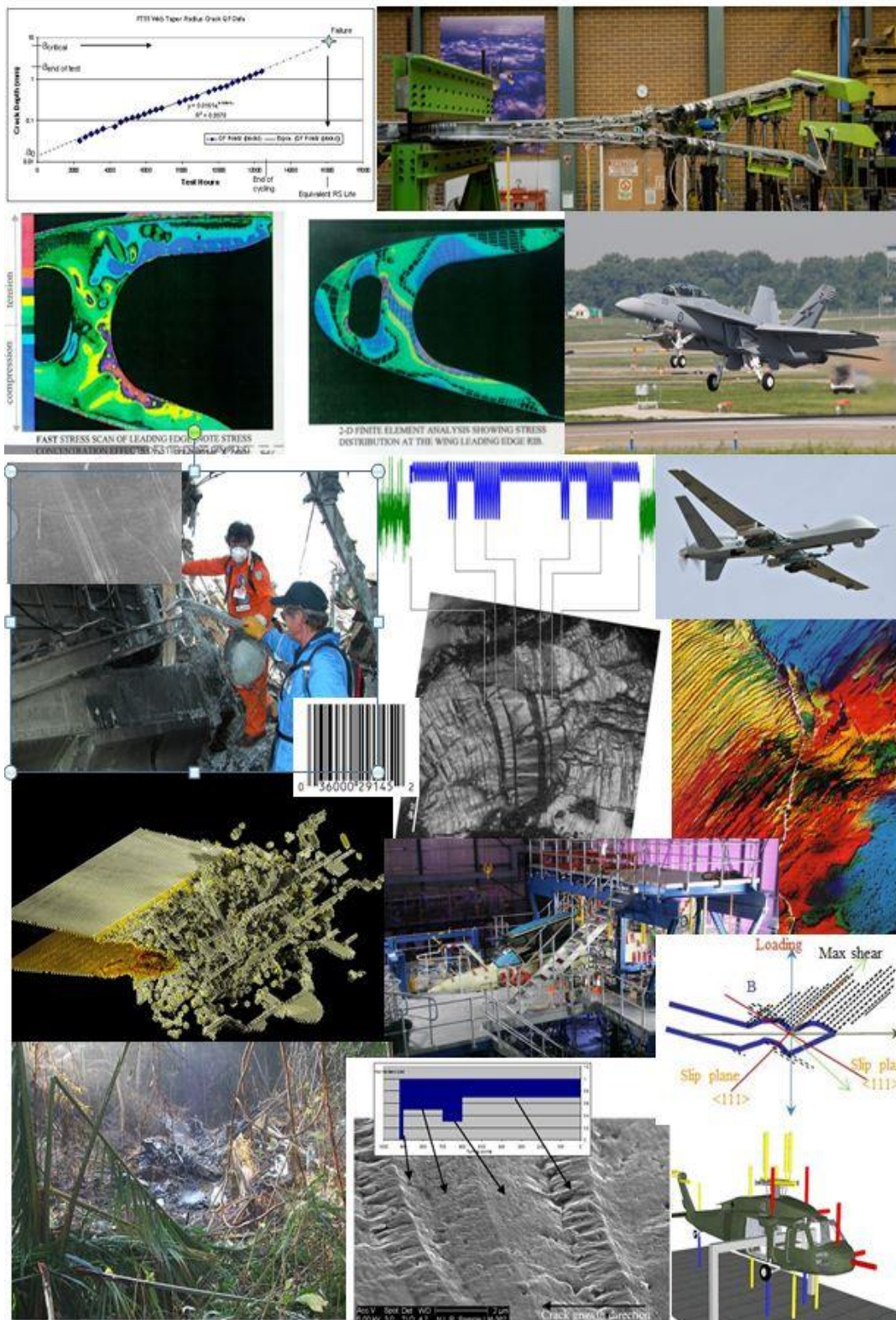


Aircraft Structural Failure Assessment & Emerging Structural Integrity Practices



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Tentative Title: Analysis and Prevention of Aircraft Structural Failures

Tentative Course Topics (approx: 25 hours)

1. Introduction
 - Whom am I
 - Overview of Course
 - Accident Investigation: Learning from Failure. History, Statistics and Technology
 - Case Study: IL-76 accident in Timor Leste
2. Why Aircraft Fail
 - Structural Design Overview
 - Common failure modes in civil and military aircraft
 - Aircraft Structural Integrity Overview
 - Airworthiness frameworks and standards
 - Case Study: P3C Orion Leading-edge Separation
3. Aircraft Accident and Incident Investigation & Forensics Overview
 - Enhancing Aircraft Safety by Accident Investigation
 - Aircraft Materials Overview
 - Failure Examination and Analyses Techniques
 - Failure Analyses of Composites
 - Non-Destructive Inspection (NDI)
 - Light Globe Filament Analyses
 - Wreckage Distribution and Mapping
 - Graphical Replay Software
 - Safety Culture
 - Case study: Eurocopter Squirrel AS350 Heavy Landing
4. Fatigue
 - What is Fatigue? (ideal versus production materials)
 - Qualitative Fractography
 - Fatigue Mechanisms (crack paths)
 - Scatter factors
 - Short cracks
 - Case Study: AeroMacchi Wing Separation
5. Sources of Fatigue Failures in Service
 - Manufacturing and Maintenance Errors
 - Classic Aircraft Accidents
 - Compendium of Defect Types
 - Case study: History of Structural Integrity Issues with F111 wing pivot

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6. Fatigue Analyses

- Fatigue design approaches (Classical safe life, fail safe and damage tolerant)
- Probabilistic failure analyses
- Novel Methods
 - o Lead Crack Framework
 - o Cubic rule
 - o Effective Block Approach

7. Fatigue Testing

- Fatigue testing: materials, components
- Full-scale structure
 - i. Overview (philosophy)
 - ii. Case study: F18 Manoeuvre and Dynamic Buffet Test
 - iii. Case study: Unanticipated F111 Wing Failure
- Test Interpretation

8. Fatigue Loads and Modes

- Individual Aircraft/ Operational Loads Monitoring
- Multiple site damage in riveted lap joints
- Case Study: Aloha Airlines B737

9. Fatigue crack prevention

- Good design practices
- Employing crack propagation models to prevent failures
- Damage tolerance
- Case Study: Nomad Tail Separation

10. Damage and Repair¹

- Types of corrosion
- Analysis and control of corrosion cracking in airframe structures
- Bonded composite structural repair: development and applications
- Case Study: F111 Wing Pivot Fitting Repair

11. Examination

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¹ Subject to time constraints