AIRBUS

Call for pitches – Guidelines for R&T topics

Topic of interest: Prognostics-Enabled Decision Making

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Short description of research topic:

The research fields of system health, diagnostics and prognostics have become mature to the point where the techniques have begun to be incorporated in new design of aerospace vehicles. This has led to the newer research area called Prognostics-enabled Decision Making (PDM), which is devoted to the ability to incorporate system health information in making decisions in the planning and control of the system. A vehicle capable of making decisions or assisting a human operator to make decisions, based on systems health information could potentially accomplish more mission objectives, or operate with improved safety margins, than those that do not incorporate those considerations.

Detailed areas of research proposed:

A useful way to drive maturation of algorithms in diagnostics has been to develop test platforms where the algorithms may be evaluated. Each platform shall provide a means for controlled injections of faults or damages to test the capabilities of the diagnostic and prognostic algorithm and drive there development to be robust to real environments and utilization of vehicle represents data latency and noise. Each test platform has to be designed with the diagnostic and prognostic problems in mind.

Research efforts shall also focus on the developing algorithm that can provide RUL estimate, generate a confidence bound around the predictions, and be integrated with existing diagnostic systems.

Proposed approach:

- For that purpose of the test platforms it is propose to cover three test platforms representing structure, system and an integrated system e.g. system and structure
- For the test platform #1 we can select a general system, for platform #2 CFC build structural component and for platform #3 we can select a multifunctional system e.g. batteries embedded in CFC structure

Research focus to be expected:

Research effort shall be focused on developing algorithms that can provide a RUL estimate, generate a confidence bound around the prediction. Today more focus in research is given to develop prognostic methods but in this study clear focus shall be given on the prognostic performance.

- Platform development – the ability to emulate realistic events in the test platform is of key importance for the maturation process of PDM algorithm. In this context, an adverse event is regarded as an unexpected off-nominal physical change in the system or structure under consideration.
- Monitoring Concept ➔ shall meet the requirements of detectability
- Development of the Diagnostic System ➔ develop real-time capable algorithms to determine health grade

- Development of the Prognostic System ➔ develop PDM algorithm including the demonstration of the required PDF (Probability Distribution Function)
- Development of an integrated diagnostic reasoner for multifunctional systems

Target results foreseen (e.g. maturity level to reach, deliverables to produce, estimated timing, etc.):

- Tread off study for the Sensing- Monitoring Systems meeting the detectability requirements link to the test platforms
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- AI based Diagnostic algorithm which meet the performance requirements validated through the selected test platforms
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- PDM algorithm which meet the performance requirements validated through the selected test platform

Other relevant aspects to consider (e.g. previous experience required working in Defence and Space sector, access to specific facilities or laboratories, etc.)

- Good knowledge in the design of a Condition based Maintenance System using various methods e.g. AI techniques or model based approach or hybrid approaches
- Some basic knowledge regarding the deployment of a PDM system and prognostic certification