ESIP v PSIP

FLT LT Belinda Pavlovic
References

• MIL-STD-3024
• Propulsion System Integrity under DASR
• AAP 8000.011 DASR
• ESI Guidebook V1.0
• F35 Aircraft Accident Investigation Board Final Report May 2015
Why do we need an Integrity Program?

• Life limits were being ignored,
• Life extensions were being granted without adequate analysis,
• Life limits were not fully published in maintenance plans,
• Fatigue usage was inadequately tracked, and
• Limited appreciation of engine airworthiness issues throughout the ADF.
Engine Structural Integrity Program:
Activities undertaken to constrain the risk of failure of the high energy, non-containable components within the engine

Propulsion System Integrity Program:
Any product whose primary failure could result in a hazardous propulsion system effect
Hazardous Propulsion System Effect
(DASR 21.A.41 GM)

• Non-containment of high energy debris
• Concentration of toxic products in the bleed air intended for the cabin sufficient to incapacitate crew or passengers
• Significant uncommanded thrust
• Uncontrolled fire
• Failure of the engine mounts leading to inadvertent engine separation
• Inability to shutdown
• Propeller failure resulting in excessive drag
• Partial or complete loss of thrust/power in a single engine aircraft
Propulsion System Critical Parts Considerations

Turbojet:
Propulsion System Critical Parts Considerations

F35 Engine Failure (AIB Report)
Propulsion System Critical Parts Considerations

Turbofan
Propulsion System Critical Parts Considerations

Turboshaft:

1 drive shaft

2 engines
Propulsion System Critical Parts Considerations

Turboprop:

- Exhaust Outlet
- Centrifugal Compressor
- Three Stage Axial Flow Compressor
- Igniter
- Fuel Nozzle
- Propeller Drive Shaft
- Free (Power) Turbine
- Igniter
- Compressor Turbine (Gas Producer)
- Accessory Gearbox
- Air Inlet

Defending Australia and Its National Interests
www.defence.gov.au
Propulsion System Critical Parts Considerations

Turboprop:
Identifying additional Critical Components

- Life Limits
- Damage Factors
- Critical Inspection Requirements
- Usage Monitoring Algorithm

\[ \text{Accumulated life} = \sum \]
Regulatory Requirements of a PSIP
Annex A to BR.20.A

The integrity of the propulsion system must be demonstrated throughout, and by a defined margin beyond, the operational envelope of the propulsion system and must be maintained for the operational life.

(i) Produce thrust (within its stated limits) demanded of it in all required flight conditions
(ii) Fabrication process and materials used for construction must result in known and reproducible structural behaviour
(iii) The effects of cyclic loading, must not reduce the integrity below acceptable limits – all necessary instructions for ensuring continued airworthiness in this regard must be promulgated
(iv) All instructions, information and requirements are provided for the safe and correct interface between the propulsion system and the aircraft
Fundamentals of a ESIP/PSIP

**Initial Airworthiness**

**CRITICAL PART LIFING POLICY**
- Classify and identify critical parts
- Establish critical part life limits and critical inspections
- Establish usage monitoring algorithms, equations, requirements, etc...
- Establish usage monitoring fill in factors, damage factors, accrual factors, conversion factors, etc...

**Continuing Airworthiness**

**USAGE MONITORING SYSTEM**
- Tracking of critical part life consumptions
- Preventing life limit exceedances
- Verified and validated for ADF specific use
- Routinely checked accuracy and completeness

**USAGE ASSESSMENT (MISSION ANALYSIS)**
- Assure applicability of critical part lives, inspections, and UM requirements for ADF CRE
- Assessments performed routinely throughout the life of type

**OCCURRENCE REPORTING**
- Accurate collection, investigation, and analysis of data
- Timely notification and action
- Robust trend management

**CRITICAL PART OPERATIONS OUTSIDE THE TYPE DESIGN**
- Ensure any excursions outside the type design are approved by the Authority
- Ensure the risk is understood and accepted by the operators

**CONDITION MONITORING**
- Comply with OEM mandated CM requirements
- Ensure CM program supports requirements of DASR reliability programme
Responsibilities of an ESIP/PSIP

Part 21 J Organisation
(Currently SPO’s and other former AEO’s)

Continuing Airworthiness Management Organisation

Part 145 Maintenance Organisation
Future

PSIP or ESIP?
Questions?