Generic Portable Maintenance Aid

GPMAID™

GPMAID is a Generic Portable Maintenance Aid system (GPMA).

The GPMAID is data driven, object oriented, Web capable maintenance tool designed to aid the maintenance technician on complex aerospace systems.

With GPMAID, a maintenance technician (MT) has automated visual access to all information available on a laptop, portable, or remote terminal for the system being maintained.

The GPMAID system is designed to aid the MT in training, servicing, general maintenance, heavy maintenance and failure/fault diagnosis, using historical and real time data. GPMAID can function in a standalone, networked and/or web based mode. GPMAIDs purpose is to provide the MT with quick interactive access to maintenance information in an object oriented visual MS Windows environment which minimizes the need for keyboard entry and specialized system knowledge. Thus GPMAID increases MT effectiveness while reducing the extensive MT training required. In short, the MT spends less time to conduct higher quality maintenance.

GPMAID provides the MT with technical manuals (T.O., Fault Guides, etc.), debrief reports, failure/fault diagnosis, expert advice, historical maintenance data, animated parts lists, automated/manual reports, and remove/replace video clips in a visual intuitive environment on a Flightline qualified laptop PC.

GPMAID is a data driven object orientated MS Windows NT based program that operates as a standalone, RF networked and World Wide Web Flightline maintenance tool. GPMAID is developed around MS C++, MSFC, 3rd party utilities and active-X controls. GPMAID utilizes a predefined database model on the system being maintained. The aircraft database model (ACDBM) drives the user interface, information available to the MT, database links (IMDS, CALS, etc.) and the general use of the tool.

The ACDBM is the key to GPMAID's generic capabilities. The software tool is data driven object oriented in design that uses a released model of the aircraft being maintained. The aircraft model is structured in the fashion that the MOB performs maintenance. Thus each model is tailored to a specific airplane based upon the current hardware and software levels of that plane. The MT simply selects the tail number of the plane and GPMAID loads that model.

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History:

In recent times the A/C maintenance environment trend has been to reduce costs by use of computer automation tools. These tools aid the Maintenance Technician by providing assistance in the detection, diagnosis and repair of A/C systems. Generally, these tools consist of automated A/C forms, electronic Technical Orders and expert system flight data diagnostic tools. The desired effect of these tools is to reduce manpower, increase MT efficiency, reduce RTOK rates and increase A/C readiness rates. In short, the AF is trying to provide better maintenance with smaller budgets. The usefulness of these computer based tools is highly dependent on the data available, user interface, program capabilities and skill level of the MT. Unfortunately, to the companies who have the greatest access to A/C data needed to build such software tools, the PMA is a double edged sword. On one hand, future aircraft contracts will heavily weighed by the estimated maintenance costs, thus a good PMA is a must. On the other, if the PMA devices for older aircraft really do work well, then the AF will reduce maintenance costs all across the maintenance process. This will, in turn, reduce maintenance related profits for the prime contractors.

Currently, each SPO is trying to develop these tools for their A/C to reduce their costs. This translates into multiple tools performing basically the same job and each of them having their own software development, training and maintenance costs. The obvious solution to this is to develop a Generic PMA device for all A/C and have it developed by someone other than an aircraft manufacturer, and the design driven by AF MT and COTS software/hardware.

MACRO Industries is a small business that has already developed a prototype of the GPMAID concept. Working as a subcontractor to Boeing at Tinker AFB, we produced a prototype PMA for the B-1B NAV/ORS subsystem in 6 months for $150k. The B-1B PMA prototype has been demonstrated to ACC in addition to several B-1B bases and all were impressed with the concept with exception of the Rockwell people who are developing the DDS system. The six-month period of performance does not take into account the design of the GPMAID concept, it only proved that the data driven object orientated approach worked and worked well. MACRO Industries has spent several years collecting information and devising the GPMAID approach. MACRO Industries wrote a couple of white papers discussing the subject for Boeing and began the process of researching ways to use laptops, MS Windows products for A/C line maintenance. Two years later, Boeing gave MACRO Industries a contract to prototype our GPMAID concept for the B-1B NAV/ORS system in a limited manner. Boeing provided MACRO Industries with the information/data needed to build the limited B-1B aircraft data model. The B-1B model consisted of MS Access tables which replicated the B-1B architecture, figure 1 illustrates the GPMAID interface for the B-1B at the A/C system level. None of the B-1B attributes were hard coded into the GPMAID program. This tool loads the database tables defining the Aircraft systems, subsystems, NAV/ORS subsystem including flight data and the correlation of fault codes to T.O. sections. In this prototype, The B-1B NAV/ORS T.O. sections were displayed using MS dynamic data exchange (DDE) and the Dynatext program.

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Figure 1 – B-1B PMA system level interface, Failure in AVIONICS

The end result was a data driven visual based GPMAID tool which the MT can easily use. In the case of the B-1B, the MT selects the plane (Tail #) and recent flight file with a mouse and graphically reviews the flight data. The MT then connects the B-1B GPMAID to the aircraft using a 1553b interface and conducts real time ground maintenance while recording the ground maintenance data. The flow of the interface is based upon the architecture of the AC. The MT graphically sees the flashing failures occur in a direct or hierarchical manner of System, Subsystem, LRU and SRU with all of the technical data necessary to diagnose and resolve the flight reported failure. The B-1B GPMAID prototype has been demonstrated at several B-1B bases, ACC and to the IMDS IMIS working group. In all of the hands on sessions, the MT had no trouble using the tool. In most cases, they wanted to take to the plane and start using it.

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