PROJECT OUTLINE

for discussion during the AGM and Workshop meeting to pass Gate 1
(16-17 April 2013, Pisa, Italy)

INTRODUCTION

The proposed project is related to Condition-Based Maintenance (CBM) practices for gas turbine plants and aims at further developing specific CBM approaches for improved asset management and efficient condition monitoring.

The main goal of the proposed project is to increase the penetration of CBM practices into gas turbine plants and allow more users to incorporate CBM policies for their asset management.

There are certain benefits of Condition-Based Maintenance over other existing maintenance approaches, including increased asset reliability and availability and more cost-effective operation with fewer surprises. However, previous research has not yet reached the point where the majority of gas turbine users are willing to adopt a CBM approach. More precisely, existing diagnostic methods, although there are many, represent one of the main parts of CBM but are dispersed and each of them is applicable to a limited range of engine health condition monitoring. The lack of an integrated diagnostic system and a tool, applicable to a wide range of condition monitoring that is useful during engine's life span, is discouraging users from adopting maintenance policies that rely on these technologies.

In the same manner, existing prognostic lifing techniques are not evolved enough to cover all desired decision support aspects required by gas turbine users. Moreover, there are also no standards or established ways for evaluating CBM related methods and techniques to assist users in measuring both the efficiency of a CBM approach and the benefits from incorporating the CBM approach.

PROJECT RATIONALE

The main scope of the proposed project is to contribute on bridging the gap between advanced maintenance methods and current industry practices. In this direction, research topics, which can be regarded as the project objectives, should address the aforementioned problems related to CBM. Such topics could be:

- ❑ Development/Integration of diagnostic approaches. A large number of diagnostic methods have been proposed by researchers in the past. However, each method is applicable on a limited range of underlying health conditions. Integration of the methods into a diagnostic tool being capable of addressing the entire diagnostic problem is required.
- ❑ Development of efficient diagnostic, prognostic and lifing approaches for condition based maintenance, operating cost reduction and safe/reliable operations. The literature of prognostics is very limited currently indicating the limited development of the technology. Prognostic and lifing approaches should be developed into tools covering all important aspects of remaining useful life of gas turbine engines (i.e. safety, availability, maintenance and operating cost).
- ❑ Development of efficient validation approaches. It is necessary to develop CBM performance metrics in order to make effective qualitative and quantitative evaluation of CBM policies compared with existing maintenance practices.
- ❑ On-site testing and evaluation of the developed CBM tool.

STATE-OF-THE-ART AND BEYOND

In general, a CBM program may consist the development of technologies of three main parts ([1], [2]):

- The Data Acquisition part, where data are acquired from the engines under monitoring;
- The Data Processing part, where the acquired data are validated, corrected and transformed properly according to the requirements of the decision-making techniques that follow;

- The Decision Making part, where diagnostic and prognostic methods and techniques are applied to available data, to analyse the current health condition of the engines and potential future development of the degradations, and recommend maintenance plans.

Over the years, many researchers have proposed and developed methods and techniques covering all these aspects of CBM (see, for example, works related to diagnosis [3-4], prognosis [5] and lifing approaches [6]). A good review of the topic can be found in [1], [2], [7] and [8]. Another review of CBM related approaches, along with some existing commercial tools has been prepared, specifically for the scope of the proposed project, together with the present Project Outline and will be available to ETN partners, during the AGM and Workshop meeting (16-17 April 2013, Pisa, Italy).

IDEAL CONSORTIUM

The idea for the current project proposal came from the research groups of Cranfield University (CU) and the Laboratory of Thermal Turbomachines of National Technical University of Athens (LTT/NTUA), who have a long experience and research activities in the field. To their viewpoint, the ideal consortium should include, but not limit to:

- ❑ Academia/Research institutions. The research community should contribute by developing CBM related methods. Integration and a common platform of the developed methods is also a task.
- ❑ Industry. The participation of industrial partners and gas turbine users is vital for the success of the proposed project. In addition, the industrial partners could provide requirements for CBM related methods and install/test developed techniques.

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