



PBCU Maturity Plan

TRM at Umbra facilities November 16th, 2016

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PBCU Maturity Plan

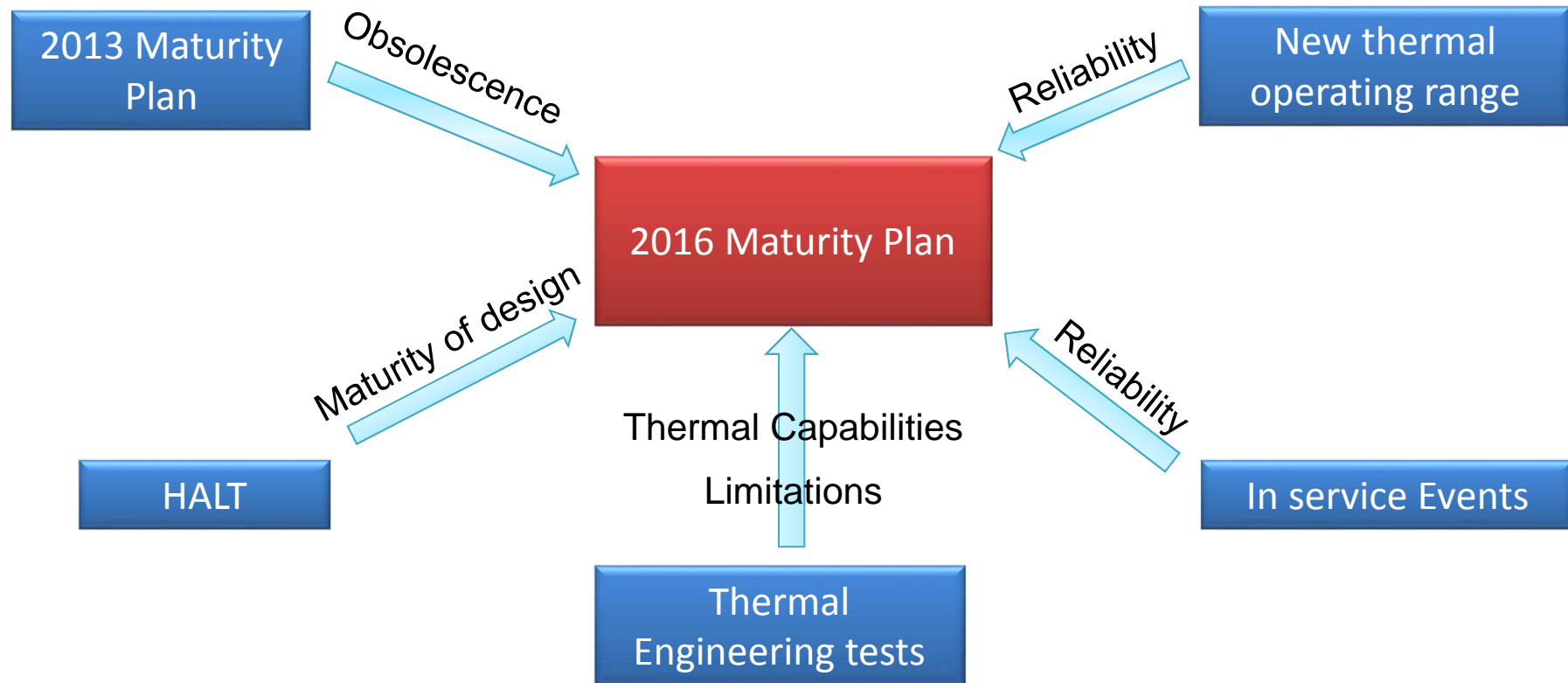
- List of data used to supply 2016 maturity plan

- 2016 Maturity plan :
 - Reliability & Robustness
 - Maturity of design
 - Obsolescence management
 - Thermal Capabilities (Limitations)
 - Improvements
- Synthesis of 2016 Maturity Plan



PBCU Maturity Plan

- List of data (tests, events,...) used to supply 2016 maturity plan:



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PBCU Maturity Plan

Theme : Thermal upscreening at PBCU level

▪ Observation(s) :

- Thermal upscreening is only performed at PBCU level during final production tests.
 - ❑ In engine environment, SAFRAN used to performed these tests at component level in order to eliminate weakest parts.

▪ Risk(s) :

- PBCU failures : Low time removal high rate



▪ Recommendation(s) :

- ✓ SAFRAN recommend to perform upscreening at component level

▪ Impact(s) :

- PBCU production process modification



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PBCU Maturity Plan

Issue : Global maturity of design

▪ Observation(s) :

- Observations of PBCU schematics shown design weaknesses:
 - Instability of Operational Amplifiers in some usages
 - Two diodes in parallel
- Some electronic components are overstressed:
 - Tantalum capacitors
 - Aluminium capacitors
- Minor error in schematics

▪ Risk(s) :

- Early fatigue of electronics components.

▪ Recommendation(s) :

- ✓ Umbra to perform a full review of the schematics and perform updates consequently

▪ Impact(s) :

- PBCU control board redesign

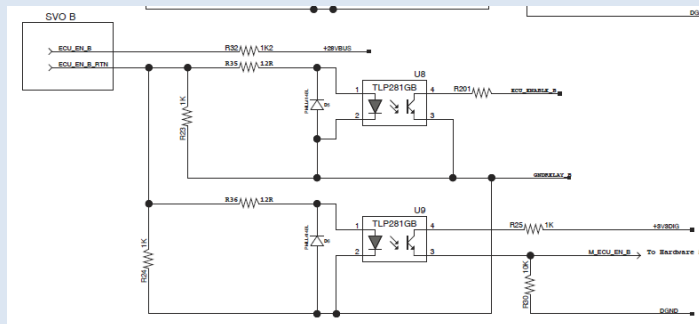


PBCU Maturity Plan

Issue : Design error on discrete interface

■ Observation(s) :

- On discrete interface (SVO A & B), conditioning interface is redundant (this is not a requirement).
 - ✓ The consequence is an output current in excess : 8mA
 - ✓ Requirement is : 4mA maximum



■ Risk(s) :

- No compliance on Airbus requirement
- Impact on interface not studied.

■ Recommendation(s) :

- ✓ Apply electronic design correction (hardware only)

■ Impact(s) :

- PBCU control board redesign



PBCU Maturity Plan

Issue : Protection of power H-bridge – AR0346

▪ Observation(s) :

- H-bridge has been damaged by back EMF from PBU.
- H-bridge does not have dedicated protection against over voltage.



AR0346

▪ Risk(s) :

- Steady failure of H-bridge due to back EMF or EMI/lighting conditions.

▪ Recommendation(s) :

- ✓ Add dedicated components in order to protect this part.

▪ Impact(s) :

- PBCU control board redesign



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Issue : Obsolescence of very single source components

- Observation(s) : Safran Aircraft Engines has no visibility on Umbra obsolescence management.
 - No information about PBCU changes due to obsolescence treatments since 2013.
 - In 2013, list of sensitive components has been identified. U1 is still considered as the most sensitive component. Its replacement would impact significantly PBCU internal board.

- Risk(s) :
 - No anticipation of part obsolescence.
 - Potential production impacts.



- Recommendation(s) :
 - ✓ Umbra to provide a synthesis of BOM obsolescence status twice a year.
 - ✓ Umbra to provide the strategy to avoid obsolescence of single sources (stock, P/N of selected part to replace the single source in case of obsolescence,...)

- Impact(s) :
 - No impact on PBCU HW or SW



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Issue : Thermal limitation of PBCU

- **Observation(s)** : In 2015, Engineering tests have been done to identified PBCU limitations. Tests performed in Umbra facilities.
- Engineering tests conclusions :
 - U1 component is the limitation of PBCU
 - In steady state : PBCU thermal limit is 80°C
- Studies and the identified evolution will only be launched if ADS finance these activities

- **Risk(s)** : The PBCU thermal limitation (ISA+22) is disadvantageous for TP400 engine missions.

- **Recommendation(s)** :
 - ✓ PBCU thermal limitation can be extended if power duration is limited (less than 2minutes).
 - ✓ PBCU thermal limitation can be removed if U1 component is replaced by a part with a thermal range of [-55°C; +125°C] .

- **Impact(s)** :
 - No impact for bullet n°1
 - PBCU control board redesign for bullet n°2



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Issue : Anticipate thermal limit & Protect against over-temperature

- **Observation(s)** : PBCU thermal limit cannot be detected because no thermal sensor is populated inside the PBCU box.
- As a consequence, margins have be integrated to take into account dispersion between components.
- Add a thermal sensor will permit to warn ECU in case of PBCU over-temperature and extend PBCU thermal limitation.

- **Risk(s)** :
 - Thermal limitation below ISA+40
 - Damage of PBCU board in case of over-temperature.

- **Recommendation(s)** :
 - Address this issue in two steps:
 1. Short term solution: adding of thermal stamps inside the PBCU case to detect over-temperatures
 2. Long term solution: populate thermal sensor on PBCU control board

- **Impact(s)** :
 - PBCU control board redesign

