

WEST MOUNTAIN RADIO

Computerized Battery Analyzer

Get answers to your battery questions, and more

by Tom Atwood and Rolly Siemonsen

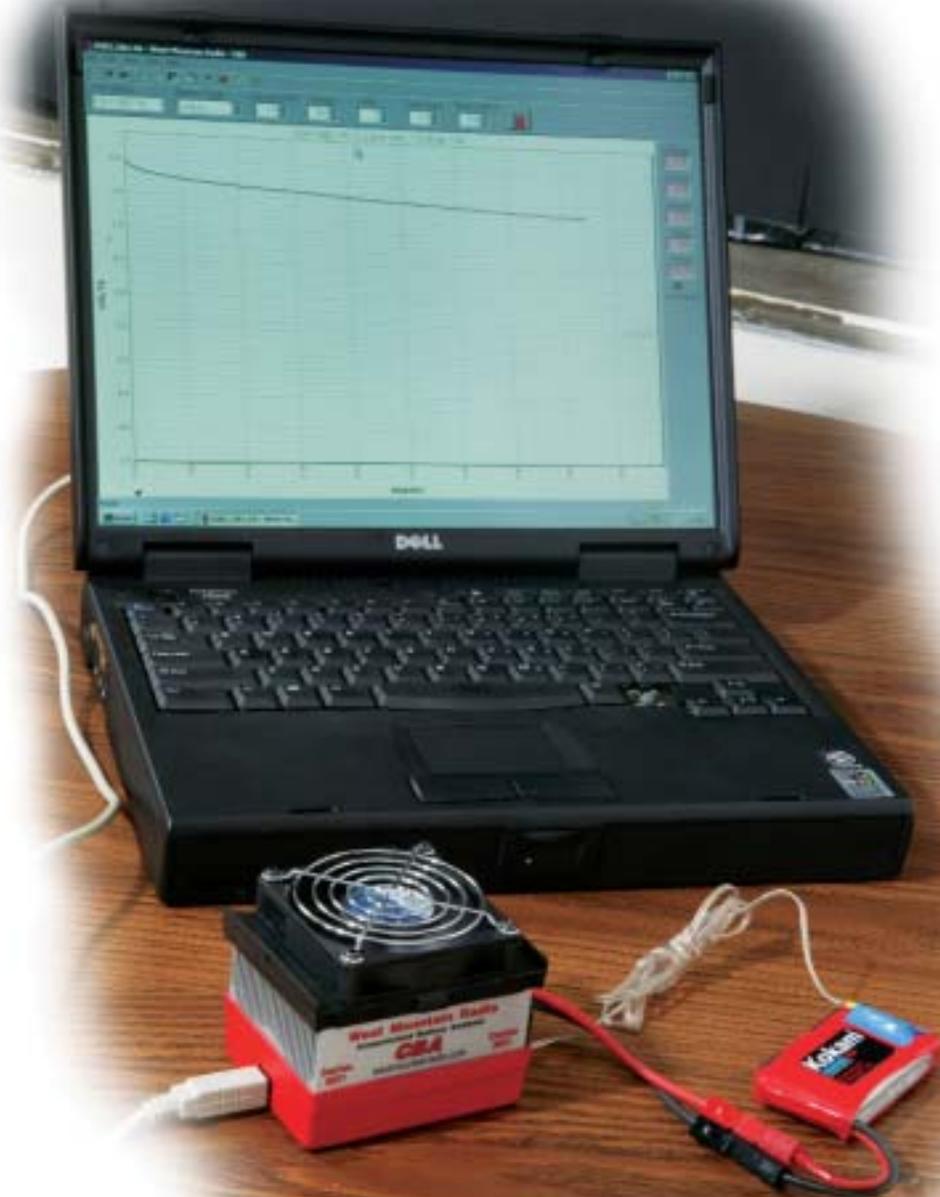
The West Mountain Radio Computerized Battery Analyzer (CBA) reveals the secrets our batteries have been harboring. The CBA can help you answer questions such as, How rapidly will the voltage of a radio flight pack drop off when it nears depletion? Which of your radio flight packs are performing the best, and do you have any fatigued ones that should be reserved for lower priority uses or replaced? Do some new Li-Poly battery brands offer better performance than that of others? Exactly how much better? Which batteries are best in terms of energy per ounce of weight at the current levels you will be draining them? Which of your packs are best suited to power a digital servo flight system?

The questions are many, and the answers the CBA provides will help you safeguard your modeling investments and improve the performance of your electronic and e-power systems. Once you start using the CBA, you will wonder how you got along without it.

In this review, we will comment on the CBA's specs and measuring accuracy, the simple steps you take to operate the unit, and how you can best organize the discharge curves it generates. Because you can overlay two or more curves on a single graph, you can combine different tests in different ways to make some very interesting comparisons.

USING THE CBA

After installing the CBA's software on your PC, connect the CBA to the USB port and open the CBA program. You will see some blank fields arrayed across the top of the screen. First, type in a battery test name. If you follow the suggested battery labeling and file folder organization described later for tracking battery tests over time, you may wish to incorporate the following in the test name: Type in the name of the battery, its chronological number,



its capacity in amp-hours, the discharge rate, and the date. For example, you might type: "TP1.32(1)@5A, 1-11-04."

Next, select the correct battery chemistry with the drop-down menu (you can choose from lead acid, NiCd, NiMH, Li-Ion, Carbon Zinc, Alkaline and Li-Poly). Finally, select the capacity of the battery.

The CBA's electrical limits are 48 volts, 40 amps and 150 watts. If battery capacity is less than one amp-hour, the CBA will test up to 150 watts. If battery capacity is above one amp-hour but below 3.5 amp-hours, the CBA will only test to 125 watts. If the battery capacity is 3.5 amp-hours or greater, the unit has a ceiling of 100 watts.

Connect the battery and you'll see that the resting battery voltage is displayed at the top of the screen. The CBA will estimate the number of cells. If it is incorrect, make the necessary adjustment in the cell count field at the top of the screen. Next, choose the test load current. If you are using the optional temperature probe, you can now calibrate it by dropping down the Edit menu and inputting the temperature in either Fahrenheit or Celsius. You can also adjust the default cutoff temperature (140°F).

The CBA discharge graph displays voltage on the vertical scale and amp-hours horizontally across the bottom.

Hit the start button and you'll see the trace begin across the auto-scaling graph. As the discharge in amp-hours increases, the amp-hour scale at the bottom of the screen self adjusts. When the discharge voltage hits the cutoff point (automatically assigned, but you can adjust it), the screen freezes and the test is done. Now save the plot. If you choose not to specify the file name, it defaults to the test name you initially entered.

After accumulating multiple tests, you can use the File dropdown to open a battery test curve, and then open additional curves using the Overlay function in the same menu. Each curve is overlaid in a different color. You can toggle on a "Legend" at any point in a test. It lists out the test or tests on the right of the screen. If you have overlays, the legend entries are color coded to match the colored overlays. Now you are ready to evaluate your test results!

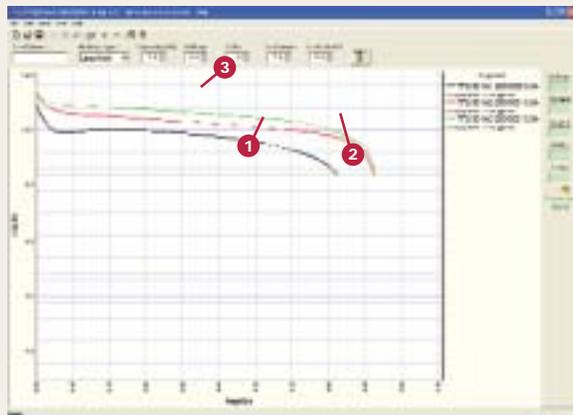
The CBA prints out test curves in color or black and white. Black and white curves have different line treatments so that you can easily distinguish overlaid curves. The CBA also permits easy printing of labels for your batteries. The program is very simple to use and the help screens are detailed and clear. The folks at West Mountain are also very "user friendly" if you have any questions.



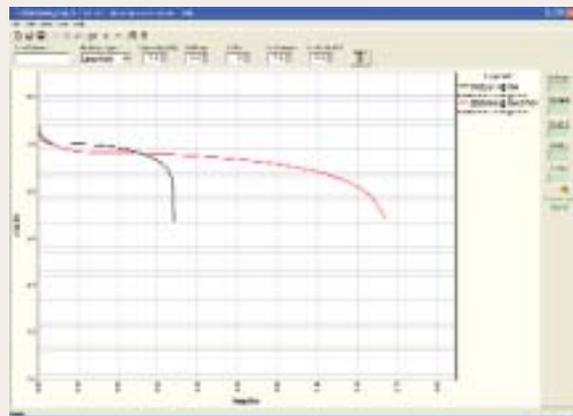
Securely tape the temperature probe to a Li-Poly battery. This holds the temp probe in place and isolates it from the cooling effects of the surrounding air. A magnetic tip in the probe holds it against the metal cell walls of nickel batteries.



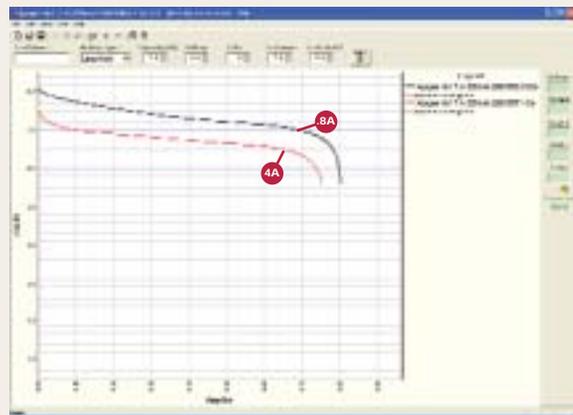
It is a good idea to label your batteries and to create folders on your PC that help organize test results.



The first, second and third of these Thunder Power packs were purchased and run over the course of the last year. In that time, battery chemistry was improved, and the older packs were cycled multiple times. Note how pack number three, the most recently purchased, outperforms the older packs.



The black trace is from a 12 oz. 6-cell 1400mAh NiCd battery that is about a decade old. The red trace represents a modern 13 oz. 6-cell 2800mAh NiMH pack.



Note how the "1C" .8A test load (black) resulted in higher voltage and additional capacity as compared to the approximately "5C" test at 4A.

SPECS

PRODUCT: Computerized Battery Analyzer

ELECTRICAL LIMITS: 48V, 40A, 150W

COMPUTER REQUIREMENTS: USB port for Windows 98SE, ME, NT, 2000 or XP. A Pentium 333 or better is recommended

INTRODUCTORY PRICE: \$89.95, CBA; \$9.95, optional temp probe

LAB GRADE

We tested the CBA's accuracy by simultaneously measuring volts, amps, watts and temperature with other laboratory-grade precision instruments. We found that the temperature probe, which can be calibrated at the start of each test, has a reporting delay of a few to several seconds, yet it was consistently within three degrees of the actual battery temperature as measured by a Fluke lab-grade thermocouple. Temperature differences of only a few degrees are generally of no significance—it's the progressively escalating temperatures spanning tens of degrees of which you'll want to be aware. Given that many "conservative" modelers using Li-Poly packs stop battery testing if the temperature exceeds 140° Fahrenheit (60° Celsius), the temperature probe provides as much accuracy as you will likely ever need.



Note data reported on the right side of the screen during a test.

A laboratory grade, professionally calibrated Fluke voltmeter and current shunt were used in conjunction with a new Astro Flight Whattmeter to measure voltage, current and capacity in amp-hours. The capacity measurements in our tests were within .03% (one third of one percent) of those recorded by the Whattmeter in tests of batteries ranging in capacity from 600mAh to

2100mAh. Voltage and amps measured by the CBA and Fluke instruments varied by less than a percent. Del Schier of West Mountain noted that the final upgrades in software and firmware improved the accuracy of the CBA beyond even their initial expectations. This is "lab-grade" gear from a modeler's perspective, as any measuring error would appear so small as to be inconsequential.

FILE MANAGEMENT TIPS

Although the CBA can give you a snapshot in time of a battery's health, you'll want to be able to test a pack repeatedly over time to track its performance after repeated charge-discharge cycles. You may also wish to compare its performance with other batteries of the same or similar voltage and capacity.

Because you can overlay any recorded curve on one or more additional plots, it makes the most sense to store each test individually and to embed relevant test information in its file name. Batteries should also be properly labeled to facilitate retesting over time. The following tips will help you organize your approach if you anticipate testing a number of batteries.

BATTERY ANALYZER BENEFITS

- Accurately determine battery performance: Tests show that the CBA's error rate for volts, amps, watts and amp-hours is less than 1%.
- Monitor battery aging: Establish a baseline for a pack so that all subsequent tests on that pack can be compared to the original baseline graph. By keeping test records over time, you can accurately determine the useful life of a given battery. This will help you purchase the best batteries for your needs.
- Compare multiple test results on one graph: "Overlay" saved test curves onto a currently displayed graph for the purpose of data evaluation. This provides immediate insight into the comparative performance of different batteries.
- Diagnose problematic connectors and solder joints: Suspected intermittent battery packs, broken welds, bad solder joints, broken wires and the like can be made obvious by flexing the wiring and connectors during a test while looking for voltage excursions in the test graph. Bad connections cause jerky, wavering or rough test curves.
- Find the maximum practical discharge current: Perform tests under different



loads to determine the maximum discharge current at which a particular battery can be operated.

- Safe testing—automatic temperature monitoring and cutoff: The "over temp" cutoff feature using the optional temperature probe is a very desirable feature when discharging packs at high rates so that maximum pack temperatures can be kept under control.
- Match cells and balance packs: By testing individual cells, you can build a pack of matched cells, or determine whether an existing pack's cells are properly balanced. If a pack is out of balance, you can determine whether it is merely a charging issue or if there are true differences in the performance of individual cells.
- Accurately determine true energy density: By dividing grams or ounces into the measured watt-hours produced by a battery, you can see which battery offers the most "punch" for its weight.

Let's start with the file structure in your PC. By default, the CBA saves files to your Documents folder. First, create a "Battery Tests" folder. In that folder, create subfolders by battery type (NiMH, Li-Poly, etc.). Next, within a battery type folder, create folders by battery brand (e.g., for Li-Poly cells, Apogee, Kokam, Multiplex, Thunder Power, Tanic, etc.). Within a battery brand, create folders that are organized by battery voltage and capacity (e.g., 2S 7.4V 730mAh, 3S 11.1V 2100mAh, etc.). Within this folder, you will want to create subfolders for individual batteries.

Let's consider labeling of batteries. The very first battery you acquire of a given brand should be labeled as "No.1." For example, Acme (1) 7.4V 500mAh, 10-15-04. This shows that it is the first such battery of that brand and size that you have purchased, and the date indicates when you bought it. Subsequently purchased batteries of that brand and capacity should be labeled (2), (3), and so on. This enables you to compare the performance of any given battery over time (you can check battery (1) every three months for two years). You can also go back into your folder and compare contemporaneous tests.

Similarly, it makes sense for the specific subfolder for a particular battery to include its chronological number. How detailed you will want to get depends on your preferences. Some modelers will add the advertised discharge rate (e.g., "10C") to the label and/or folder name.

CONCLUSION

The West Mountain CBA is an ideal tool for evaluating the performance of your batteries, whatever their chemistry. It is an accurate and versatile test unit and is easy to use. At \$89.95, we consider it a bargain. The optional temperature probe (\$9.95) is a nice touch that you will also value. If you plan to test maximum discharge rates, you will need to use the temperature probe. The CBA is likely to become a mainstay for modelers who care about the performance of their batteries. ☺

Links

West Mountain Radio,
www.westmountainradio.com, (203) 853-8080.

For more information, please see our source guide on pg. 177.