November 28 - 30, 1995
Huntsville, Alabama
The Huntsville Hilton
The 1995 NASA Aeronautics Battery Workshop

Marshall Space Flight Center, Alabama
NASA George C. Marshall Space Flight Center
J. Brewer and L. Jackson

Redondo Beach, California
Tri Space and Electronics Group
C. Lurie and S. Foroozan

During Low Rate Trickle Charging
Nickel-Hydrogen Battery State of Charge
Background

Pre-Launch Ambient Environment

Temperature during low rate trickle charging in a simulated
battery workshop and low rate trickle charging was discussed at
the 1995 IEC conference. The adiabatic charging technique was presented at the 1994 NASA
low rate trickle charging

- Adiabatic charging, and

Cooling, utilizing

of charge can be achieved and maintained in the absence of active
the overall conclusion of these investigations is that high state
launch operations, in the absence of active cooling

The AXAF-I program has been investigating techniques for managing

Cont'd
BACKGROUND
Battery would experience in the spacecraft, during operations. This characteristic was designed and fabricated. Accordingly, a six-cell module, simulating battery mounted in a structure simulating the thermal environment. To the ambient air is difficult to model. Heat transfer from the battery, as integrated into the axaf-1 battery mounting configuration provides.

Battery heat capacity, dissipation, and cooling. Prediction of battery temperature requires knowledge of state of charge and a strong function of temperature. The ability to predict battery temperature is important.
<table>
<thead>
<tr>
<th>CELL PART NUMBER</th>
<th>TEST CELL DEFINITION</th>
</tr>
</thead>
</table>

- **Precharge**: Weight (gms)
- **Terminal Configuration**: Axial
- **Strain Gauge**: Yes
- **Operating Pressure (psi)**: 475
- **Electrolyte (% Final)**: 31
- **Separator**: Zircar, 2 Layers
- **Positive Electrode**: 0.030" Slurry
- **Stack Configuration**: Back-to-Back
- **Rated Capacity (Ah)**: 30

**Flight Battery Steady State Thermal Characteristics**

Testing was performed on a six-cell module designed to simulate

**Test Articles**
TRICKLE CHARGE TEST SET UP

SIX-CELL MODULE
Temperature Increase
C/500 Rate Trickle Charge
STEADY STATE CAPACITY
C/500 RATE TRICKLE CHARGE
STeady State Capacity

C/250 Rate Trickle Charge
Function of trickle charge rate and temperature
Steady state capacity
TEMPERATURE DATA
OPEN CIRCUIT STAND
Temperature Increase As a Function of Trickle Charge Rate

Charge Rate (C/Ix)

For these cells is c/750 the self discharge rate
SUMMARY

ENVIRONMENT

Module in a test setup simulating the anticipated A/C and PWR has been determined experimentally, using a six-cell battery. Battery temperature increased due to low rate trickle charge.

TEST RESULTS INDICATE

- Test results indicate discharge.
- Trickle charge rates less than or equal to the self discharge.
- Significant trickle charge rates (~C/500) result in battery discharge.
- Temperatures only a few degrees (F) higher than observed.
- During periods of open circuit standby.

DURING PERIODS OF OPEN CIRCUIT STAND.