

Aircraft Battery Maintenance Automation

Posted: March 4th, 2005 04:23 PM EDT

Online feature

Aircraft Battery Maintenance Automation

By Scott Marvel

July 2004

While enjoying his morning cup of coffee, Bob boots-up his PC while a new nickel-cadmium battery arrives in the battery shop for deep cycle. He scans the battery's bar code, opens up an electronic work order, and starts his incoming inspection. The battery looks good, so Bob powers-up the charger/analyzer and clicks the analyze button on the screen.



The controller signals the charger/analyzer with the correct charge current from the battery database, and the top charge begins. Bob scans another battery while waiting for the battery management system to alert him all cells have reached the correct charge voltage. Then he uses his automatic watering system to record the amount of water added to each cell in the electronic work order via a wireless link.

Welcome to the next generation of aircraft battery maintenance automation. In the September 1995 AMT article, "A New Approach to Battery Maintenance, State-of-the-Art Documentation", I wrote about the importance of proper documentation and new tools for monitoring and printing battery service data. Now, advances in computers, data acquisition, and closed-loop control technology have made it possible to truly automate the battery shop.

Benefits to automation

Experienced technicians understand the importance of quality, efficiency, and productivity. The days of egg timers and clipboards are finally over.

How many times have you missed a critical capacity check reading? During the capacity check, it is necessary to measure each individual cell near the end of discharge to confirm all cell voltages are 1.00 volts or higher. When a capacity check is missed because you are not in the area, do not hear the timer go off, or are busy taking manual cell voltage readings on another battery, time is lost while the battery is recharged and the capacity check is run another time. Automation solves this problem by taking the required readings at the appropriate times and automatically recording the results.

Using a PC-based battery management system, technicians can see a digital picture of the battery shop including which batteries are connected to each charger/analyzer, processing status, and real-time servicing data including cell voltages, charge/discharge current, battery temperature, and amp-hour capacity. See Figure 1. This allows technicians to set priorities, make critical decisions in a timely manner and maximize productivity.



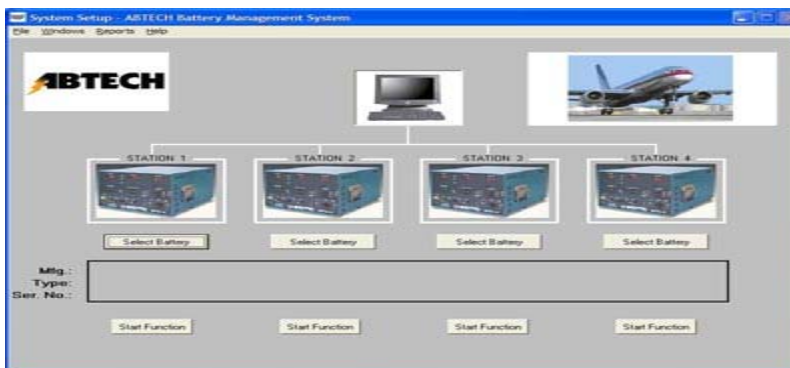


Figure 1 (click image for larger view)

Individual cells are continuously monitored and analyzed for common fault conditions such as gas barrier damage, elevated voltages, reversed polarity or out of balance condition. Bob can't possibly monitor each individual cell at all times for these common fault conditions as precisely and efficiently as a battery management system. Early detection of common cell fault conditions can reduce battery maintenance costs. For example, a cell with gas barrier damage can be identified early enough for removal before adjacent cells are damaged.

Using a battery management system also creates a consistent, structured battery-processing environment, compliant with the battery manufacturer's component maintenance manuals and regulatory requirements.

Since all servicing results are logged in a central database, technicians have visibility into a battery's entire servicing history. See Figure 2. Training is also standardized so new technicians can be brought up to speed quickly.

Manufacturer	Type	Part Number	Serial Number	Aircraft Type
Serial Number	Station Number	Status	Start Date	Start Time
Task	Status	Date	Time	Summary
MARATHON	3690296503-7	30949-001	10200910	MC600
10200910	1	Complete	10-Mar-04	11:01:45 AM
10200910	1	Complete	31-Jan-04	02:41:59 PM
10200910	1	Complete	30-Jan-04	05:58:25 PM
10200910	2	Complete	16-Jun-03	11:41:39 AM
Charge	Complete	18-Jun-03	08:05:18 AM	top charge
Charge	Complete	17-Jun-03	12:38:52 PM	main charge
Discharge	Complete	15-Jun-03	05:44:40 PM	capacity chg
Charge	Complete	16-Jun-03	11:42:11 AM	top charge
Charge	Stopped by user	15-Jun-03	11:41:41 AM	top charge
Charge	Complete	16-Jun-03	01:42:38 PM	top charge
SAFT	NICAD	40208-2	K01170	EC155B
SAFT	4076	015580000	081997	QI
SAFT	4078-3	NA	AF492	CL601
SAFT	1606-1	18624	39177	AS350
SAFT	1606-1	018624000	064883	AS350
SAFT	NI-CAD	1606-1	A00040	AS350
SAFT	NI-CAD	151CH1	L01151	EC130
SAFT	NICAD	151CH1	G03798	AS350
SAFT	NI-CAD	40178-24	113915	CL601
SAFT	4078-3	20583	55008	CL601
SAFT	1606-1	018624-000	095843	AS350
SAFT	1606-1	11109524/1606-1	78678	CL601

Figure 2 (click image for larger view)

A battery management system can provide water consumption and performance tracking by battery, fleet type, or aircraft tail number. This information can be used to support increased maintenance intervals on new low-maintenance battery designs, reducing annual battery maintenance costs.

Automation streamlines battery processing, increases productivity, and provides trained technicians with the necessary information to make informed battery servicing decisions.

Charger/analyzer controllers

Charger/analyzers are generally operated by manual front panel controls. It is necessary for the technician to

set the operating mode, time, current, number of cells, and other parameters. Then as the battery moves through the servicing process, the front panel controls must be continually reset as needed.

It is now possible to use a controller to take command of the charger/analyzer with a PC interface, providing the necessary digital control inputs and outputs for battery processing. As the battery is being charged or discharged, the controller continuously monitors the battery being processed, and quickly makes the necessary adjustments. This process is called closed-loop control, and is used in many modern automation and control systems.

Figure 3

A typical controller is shown in Figure 3. Preprogrammed service routines allow the user to select common battery servicing tasks for automated battery processing in accordance with the battery manufacturer's recommendations.

A controller expands functionality of the charger/analyzer, automatically loads the proper charge/discharge currents, eliminates continual re-setting of front panel controls, and improves accuracy of current and voltage metering. It also makes it possible to create unique charge/discharge scenarios, or profiles, and adapt to new charging methods, making the charger/analyzer compatible with future maintenance procedures and battery technology.

The controller shown also features built-in battery data acquisition capability for precision monitoring of individual cell voltages, charge/discharge current and battery temperature.



Figure 4

Automatic watering systems

Figure 4 shows a popular automatic watering system. Technicians find such a system quite useful to add distilled water to each cell quickly, while recording the exact quantity of water added for hard-copy printout or transmission to a PC.

Designed for vented nickel-cadmium batteries, the system reduces filling and documentation time to only two to three minutes per battery. An adjustable feeder is provided to suit various battery types.

Battery management systems

A battery management system is a PC-based software application which displays and logs battery servicing information collected from data acquisition hardware, has a central battery database, and provides work order tracking and reporting capabilities.

The ABTECH battery management system (ABMS) is an excellent example of a state-of-the-art, fully integrated, automatic aircraft battery servicing solution. Figure 5 shows a block diagram of the system, which is expandable up to 32 battery servicing-stations.





(click image for larger view)

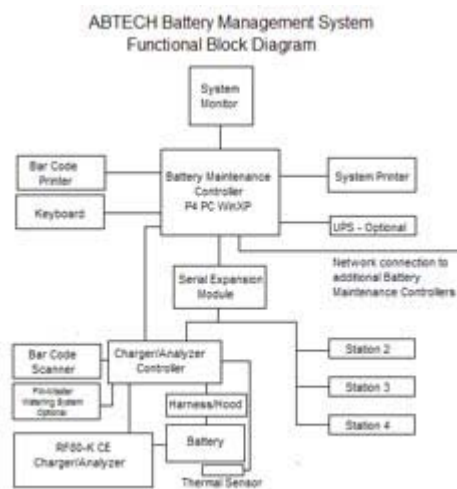


Figure 5 (click image for larger view)

The system features automatic remote PC control of the popular RF80-K charger/analyzer, real-time monitoring of battery and cell data, storage of critical battery servicing information in a central database, and access to various battery management reports. The system includes the AB3000 controller with Aero-Panel PC Interface, ABMS software (WIN XP), Universal cell scanning harness, interface cables and operator's manual.

Optional items include a preconfigured and customized Pentium 4 PC, Fill-Master automatic watering system, custom battery hoods, bar code reader, bar code scanner, serial expansion module, and battery temperature sensors.

What's next?

Stay tuned for more developments in automation and battery management technology such as remote control and system diagnostics using the Internet, centralized battery databases for multiple locations, new charging methods, and service routines for emerging battery chemistries.

Scott Marvel is general manager of ABTECH North America, Lake Forest, CA, (949) 829-8264, www.abtech.aero.

Printable version may be for personal use only. Content may not be duplicated, re-used or otherwise replicated without expressed, written consent from AMTOnline.com and/or the original author/source.

Visit AMTOnline.com daily for the latest industry news, commentary, features and more.