Chapter 60
Airplane Health Surveillance System: For Connected World

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ABSTRACT

The Airplane Health Surveillance System is an information system which is designed to guide the pilot to make decision under uncertainty. The system is expected to detect the defect along with cause for the delay and airplane crashes which has high impact on society. The system is capable of detecting and diagnosing the defects which may be initiated during a flight. There by trigger a maintenance procedure to safeguard the airplane from possible odds by analyzing the effects caused by the defect detected. Airplane health surveillance system collects data in real-time from flying fleet and makes it available to ground operations. Ground system aims at incorporating new technical and functional features to provide best in class features for operational and strategic insight. In this work two actors are considered namely supplier (airplane manufacturer who delivers the services) and operator (operates the airplane in day to day life). This is a user friendly though has a very powerful impact on the aerospace division by eliminating the uncertain economic loss.

INTRODUCTION

The software applications available in today's era can turn unscheduled maintenance into scheduled maintenance, identify potential operational disruptions even before they occur, and recover from unavoidable delays. By embedding advanced sensors to collect data from tip to tail of an airplane and processing the sensor data to optimize airplane maintenance and flight operations.

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Airplane Health Surveillance System (AHSS) has on-board maintenance related systems and functionalities, the supporting ground IT infrastructures and its functionalities as well as the connectivity means between the airplanes and the ground via its data exchange functionalities, the AHSS also supports operations of the airplane.

The AHSS will bring to supplier and its operators the following capabilities:

- Local and remote diagnostics of airplane systems;
- Real-time awareness of the airplane and/or fleet health status;
- Automated airplane performance monitoring and reporting;
- Fleet issue recognition and resolution capabilities;
- Decision support for fleet maintenance and operational management;
- Fleet management optimization.

Although there are few similar systems available by some of the airplane manufacturers, but these systems are very complex to operate and not user friendly. These require highly expertise people to operate the system. The proposed system is intended to be very user friendly and powerful in terms of detecting and diagnosing the defects. The system is expected to operate in near real-time and the allowable delay between the data received and the alert is displayed on the system is expected to be 20 seconds.

LITERATURE REVIEW

Structural Health Monitoring System (SHMS) is developed to monitor the physical structure of the airplane by embedding the sensors into the body of airplane. In this work the author's intension is to provide continuous and autonomous monitoring capabilities to the system. The work also concludes the prosperity achieved by implementing the decision fusion algorithm to SHMS. (Martins, 2012).

The author (SalehZein-Sabatto, 2011) has utilized the Dempster-Shafer theory of evidence for the implementation of decision-fusion algorithm in matlab. Result is examined on the synthetic data which indicated a vast advancement due to fusion.

The author (Pinsonnault, 2011) also considers SHMS as the subject of their work. In this article the author's intension was to show the benefits of the implementation scenarios of the SHMS to the airplane operator and the possible expected users of the SHMS and also concludes how this system can change the next generation airplane maintenance. In similar way author (Rabatel, 2009) summarizes that the intension of the damage monitoring is to scale down the cost and the time required for inspecting the airplane for defect and thereby enhancing the repair plan.

With the similar intensions, Boeing also provides a complete airplane health solution and it is named as Integrated Vehicle Health Management (IVHM). Here, the Boeing have on-boarded the IVHM system into the airplane and this system will continuously collect the sensors data and load it to the ground maintenance system. This method will save the waiting time for the health data download after landing. (Stephenson, 2006) The system is designed work in a near real-time, this empower pilots to perform the corrective operations in-flight and also based on this mechanics can schedule the maintenance tasks and execute them once the plane lands. (Zakour).

The author Wang (2010) considered the integrated safety monitoring system as the topic of work the article. The design implementations of the integrated safety monitoring system considered that the air-