

# Meeting Minutes

Re: Battery Condition Monitoring Workgroup Teleconference

Date: May 2, 2001

## LIST OF PARTICIPANTS:

Michael Cox, *Midtronics*  
Dell Crouch, *Delphi*  
Gary DesGroseilliers, *MIT*  
Thomas Dougherty, *Johnson Controls*  
James Geraci, *MIT*  
Hans-Michael Graf, *Siemens Automotive*  
Henry Huang, *Ford*  
Alan Jacobs-Cook, *TRW*

Richard Johnson, *Bolder Technologies*  
Scott McCaskey, *East Penn*  
Michael Mullin, *General Motors*  
Thirumalai Palanisamy, *Honeywell*  
Christophe Picod, *Valeo*  
Hans-Peter Schöner, *DaimlerChrysler*  
Indermohan Sethi, *Siemens Automotive*  
Alan Williams, *TRW*

## AGENDA

- Dell Crouch →
- Tom Dougherty →
- Agreement Topics and Status →
- Future Meetings →

## DELL CROUCH

Dell Crouch talked about the need to more concretely define the purpose of this workgroup. A copy of his presentation materials can be found on the workgroup's web page →. Crouch indicated that there is no preferred technique for battery monitoring and different approaches might be possible. Therefore, he feels that this workgroup should be limited to deciding the battery parameters that need to be collected in order for some proprietary control system to be able to intelligently perform some battery monitoring function and the physical interface necessary to transmit those parameters to that control system. He also feels that OEMs should define specific requirements for the monitoring device.

### DISCUSSION:

Palanisamy..... believes the group should be limited to discussion of parameters. Also called attention to Honeywell (Allied Signal) United States patents [4,937,528](#) issued in 1990 and [5,281,919](#), issued in 1994<sup>†</sup>. Also feels that the 2 main concerns when dealing

---

<sup>†</sup> Please direct all licensing inquiries to Robert Saccomanno, Licensing Manager, Defense and Space Systems, Honeywell International Inc., 699 Route 46 East, Teterboro, NJ 07608-1173 Tel: 201-393-3589

with battery monitoring are: 1) predicting starting failure 2) predicting power failure for safety devices.

Mullin..... Agrees that group should be limited to discussion of parameters.

Schöner ..... details such as the required capabilities for the monitoring device are going to be proprietary. Therefore, the group should focus on defining parameters that would allow the description of the behavior of a new battery.

Dougherty ..... parameters should be universal enough to accommodate future functions of a battery monitoring system so that OEMs can decide what to do with those parameters. Would like to make sure that the parameters do not describe the electrochemical properties of the battery, but instead provide mathematical descriptions about the state of the battery.

Dell..... questioned whether or not a real-time on-board battery model was needed

Dougherty ..... the on-board battery monitoring system need not be a complete real-time electrochemical battery model but the parameters that it uses should be compatible with more detailed models.

Dell..... does not necessarily agree that the parameters for a detailed battery model and an on-board diagnosis system need to be the same.

**Conclusion..... defined objective of the Battery Condition Monitoring Workgroup is not inconsistent with Crouch’s suggestion that we agree on battery parameters and interface methodology. His request for specific performance requirements by OEMs will be taken under consideration but might be considered proprietary.**

## TOM DOUGHERTY

Tom Dougherty gave a presentation about the scope of the battery parameters. He feels that the battery parameters should be general enough to provide for a calculation of State-of-Health and Deliverable Energy. The parameters should also be able to model aging effects and condition effects on the battery. Dougherty is also very concerned that the tests used to measure these parameters be simple, repeatable, and only electrical in nature. He is concerned that if electrochemical information about the battery had to be surrendered, battery manufactures would not agree to cooperate.

### DISCUSSION:

Mullin..... thinks the proposal sounds good, but has questions about the physical implementation in a dual-voltage system because of the physical interactions between parts of the system. Feels that “Deliverable Energy” is something that GM would definitely like to know.

Palanisamy..... had a question about what was meant by “aging parameters.” Dougherty responded by saying they are the perceivable electrical effects on the positive plate potential, negative plate potential, and grid conductor resistance.

Cox ..... indicated general concern about the correlation between physical battery design parameters and the final information reported to the OEMs’ monitoring systems.

Dell..... used complexity of Peukert’s curve as an example to argue that the model should be limited in function. Otherwise, the model will get to be too large and too complex.

**Conclusion..... further discussion of the detailed battery discharge parameters is needed in order to resolve differences in approach between previous presentations by Johnson Controls and TRW. Dougherty agreed to hold off-line discussion with TRW, Delphi, and Bolder Technologies to try and resolve those differences. He will report consensus opinion at next meeting.**

**AGREEMENT TOPICS AND STATUS:**

The status of topics under discussion by the BCM workgroup is summarized in the table below

Topic	Status
1. BCM Workgroup “Statement-of-Purpose” → and “Guidelines for Participants” →	Accepted without change
2. Battery discharge performance parameters to be encoded in 5-bits each, referred to as “Word-1”	Under discussion
3. Charging and life information of the battery would be encoded in separate set of parameters, “Word-2”	Under discussion
4. “Words” will be provided on a label or electronic chip.	Under discussion
5. Battery discharge performance parameters will include: Nominal capacity Peukert’s slope Charged voltage  OCV/SOC slope  Internal resistance  Ionic/electronic ratio  Kinetics Thermal time constant	Under discussion Under discussion Proposed alternatively to charged voltage and OCV/SOC slope would be acid concentration fully discharged and fully charged  Proposed alternatively to charged voltage and OCV/SOC slope would be acid concentration fully discharged and fully charged  Proposal to determine both internal resistance and kinetic resistance from a single experiment by fitting an equation with current and log (current) terms  Proposal to determine both internal resistance and kinetic resistance from a single experiment by fitting an equation with current and log (current) terms  Under discussion Under discussion

Topic	Status
6. Battery terminal standard should include 4 pins, two for power and two for sensing. The application of the sensing pins (e.g., temperature, disconnect, battery condition monitoring) will be determined later.	Accepted
7. OEMs will be asked to provide detailed performance requirements of a battery condition monitoring system	Under discussion
8. Test procedures for battery discharge performance parameters	Under discussion

### **FUTURE MEETINGS:**

1. The next meeting will be a teleconference on **Tuesday, June 5, 2001, from 6:00 p.m. until 7:00 p.m.** (United States Daylight Savings Time). At that time, Tom Dougherty will give a report on his discussion with Bolder, Delphi and TRW on the battery discharge performance parameters. The meeting was scheduled to begin at this time so that it would be convenient for Asian participants. As we discussed in Lisbon, we will rotate the timing of the meeting so the burden of an inconvenient time is equally shared among the participants in North America, Europe and Asia. Information about connecting to the voice and NetMeeting service will be provided prior to the meeting date.
2. A face-to-face meeting is also planned for **Friday, June 22, 2001, at the JCI office in Plymouth, Michigan, from about 10:00 a.m. until 3:00 p.m.**, including lunch. The purpose of this meeting is a detailed discussion of separate set of parameters for charging and life information. A teleconference voice line will be provided for the convenience of participants who are not able to travel.