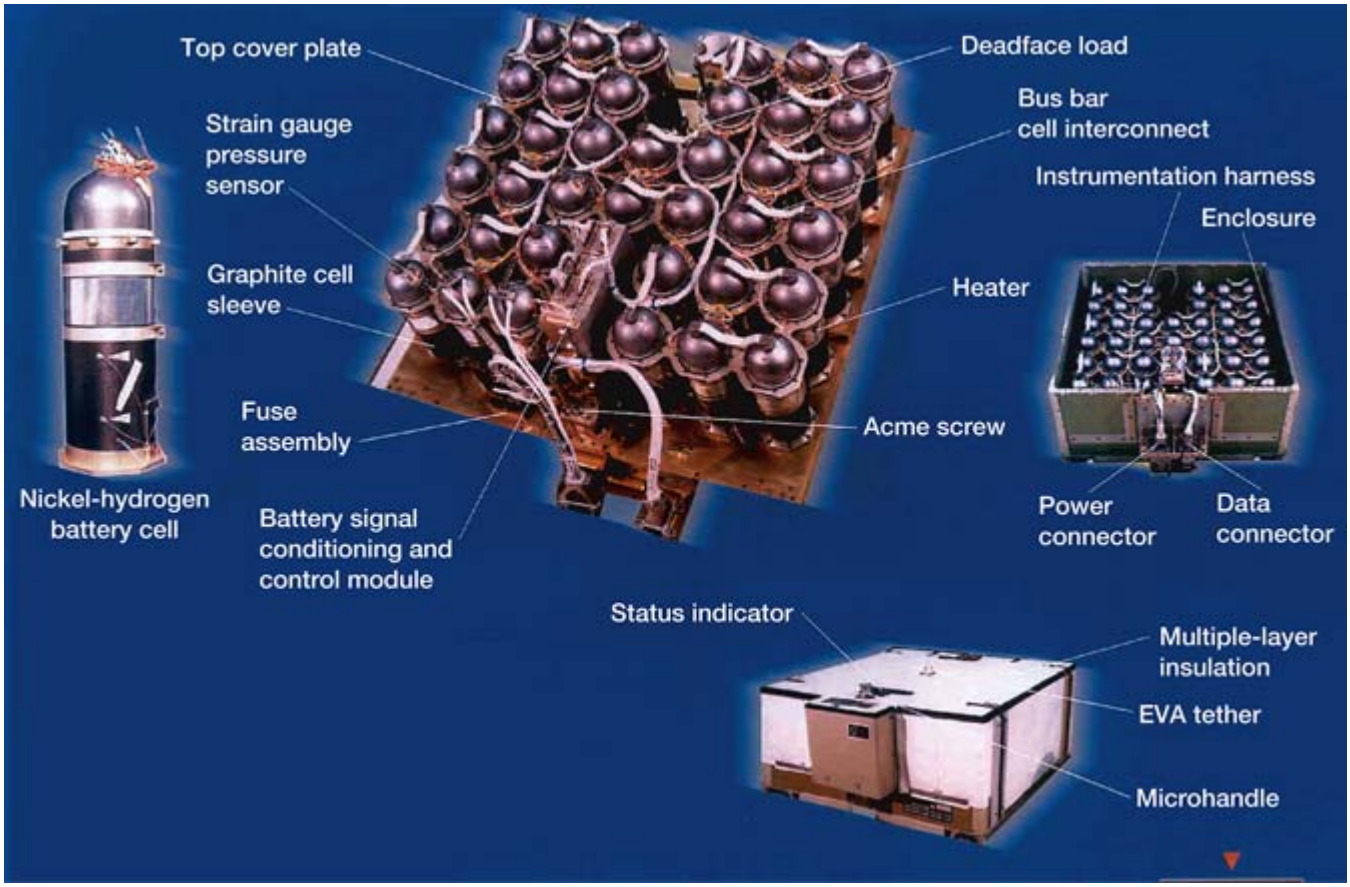
International Space Station Nickel-Hydrogen Batteries Approached 3-Year On-Orbit Mark

The International Space Station's (ISS) electric power system (EPS) employs nickel-hydrogen (Ni-H_2) batteries as part of its power system to store electrical energy. The batteries are charged during insolation and discharged, providing station power, during eclipse. The batteries are designed to operate at a maximum 35-percent depth of discharge during normal operation.

Thirty-eight individual pressure vessel Ni-H_2 battery cells are series-connected and packaged in an orbital replacement unit (ORU), and two ORUs are series-connected, using a total of 76 cells, to form one battery. When the ISS is in its assembly-complete form, the electrical power system will have a total of 24 batteries (48 ORUs) on-orbit. The ISS is the first application for low-Earth-orbit cycling of this quantity of series-connected cells.



ISS battery subassembly ORU.

Long description. Illustration showing nickel-hydrogen battery cell, top cover plate, strain gauge pressure

sensor, graphite cell sleeve, fuse assembly, battery signal conditioning and control module, acme screw, heater, bus bar cell interconnect, deadface load, instrumentation harness with power connector and data connector, and status indicator, muliple-layer insulation, EVA tether, and microhandle.

Each battery ORU was designed to meet the following requirements:

- 6.5-year design life (38,000 charge-discharge cycles)
- 81-A·hr, 4-kW·hr nameplate capacity
- Contingency orbit capability consisting of one additional orbit at reduced power after a 35-percent depth of discharge without recharge
- 5-year mean time between failure
- Easy on-orbit replacement, utilizing the robotic arm

The cells selected for use in the battery ORUs are manufactured by Eagle Picher Technologies. They are RNH-81-5 EPI individual pressure vessel NiH_2 cells that have a back-to-back plate configuration. They were activated with a 31-wt% aqueous solution of potassium hydroxide electrolyte. The ORUs were assembled and acceptance tested by Space Systems/Loral.

The first set of 12 battery ORUs was integrated into the P6 (port side) integrated equipment assembly (IEA) and was successfully launched on November 30, 2000. The on-orbit battery cycling started in early December 2003. The remaining 36 battery ORUs have been delivered to the Kennedy Space Center and have been integrated into the next three IEAs, which are awaiting launch in 2004 and 2005.

The telemetered on-orbit data clearly show that the batteries are performing within their design specifications over the operational range. Because of the lower-than-anticipated power demands of the station, the P6 battery life is expected to meet or exceed the ISS 6.5-year life requirement.

All aspects of the ISS battery hardware, including design, development, assembly, test, and operation, are managed by the NASA Glenn Research Center. In addition to the current battery, Glenn is investigating advanced technologies as future replacements for the ISS.

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