COMPASS*: A Generalized Ground-based Monitoring System

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1. Abstract
COMPASS (COndition Monitoring and Performance Analysis Software System) is a ground-based computer system developed by Rolls-Royce plc for application on the Rolls-Royce RB211 and Tay and IAE (International Aero Engines) V2500 turbofans. This paper describes COMPASS, its sources of data and its analytical functions, including details of new techniques developed to improve the usefulness of the analysis that is done. The paper also shows that COMPASS is designed in two parts:
- Analytical functions specific to a given application.
- General host routines, providing all the "housekeeping" functions required in any monitoring system.

The use of the general host routines could be extended to cover any operation (aerospace or non-aerospace, civil or military, etc) which is to be monitored. The paper concludes by outlining the approach Rolls-Royce plc has adopted to enable the COMPASS host to be made available for widespread application.

2. Introduction
Many airlines over the last several decades have recognized the benefits of in-service monitoring, and have developed condition monitoring systems ranging from simple hand recording and analysis of cockpit instrumentation to the use of electronic on-board data gathering systems which select and record a...
multitude of engine and aircraft measurements for onward transmission to ground-based computer systems which store and analyse data from an entire fleet. These systems have become more complex as the amount of data to be processed has increased, the data quality has improved and user requirements for better analysis routines and more user-friendliness have emerged: the aim is further reduction in equipment operating costs, together with increased equipment availability.

COMPASS is a ground-based computer system developed by Rolls-Royce plc for initial application on the Rolls-Royce RB211-524G and Tay and IAE (International Aero Engines) V2500 turbofans, and which will be made available for use on future civil and military engines (and, retrospectively, on earlier versions of the RB211 and Spey turbofans), airframes and APUs (Auxiliary Power Units). The paper describes COMPASS, its sources of data and its analytical functions. It also describes the concept of COMPASS as a Neutral Host, ie a general system providing all the "housekeeping" functions (data input, output and storage, smoothing/trending, alerts and statistical calculations) necessary to turn any set of analytical functions for any application into a powerful condition monitoring system. The approach Rolls-Royce plc has adopted to enable COMPASS to be used with other (non Rolls-Royce plc) functions is also discussed.

3. What is COMPASS?
COMPASS is a ground-based engine health monitoring system with built-in flexibility to allow the user to select those functions he requires to maximize the benefits to his operation. These range between the extremes of simple trending of cockpit parameters (eg shaft speeds, temperature, fuel flow, vibration) and full module performance analysis plus mechanical analysis, with or without alert message generation. Input data to and output data from the analytical functions can be stored within the system and displayed on a terminal or printer. Depending on the user's operations, COMPASS can be configured to run either on-line on receipt of data or in batch mode. It