GMADS - GROUNDBASED MAINTENANCE AID AND DIAGNOSTIC SYSTEM

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Abstract

Saab Aircraft AB has developed a Groundbased Maintenance Aid and Diagnostic System (GMADS) that will significantly reduce operation and support costs and increase the availability of the Saab 340 and the Saab 2000 regional airliners.

GMADS combines troubleshooting with instructions for procedures such as inspection, repair/replace (AMM), and parts catalogue (IPC) together with diagrams and help in electronic form on CD-ROM. GMADS runs on a portable computer. With the significantly improved diagnostic coverage, GMADS reduces aircraft downtime, equipment false removal rates, spare parts requirements and repair costs. The use of CD-ROM provides a more intuitive way of displaying technical data thus allowing for reduced skill level requirements for performing maintenance and troubleshooting and reduced training requirements.

This technology has very broad applications, especially on complex equipment, and can provide great pay back in increased aircraft availability and reduced operation and support costs.

Introduction

Aircraft represent a large capital investment which must be used efficiently. Each delay, each cancellation, unplanned downtime cost the airline a lot of money and a lot of trouble. Competition between manufacturers and demands from the airlines have forced the manufacturers into analysing any possibility of reducing costs. We are on the other hand required by the aviation authorities to ensure that extensive airworthy regulations are followed.

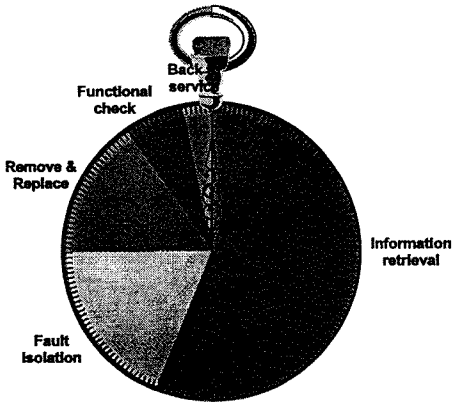
Maintenance Costs

Today, maintenance costs play a major role for an airline when looking for a new aircraft. In order to create knowledge and understanding of the importance of maintenance, to determine the resources required for planned and preventive maintenance, and to help an operator utilize his fleet as efficiently as possible, efforts must be made in order to create conditions for less planned and un-scheduled maintenance, reduce retrofit changes and higher service level.

Computerised Troubleshooting

To meet an airline's economical demands, maintenance time has to be kept to an absolute minimum. Each technician must have the required knowledge plus correct equipment in order to perform maintenance work efficiently.

The time to rectify a problem can include information retrieval, fault isolation, removal/replacement times and function checks.



Unscheduled Maintenance Allocation Times (Example)

The utmost goal for us is to reduce aircraft downtime to a minimum. If a fault occurs, it must be possible to localize the faulty component and replace it with a new one. Any cancelled flight due to technical reasons has the following consequences:

- actual costs to repair aircraft;
- loss of income as passengers are routed with other carriers;
- possible hotel costs; and a
- certain amount of "bad-will" for the airline.

As today's aircraft contain more and more sophisticated items, there is a requirement for highly trained technicians who can maintain these systems and equipment. As a system becomes more complicated, the number of technicians capable of maintaining this system decrease. Lack of experts will affect dispatch reliability of the aircraft.

In most cases the critical point of any problem is to isolate the fault. This is normally carried out by a skilled technician, a specialist on the actual system. Personnel who carry out these maintenance actions usually have a broad technical background, a lot of training plus practical experience with the system.

Usually this type of qualified person advances to other jobs within some years. As the complexity of components increases, as well as personnel rotation, the technical expertise required for troubleshooting will become a diminishing resource.

Maintenance technicians, even experts, frequently use maintenance manuals which are often bulky and require training and experience to use. It is essential to find a solution that:

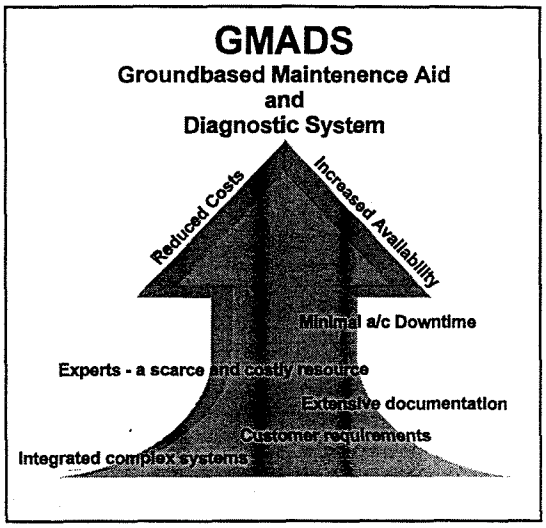
- collect technical knowledge and experience which is available for non-experts
- provides the right information at the right time

Such a way is to collect in an "expert system" knowledge which is drawn from manuals and practical experience. Using this system a less experienced technician has the possibility of isolating the majority of faults and being able to take suitable action.

GMADS - Advanced Service Support fo Saab 340 and Saab 2000

Experience at Saab Aircraft AB has shown that the introduction of a complementary system for troubleshooting based upon expert knowledge is required by our customers.

We have taken on ourselves to developed a ground based service support system, GMADS, which will drastically reduce maintenance costs and improve reliability for our civil aircraft Saab 3400 and Saab 2000.



We have concentrated on certain aircraft systems which can be troublesome from a troubleshooting point of view and present a challenge for the maintenance departments.

A commercially available software has been chosen to develop the advanced service support system with built in troubleshooting logic. Based on the knowledge on how a certain system can go wrong, the system can diagnose faults in part of an aircraft system.

We have gone one step further and integrated the troubleshooting logic with the maintenance manuals which are stored on a CD-ROM. Instead of thousands of hard copies in binders, the technical documentation is stored on a CD-ROM which enables direct access to the manuals from the "expert system" through an advanced "search" possibility.

This technology has a broad application area, especially complex material, which can result in higher reliability and reduced maintenance costs.

Development of GMADS

The system for aircraft maintenance must help the technician to troubleshoot and eliminate the fault. It must also be possible to use the system as a training aid. The data contained in the system must be readily understood by the technicians.

This means that the data must be organized in such a way that it reflects ATA standards which are the basics of maintenance philosophy. To attain and retain this system at the same speed as an aircraft is modified, we have chosen to structure the system in modules, which makes it easier to revise or modify information.

The data is divided into blocks as per ATA standards, based upon precise analysis of the system function, possible faults and their effects MSG-3 analysis, which are completed during development of an aircraft.

Thanks to GMADS, we can collect design drawings, manuals, personal experience etc in a portable PC. Information is directly available when required.

In a short time a program can be built up for troubleshooting, documentation and training.

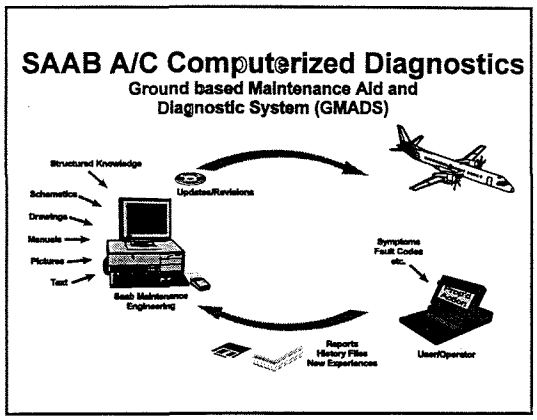
CAD drawings, photographs and complicated logic schemes are built up into a computer base Service Manual. The system's ease of use enable new experiences to be fed into the system. Due to the rules and regulations with the aircraft industry, the end user is not allowed to revise GMADS's data. This can only be performed by Saab, based upon information from the end user.

Outlines for development of GMADS are as follows:

- The required technology, both hard and software, must be readily available and cheap
- Characteristics that need to be met in order to make GMADS worthwile:
    - User friendliness
    - Increase aircraft use
    - Significantly reduce operator's costs for troubleshooting
    - Recording end user's comments and criticisms
    - Simple modifications, updating

Use of GMADS

Based upon the fault report from the pilots, information from a component's "built in test system" or Maintenance Data Computer or other fault report a technician can with the help of GMADS localize the faulty replaceable unit. As GMADS contains a function for retrieving information from manuals, stored on CD-ROM, the technician can receive help on how to remove and replace the faulty component as well as following functional checks. He can also locate information regarding spare part numbers, effectivity etc.



The user/system interface is uncomplicated. It consists mainly of a "conversation" between user and PC. GMADS asks relevant questions and shows explanatory figures, schematics or text. Depending upon the answer given by the user, GMADS searches for solutions from the data base. If required the technician can "turn to the correct page" by asking GMADS to show the relevant page from the technical documentation which is stored on the CD-ROM.

Documentation/Revision of GMADS

During the whole troubleshooting process, the technician can, when required, make notes regarding discrepancies and new findings. Apart from the built-in log in GMADS, which records the whole troubleshooting process, the technician has the possibility to note his own actions. It is our hope that users of the GMADS system send in comments and reports to Saab so that we can incorporate these comments in future versions of GMADS.

Conclusion

With the assistance of GMADS, the technician can

- navigate through information stored in the system;
- receive help in finding the probable fault; - receive suggestions regarding actions and store past experience.

GMADS stores technician's actions so that the data base expands continuously. A less experienced technician can, using this system, quickly solve the problem.

Multi media techniques are used to present the relevant videos, photographs, drawings and schematics on the screen.

Experienced technicians can tackle complicated repairs quicker as GMADS provides a structured working platform. Shorter repair times signify large savings for our customers.