requirements will be evaluated. Limited charge optimization studies will be undertaken to quantify the energy efficiency/capacity trade-offs and to establish optimized charging procedures. Battery temperatures under various operating conditions will be analyzed and recommended methods for proper thermal management will be defined. If appropriate, post-test analyses of failed cells will be conducted.

Recent publications

1 C & D Batteries Division of Eltra Corp., Final summary report — research, development, and demonstration of advanced lead–acid batteries for utility load leveling, Argonne National Laboratory, *Report ANL/OEPM-81-15*, March 1982.

2 K. Ledjeff, H_2O_2 recombination device for load-leveling lead–acid batteries, *4th DOE Battery and Electrochemical Contractors' Conference, Washington, DC, June 2 - 4, 1981.*

3 R. M. Meighan, D. R. Green and C. W. Fleischmann, Advanced lead–acid load leveling battery, *Progress in Batteries and Solar Cells, 3* (1981).

4 Varta Batterie Co., Cost/design study and fabrication /testing of a 300-W gas recombination device for utility lead–acid cells, Argonne National Laboratory, *Report ANL/OEPM-82-4*, May 1982.

ADVANCED LEAD–ACID BATTERIES FOR ELECTRIC UTILITY LOAD-LEVELING APPLICATION

Exide Management and Technology Company, 19 West College Avenue, P.O. Box 336, Yardley, PA 19067 (U.S.A.)

This project encompasses the research, development, and demonstration of advanced lead–acid battery technology with major goals of increasing cycle life of a utility-sized stationary lead–acid battery from the state-of-the-art of 2000 cycles to greater than 4000 cycles at reduced cost of $50 to $68/kW h (1977 dollars) and operating and maintenance cost of less than 0.5 mi/kW h. Phase I (3 yr) emphasizes the research and development of low-maintenance cells capable of long-lived cycle application. The reduction of cost and increased cycle life will be achieved primarily by R & D of improved active material, using low-corrosion grid alloy, electrolyte circulation, improving the separator retainer, and developing a subsystem for further reduction in battery maintenance.

In Phase I, accelerated testing of 156 cells with full-sized plates is nearing completion. In a continuous overcharge test at 50 to 55 °C, 24 400-A h cells have accumulated 127 000 A h overcharge at rates from 30 to 90 A.

Predictions from corrosion rates of positive grids measured in these cells by weight loss have shown that the ultimate positive plate grid in the load-leveling cell will corrode about 15 to 20 percent during 4000 deep cycles with 10 percent overcharge per cycle, but will not limit life. Twenty-four out of sixty 200-A h cell designs have reached more than 13 500 shallow cycles on a routine of 36 cycles per day at room ambient designed to accelerate positive material shedding. Eleven out of sixty 1800-A h cell designs subjected to accelerated testing at two cycles per day at 70 + 2 °C have reached the equivalent of 5610 cycles at 25 °C (1110 actual cycles) at 80 percent depth of discharge. Eight full-sized preprototype cells (3500-A h) have completed 500 cycles in ongoing testing. Cost analyses have yielded cell costs of $85/kW h (1982 dollars). Twelve full-sized preprototype cells were delivered to the National Battery Test Laboratory for verificational testing.

All Phase I R & D activities were completed at the end of 1982. Testing of eight full-sized cells will be continued and a statistical analysis of accelerated test methods and data will be conducted in 1983.

Recent publications

1 A. M. Chreitzberg, T. M. Noveske and W. P. Sholette, Accelerated deep cycling test for lead–acid load-leveling cells, *Electrochemical Soc. Meeting, October 11 - 16, 1981, Denver, CO.*

2 T. M. Noveske and A. M. Chreitzberg, Continuous overcharge accelerated positive grid corrosion test on lead antimony pasted flat plate cells, *Electrochemical Soc. Meeting, October 11 - 16, 1981, Denver, CO.*

3 J. C. Sklarchuk and A. M. Chreitzberg, Accelerated positive material shedding test for pasted flat plate lead–acid cells, *Electrochemical Soc. Meeting, October 11 - 16, 1981, Denver, CO.*

4 E. A. Wagner and W. P. Sholette, Correlation of accelerated test results to in-service cycle life, *Electrochemical Soc. Meeting, October 11 - 16, 1981, Denver, CO.*

NICKEL/HYDROGEN BATTERY DESIGN

The objective is to design a sealed 100-A h nickel/hydrogen battery for deep discharge, terrestrial applications that will be cost competitive with lead–acid batteries in a system designed for a 20-yr life. One such application is a solar energy system employing photovoltaic collectors. Technically, the nickel/hydrogen battery meets virtually all of the requirements for solar applications, but the cost of the aerospace quality cell is too high. The main thrust of this contract will be to reduce the cost without unduly compromising the desirable features such as long cycle life at high depth of discharge, high rate of charge and discharge, long calendar life, sealed design with no maintenance, capability to stand at a partial state of charge without degradation, and tolerance to cell reversal and overcharge.

A contract for this project is being negotiated.