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NICKEL-HYDROGEN CAPACITY LOSS ON STORAGE

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Nickel-hydrogen batteries are rapidly becoming accepted for use in low-earth-orbit and geosynchronous orbit applications. With their increased use it has become evident that the storage procedures commonly used for nickel-cadmium cells are not adequate for the nickel-hydrogen system. Frequently cells that have been stored, under varied conditions, have exhibited a significant loss of capacity. However, due to variations in test and handling procedures, much of the data available on capacity loss has been confusing and often conflicting. As a result, members of the Electrochemical Technology Branch at the Lewis Research Center conducted a controlled determination of the capacity loss exhibited by nickel electrodes from various manufacturers when exposed to different storage conditions.

A comprehensive test matrix was developed to evaluate capacity loss in nickel electrodes from four different manufacturers. Two types of tests were run; individual electrode tests, which involved flooded capacity and impedance measurements before and after storage under varied conditions of temperature, hydrogen pressure, and electrolyte concentration; and cell tests which primarily evaluated the effects of state-of-charge on storage. The electrode tests were run using electrodes from Hughes, Gates Aerospace Batteries, Whittaker-Yardney, and Eagle-Picher Industries, Inc. - Joplin. The cell tests were run only with Hughes electrodes. The cell tests evaluated capacity loss on cells stored open circuit, shorted and trickle charged at C/100 following a full charge.

The results indicate that capacity loss varies with the specific electrode manufacturing process, storage temperature and hydrogen pressure. In general, electrodes stored at low temperatures or low hydrogen pressures exhibited a smaller loss in capacity over the twenty-eight day storage period than those stored at high pressure and high temperature. The capacity loss appears to correlate with the level of cobalt in the nickel electrode, with the most significant loss of capacity occurring in electrodes with higher cobalt levels. Impedance measurements appear to correlate well with the capacity loss observed for a given type of electrode but do not correlate well with the capacity loss between electrodes fabricated by different manufacturers. There was a definite correlation between the electrode potential measured immediately following storage and the measured capacity loss.