



FUTURE REPAIR AND MAINTENANCE  
FOR AEROSPACE INDUSTRY

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**Deliverable 4.4**

**Experimental Methodology and Plan**

Final

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Work Package 4

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## **Executive summary**

### **Introduction**

Work Package WP4 is aimed at gaining a better understanding on the degradation of Additive Manufacturing (AM) components in real aerospace applications. To achieve this goal, the Integrated Drive Generator (IDG) was considered the best system to conduct a case study. Tests will be conducted to study the degradation of some components of the IDG and analyse the symptoms they produce in order to develop diagnostic and prognostic capabilities.

This document provides a description of the experimental methodology and plan that will be followed throughout T4.3 – ‘Part lifecycle pattern analysis and maintenance prediction’. The results of these tests will be used by Cranfield University (CU) and ATOS for the development of the different components of the degradation model.

The experiments will be conducted using the test rig constructed by CU and available at CU’s facilities in the UK.

### **Test Rig Capabilities**

The test rig has been designed to be able to perform a wider range of tests than those necessary for the completion of WP4. Whilst different tests may require a different configuration of the rig, all of them can be conducted with the existing equipment and without the need for long setup periods.

The test rig is capable of performing:

- Degradation tests
- Seeded fault tests
- Lubrication failure tests (including thermal tests)
- Imbalance tests
- Electrical system tests
- Acoustic emissions tests

### **List of experiments and methodology**

The experiments are aimed at generating all the data necessary to develop and validate all the models that will become part of the lifecycle analysis and maintenance prediction tool. Therefore, the set of tests included in document are aimed at identifying the similarities and differences in the degradation of components of the IDG when conventional parts are replaced by spare parts produced using AM components.

The description of each experiment includes: its objectives, measured parameters, variables, confidence, and materials and method.

The complete set of experiments includes:

- Seeded fault tests (using both AM and non-AM parts)
  - Excessive play between hydrodynamic bearing and planet gear – Steady state.
  - Excessive play between hydrodynamic bearing and planet gear – Transient conditions.
  - Excessive play between hydrodynamic bearing and carrier shaft – Steady state
  - Excessive play between hydrodynamic bearing and carrier shaft – Transient conditions
- Lubrication fault tests (using both AM and non-AM parts)
  - Pump failure
  - Drop of pressure in lubrication circuit – Partial
  - Drop of pressure in lubrication circuit – Total
- Thermal tests (using both AM and non-AM parts)
  - Thermal model validation test
- Degradation tests (using only AM parts)
  - Carrier shaft degradation test

### **Experiments Plan**

The experiments for WP4 are planned to start on September 2014 and will continue until the end of February 2015. The experiments have been scheduled taking into consideration the need to generate data to validate models developed during task T4.3 (Part lifecycle pattern analysis and maintenance prediction).

Degradation tests, which can lead to the total failure of rotating parts, which could affect operation of the rig. Consequently, these tests are to be conducted last.

Like any R&D project, the possibility exists of new phenomena being discovered during the experimental phase. In order to allow for sufficient flexibility, the last month of the experimental phase of T4.3 will be left available for scheduling any additional tests that CU and ATOS consider necessary.