Welcome

To the Aircraft Structural Integrity (ASI) community.

Welcome to the *ASI Guide*. DGTA-ADF staff have prepared this document to confirm DGTA-ADF’s ongoing commitment to the strength of Defence’s ASI sovereign capability and to help you identify how our existing ASI Programs (ASIPs) shall work with Defence Aviation Safety Regulations (DASR).

Please read this in conjunction with our web site. If you cannot find what you are looking for, please contact WGCDDR Ben Main, Deputy Director Aircraft Structural Integrity, at Ben.Main@defence.gov.au or (03) 9256 3499.

Thank you for helping us assure ASI for Defence aircraft.
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History of ASI

International Aviation Accidents that Shaped Structural Integrity

1954: DeHavilland Comet
Lead to Fail Safe and Fatigue Testing

1969: USAF F111
Lead to Damage Tolerance

1977: Dan Air Boeing 707
Advent of Ageing Aircraft policy

1988: Aloha Boeing 737
Lead to Widespread Fatigue Damage/Multiple Site Damage requirements

Navigator Sextant Window fragment of BOAC Comet G-ALYP (operated as flight 781) – identifies crack initiation sites at window corners.

Wreckage of Nomad

Significant Australian Defence Force (ADF) Structural Integrity Accidents

1990: Nomad Empennage Separation
Root Cause: No historical usage data (used aircraft with extensive ground runs). Fatigue critical structure not identified (no full scale fatigue test).

1990: Macchi – Wing Spar Failure
Root Cause: Poor build quality during Life of Type Extension (LOTEX) modification program. No Full Scale Fatigue Test (FSFT).

Wreckage of Nomad

Macchi A07-076 in flight
**ASI Principles**

**What is ASI?**

From a basic engineering perspective, ASI assures structural strength and stiffness, throughout an aircraft’s service life, when operated within the approved envelope, restrictions and limits.

**How much strength and stiffness?**

Enough for the singular and repeated loads, which the aircraft’s certification basis specifies.

**How is structural integrity lost?**

Through Error:
- design doesn’t comply with its certification basis
- manufacture differs from its design
- role and environment differ from their design assumptions
- maintenance doesn’t comply with the Aircraft Maintenance Program (AMP).

*This highlights the need for continual communication between designers, manufacturers, operators and maintainers. It is in fact an obligation placed on all those regulated by DASR. Hence quality assurance and its impact on ASI is reliant on effective cooperation.*

Through Decay:
- The loads are relentless
- The environment is hostile (to composites as well as metals)
- Accidents (including maintenance induced damage)
How does Defence assure ASI?

By establishing a MIL-STD-1530C ASIP, Structural Integrity related safety is assured while increasing capability (availability) and reducing cost of ownership (DEFLOGMAN Part 2, Vol 10, Chapter 18 refers). The ASIP assures this through the application of:

- prevention (e.g. corrosion-inhibitors and life-limited parts),
- inspection
- repair
tailored to the Configuration Role and Environment (CRE) to which ADF fleet are exposed (informed by usage and condition data).

Hence the need for an Aircraft Maintenance Program (AMP), which is underpinned by an ASIP.
Purpose

Who is this ASI Guide for?

It is for anyone involved with Defence aircraft, or any part of their structure (airframe).

Engineers and Managers within:

- Designer (Part 21),
  - Military Type Certificate Holder (MTCH) / Delegate, Heads of Design, Compliance Verification Engineers, ASI Design Engineers
- Operator (Part M)
  - Continuing Airworthiness Manager, ASIP Manager
- Maintainer (Part 145)
- Others
  - Defence Science & Technology Group
  - Industry Partners
  - Academia
  - Foreign Military Airworthiness Authorities (MAA)

Why an ASI Guide?

To define key ASI requirements under DASR and reaffirm the place of our extant ASIPs within the DASR construct.
What becomes of ASIP?

Under TAREGs, ASI-DGTA manages ASI via a MIL-STD-1530C Aircraft Structural Integrity Program (ASIP), documented within an Authority approved Aircraft Structural Integrity Management Plan (ASIMP). Under the DASR construct, the established ASIMP will be preserved for existing weapon systems and established for new acquisitions consistent with the DEFLOGMAN Part 2, Vol 10, Chapter 18 and AAP 7001.054 Section 3 Chapter 12 requirements.

Responsibility for the execution of ASIP elements is divested among the 21J (Design), 145 (Maintenance) and M (Continuing Airworthiness Management) organisations.

- **Part 21 Design Organisation responsibility**
  - Establish certification basis
  - Establish structural integrity program
  - Ensure access to required type design data
  - Conduct structural assessments (including occurrence reporting on critical structure)
  - Establish operational loads measurement program
  - Maintain design / initial airworthiness aspects of the ASIP

- **Part M Continuing Airworthiness Management Organisation responsibility**
  - Implement structural integrity program through Aircraft Maintenance Program
  - Establish routine structural (usage and condition) monitoring
  - Support operational loads measurement program
  - Support ageing aircraft structural assessments
  - Maintain continuing airworthiness elements of the ASIP

- **Part 145 Aircraft Maintenance Organisation responsibility**
  - Execute structural management policy in accordance with Aircraft Maintenance Program
  - Support operational loads measurement program
  - Support collection of structural (usage and condition monitoring) data, including occurrence reporting for critical structure
  - Support ageing aircraft structural assessments (aircraft inspections)
Where is the DAS Regulation for ASI?

Unlike TAREGs, DASR are technology agnostic.

Initial Airworthiness (Part 21) has obligations to support initial type certification, modifications/repairs, ongoing validation of the type design and rectification of latent defects in design.

Continuing Airworthiness (Parts M and 145) is focused on ensuring individual aircraft remain airworthy through compliance with instructions for continuing airworthiness (which may include a usage/condition monitoring obligation), and working closely with the Type Certificate Holder in the event of a defect/occurrence.

So while ASI is not explicitly addressed, your obligation to assure structural integrity and validation of the type design (and preservation of the CB) is addressed by various requirements. Adaptation of an ASIP constitutes means of compliance with those regulations. Accordingly, the Acceptable Means of Compliance (AMC) and Guidance Material (GM) of several DAS Regulations have been supplemented with ASI specific content to convey:

- where an acceptable means of compliance for a DASR requirement is a functional ASIP; and
- how ASI practitioners and the ASIP operate within the DASR regulatory framework.

Table 1 cross references ASIP tenets to DASR

*The DASR cross referenced in this table are not exhaustive. This table is provided as a guide to key elements of the DASR suite, whereby compliance, for structures, can be achieved through an Authority approved ASIP. This document is intended to evolve as the regulated community migrate away from TAREGs to fully compliant DASR organisations.*
What are Key (not exhaustive) DASR Changes?

Part 145:
- Occurrence Reporting
  
  *A good system has feedback. Any finding of decay or damage or anything else structural is a chance to review your own part of the system, and to tell others about theirs.*

CAMO:
- Execute ASIP Cycle

  *The functional management of the ASIP, previously executed by the System Project Office (SPO) and/or ASI-DGTA, lies within the remit of the CAMO under DASR. This is consistent with the Continuing Airworthiness role in managing Instructions for Continuing Airworthiness (ICA) and configuration control under a successfully executed ASIP.*

  *Co-endorse the ASIMP with MTCH/D for Authority Approval*

  *As previously outlined in this guide, DEFLOGMAN policy and eADRM require each aircraft to have a MIL-STD-1530C based ASIP. Co-endorsement assures acknowledgement and ownership of that requirement.*

Part 21J:
- MTCH/D Co-endorses the ASIMP with the CAMO for Authority Approval

  *Fulfils the MTCH obligation to provide and maintain ICAs per DASR 21.A.61.*

- All major changes to type design for primary structure require ASI-DGTA approval.

  *This includes all changes to life limits, Safety By Inspection (SBI) programs, Component Retirement Times (CRTs), loads envelope and significant stores changes etc.*

Tailoring of ASIMPs for DASR

During the course of Defence’s DASR transition, ASIP managers should update the roles and responsibilities and compliance matrices for each ASIMP chapter. DGTA-ADF shall undertake this for Defence managed ASIPs. TLS providers should discuss their plans for ASIMP update with their ASI-DGTA Desk Officer.
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<th>GUIDANCE</th>
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