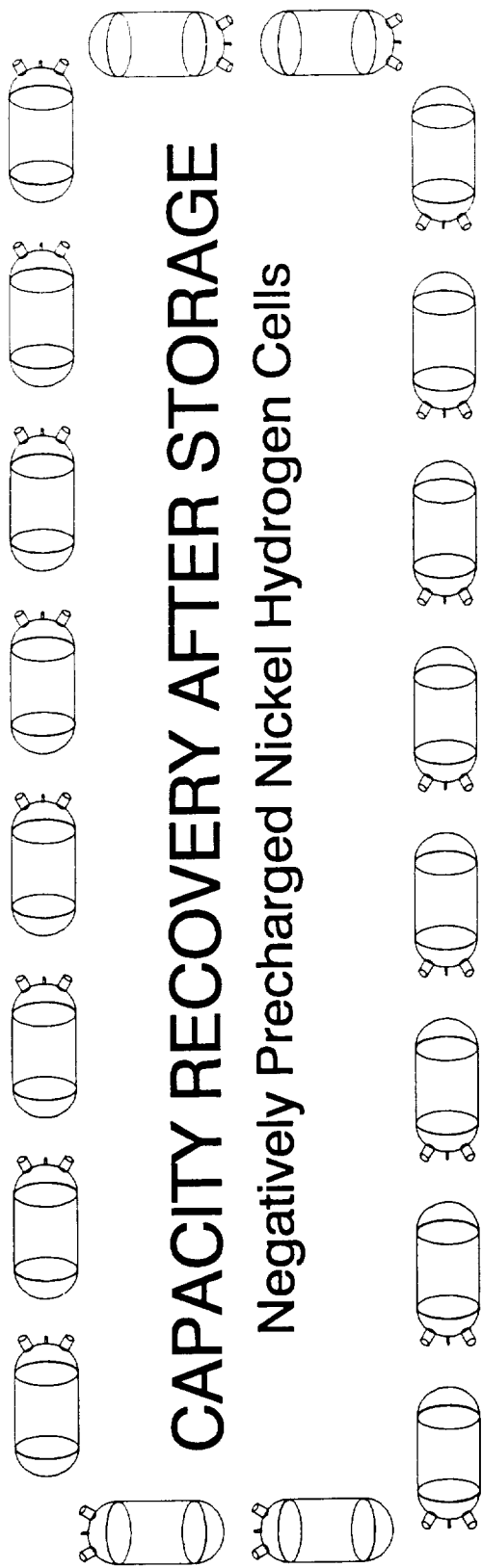


N 9 3 - 2 0 5 0 3



# CAPACITY RECOVERY AFTER STORAGE

## Negatively Precharged Nickel Hydrogen Cells

John E. Lowery  
 NASA, Marshall Space Flight Center



## Recovery of Capacity Lost During Open Circuit Storage of Negatively Precharged Nickel Hydrogen Battery Cells

- During Storage, NiH<sub>2</sub> Cells Experience Loss in Useable Capacity.
- Cells from all Manufacturers exhibit losses.
- Loss Due to Cobalt Migration?
- Extent of Migration and the Ability to recover are function of the Length of Storage Period.
- Attempt to quantify amount of useable capacity that may be recovered and propose a timely procedure for the recovery.

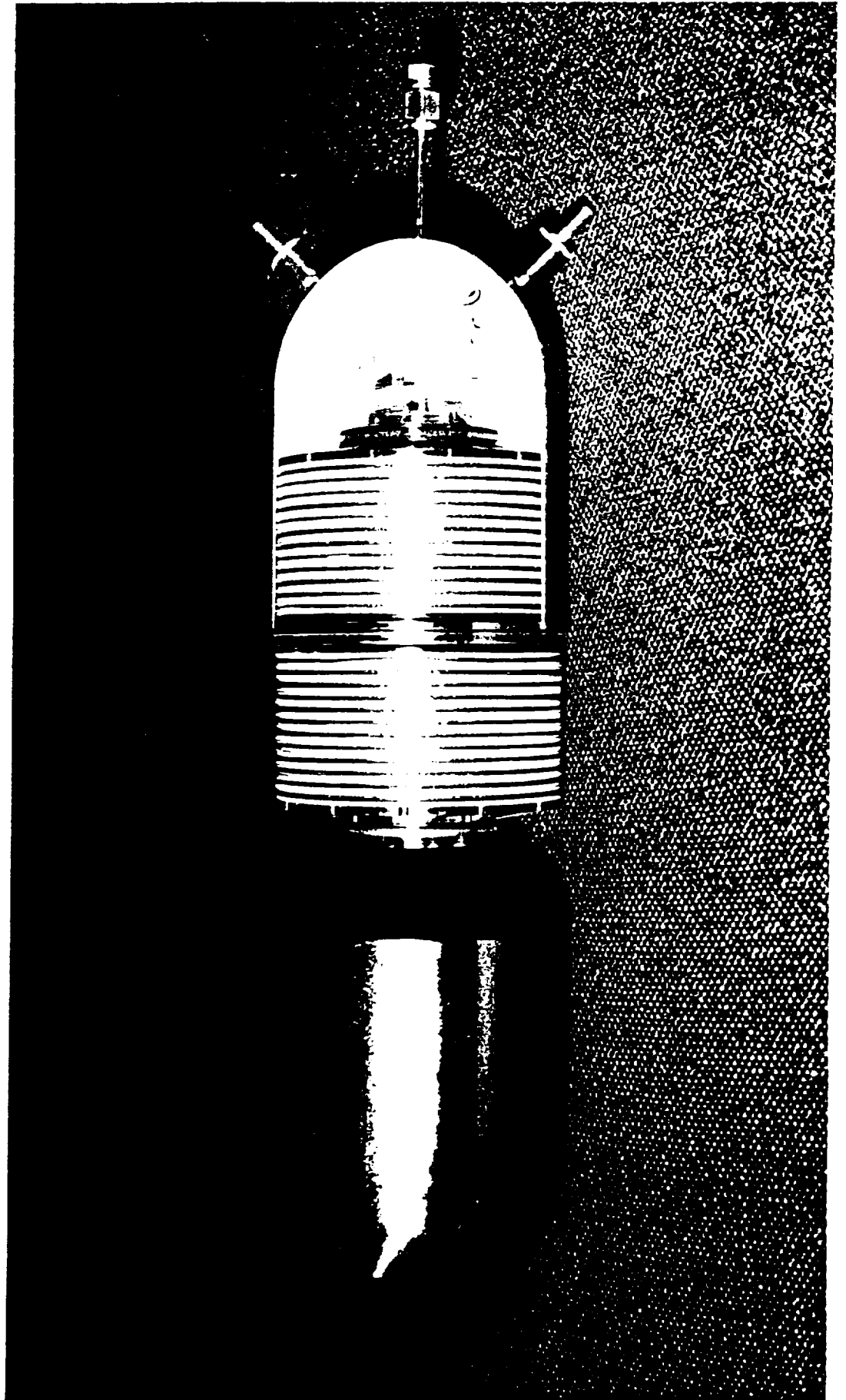


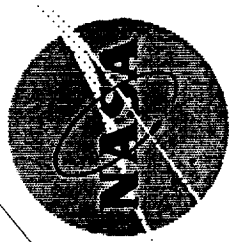
## Test Cells

- Four EPI RNH 90-3, TM2 Lot.
- Air Force Design, Pineapple Slice, Neg Precharge.
- Acceptance Test Procedure after build.
- 41 Months Open Circuit Storage at 0 deg C.

# Eagle Picher RNH-90-3

Developed for the Hubble Space Telescope





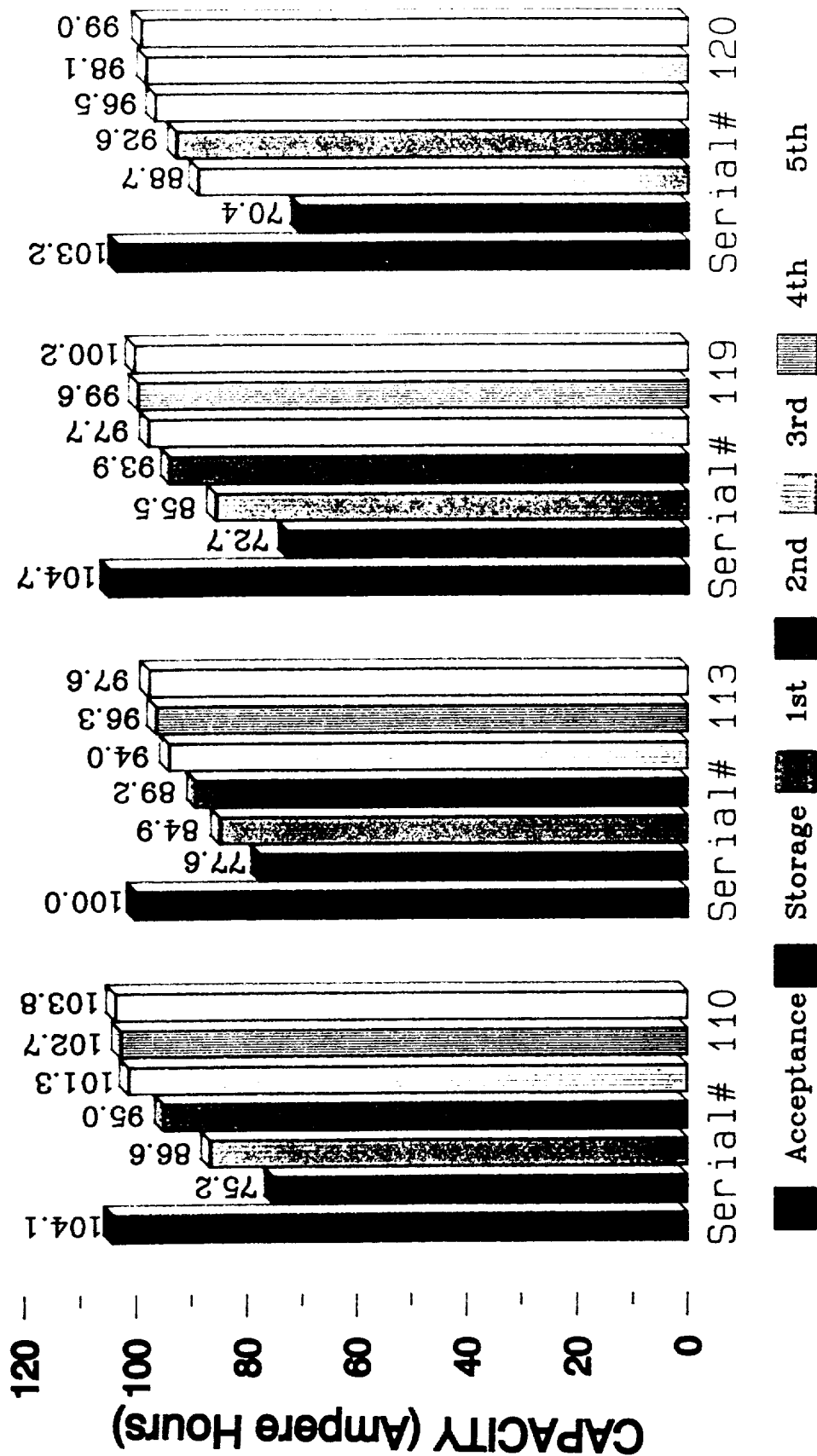
# RECOVERY PROCEDURE

- Cells Initially discharged (OCV < .2 V).
- Temp stabilized at ) deg C.
- Baseline Charge, 160% of C rating in 24 hours:
  - C/10 (9.3 A) for 10 hours.
  - C/22.5 (4 A) for 14 hours.
- Raise Temp to room level.
- Allow to sit open circuit for 14 - 16 days.
- Lower Temp to 0 deg C.
- Discharge cells at C/6 (15 A) to 1.0 V/cell.
- Recondition cells 12 - 16 hours (V < .2).
- Baseline charge cells and allow to stabilize 1 hour.
- Discharge cells at C/6 (15 A) to 1.0 V/cell.
- Capacity is measured at 1.0 V/cell.



# Capacity Gain from Open Circuit Stand

EPI RNH 90-3



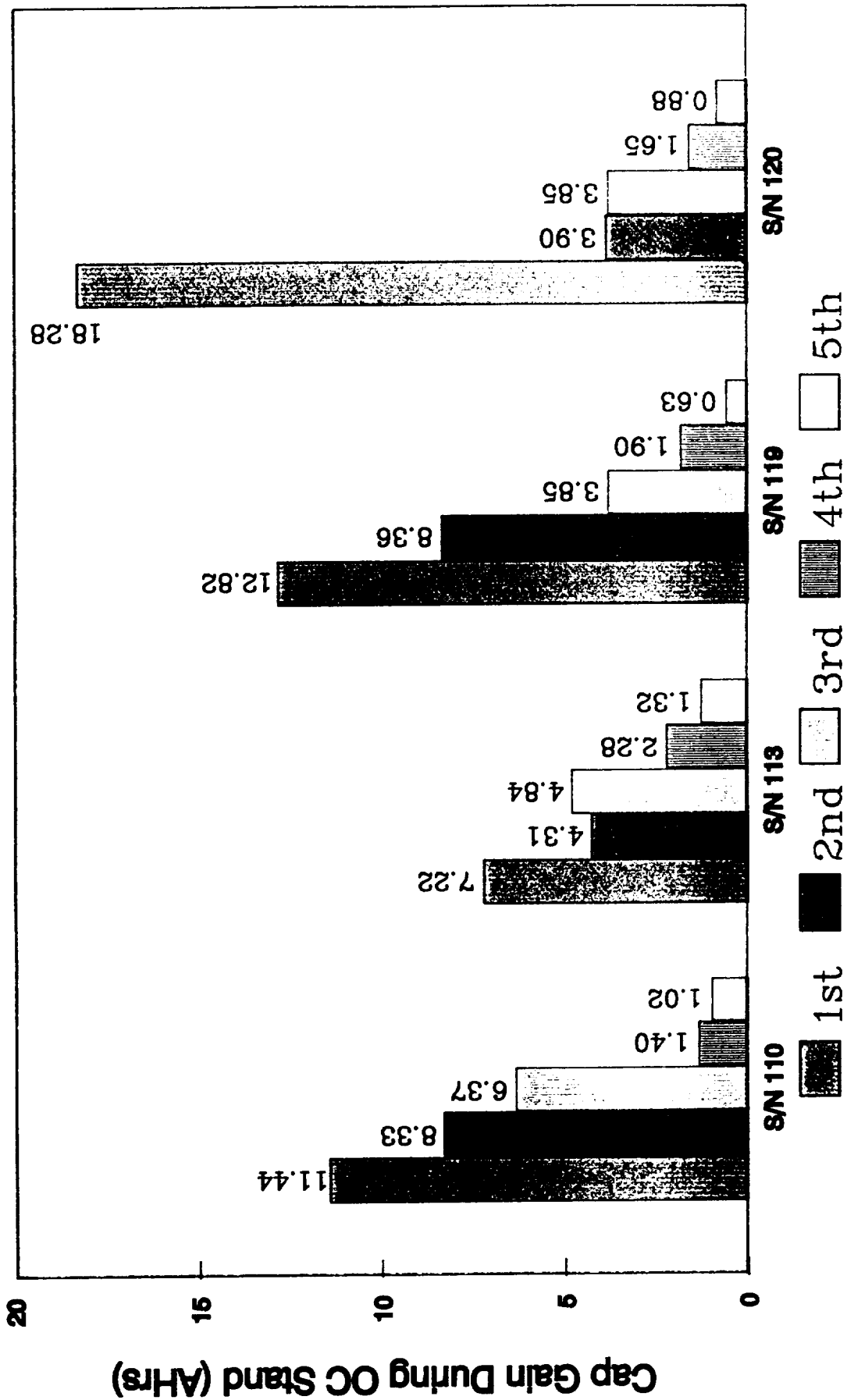
41 Months Storage

Fig. 1.



# Capacity Gain from OC Stand

EPI RNH 90-3



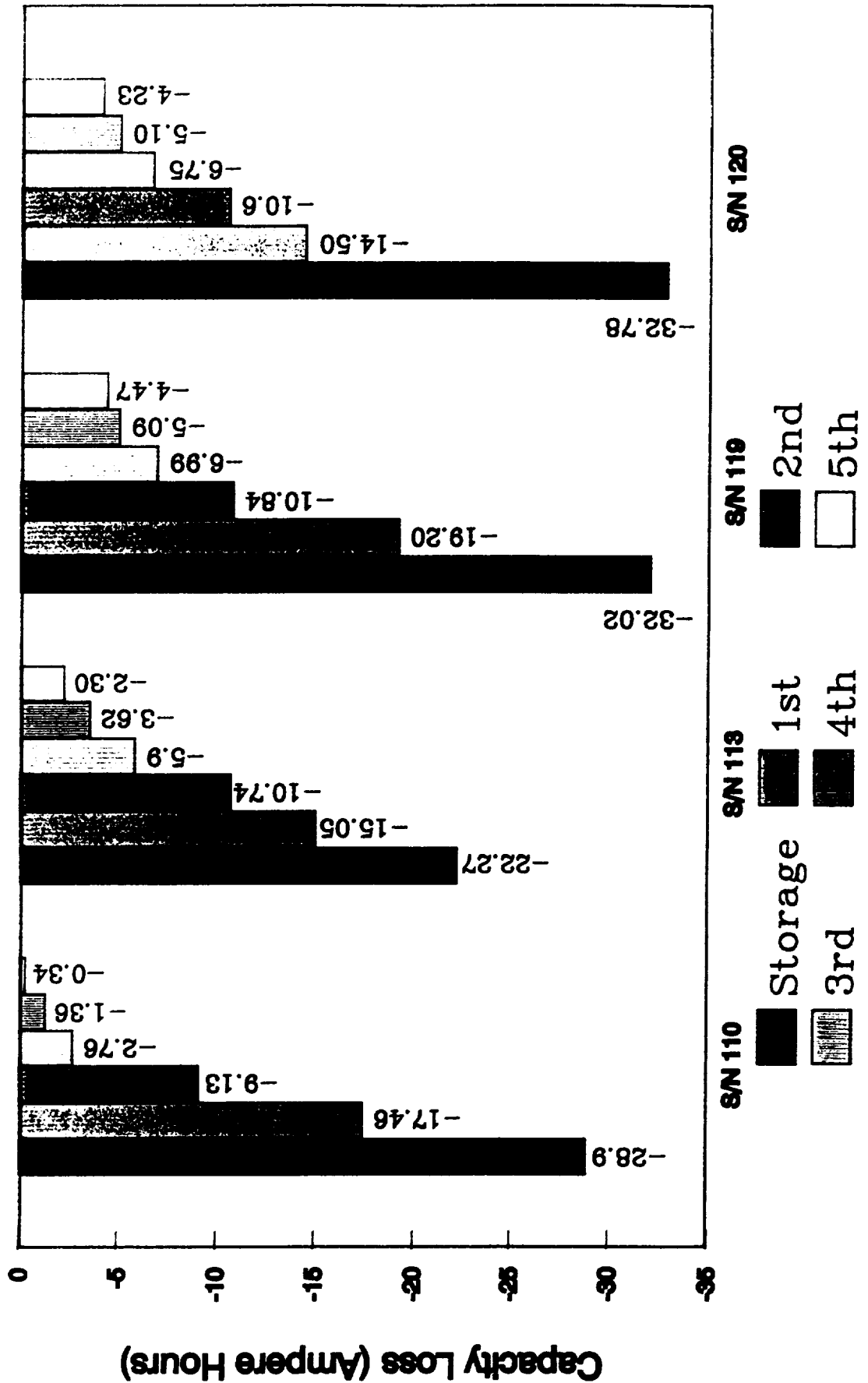
41 Months Storage

Fig. 2.



# Capacity Loss from Acceptance Test Value

EPI RNH 90-3



41 Months Storage

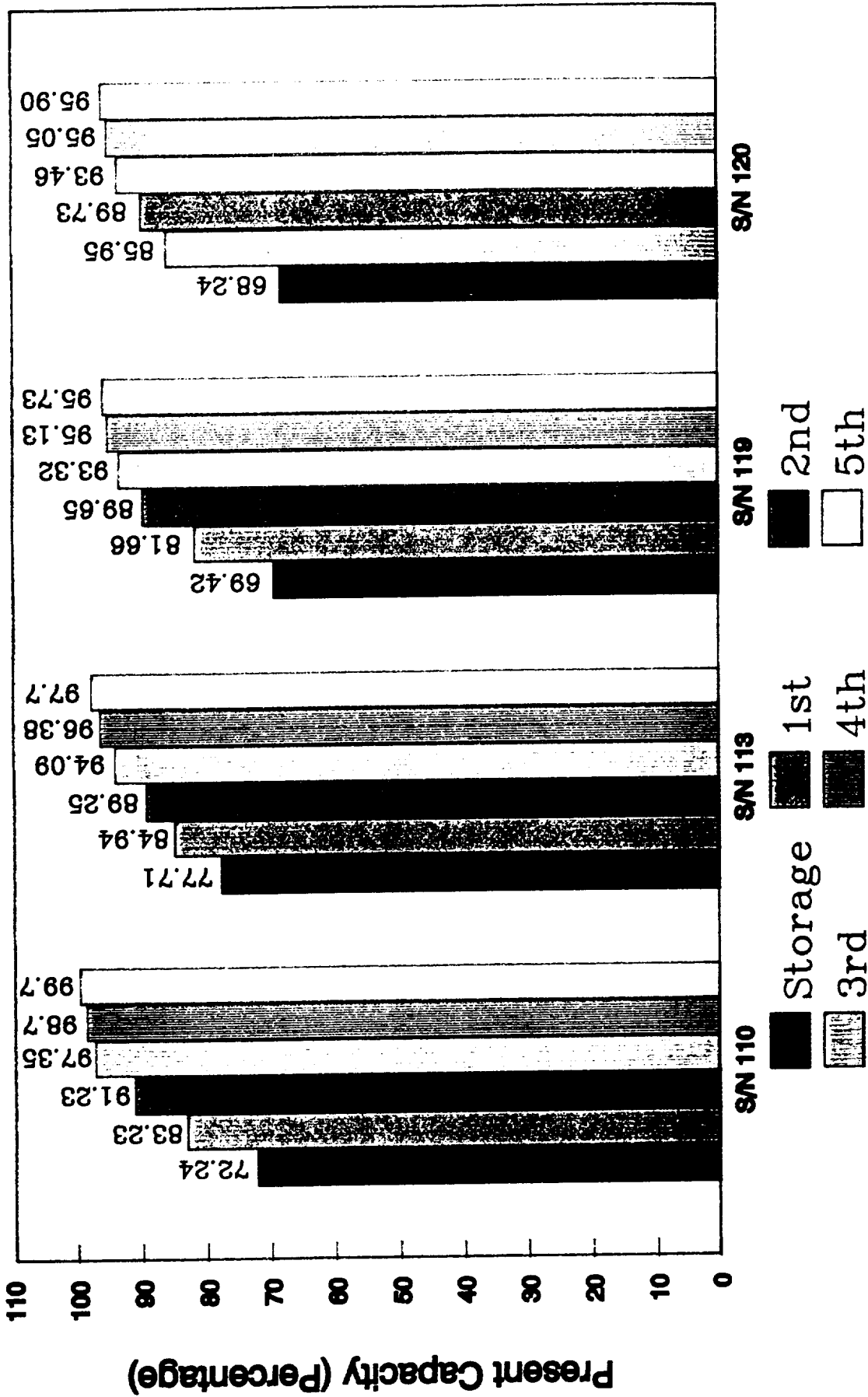
Fig. 3.





# Present Capacity as % of Acceptance Test Value

EPI RNH 90-3



41 Months Storage

Fig. 4.



## STORAGE

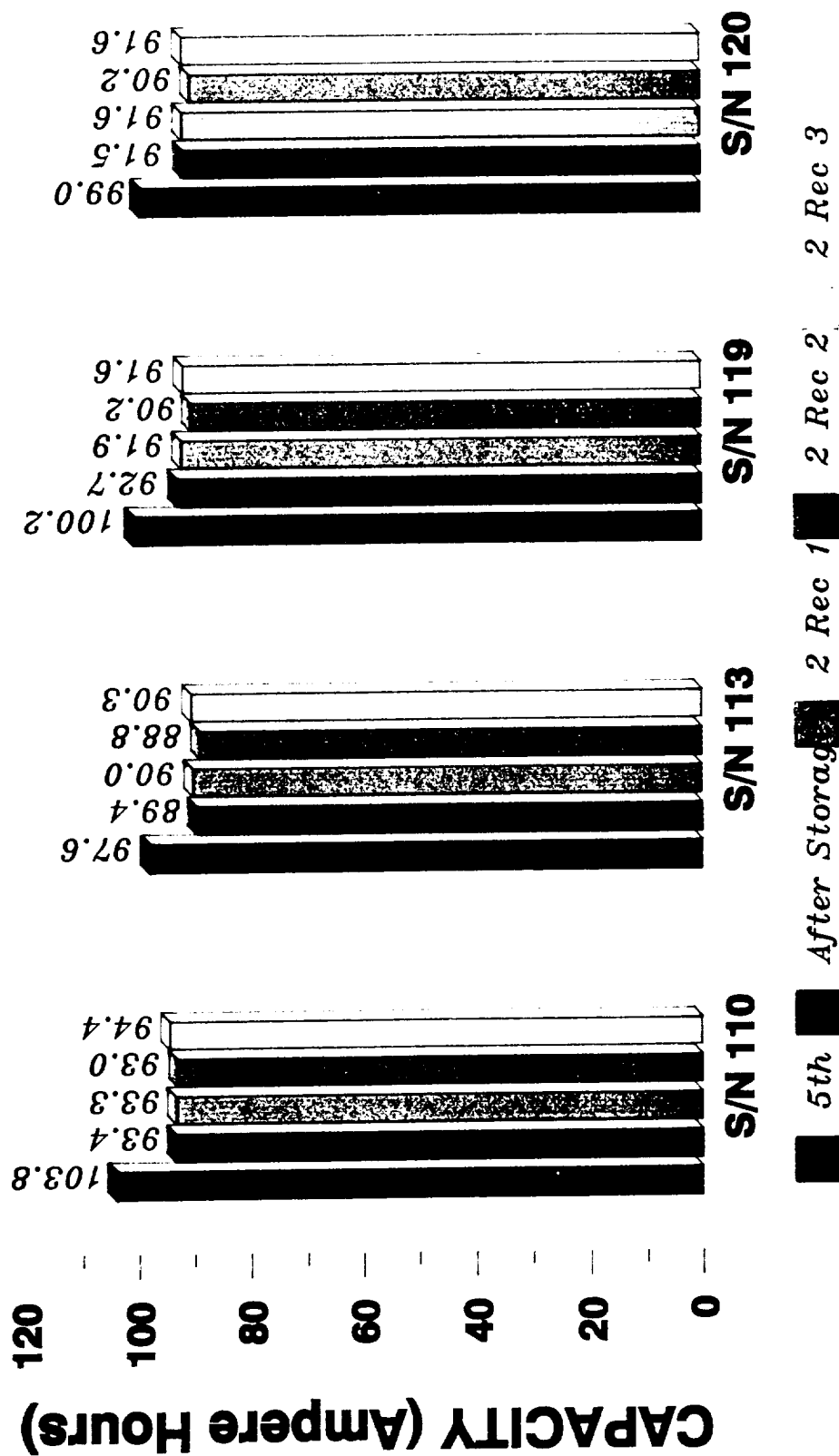
Open Circuit vs. 3/4 Volt at 0 deg?

- 2 Cells OC:
  - S/N 119, 120.
- 2 Cells in series at 1.5 V:
  - S/N 110 - 1.32 V, S/N 113 - .18 V.
    - 1 month in series
- Divide equally at 1.1 V/cell.
- 2 Cells paralleled at .75 V:
  - S/N 110 - .75 V, S/N 113 - .75 V.
    - 1.5 months paralleled.
- Question??? Do cells retain their recovered capacity upon cycling?



# Capacity Behavior After Initial Recovery

EPI RNH 90-3



2 1/2 Months Later.

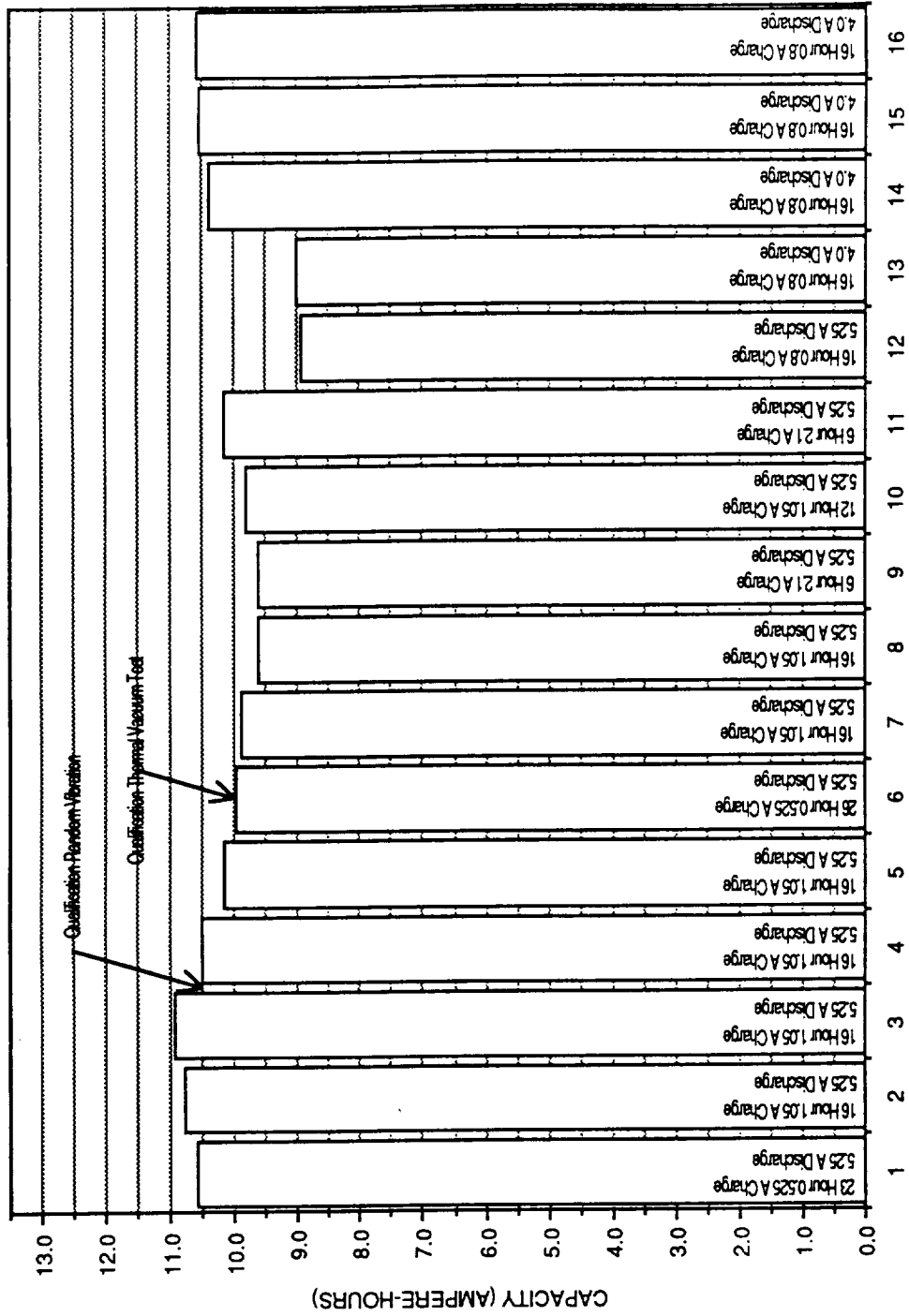
Fig. 5.



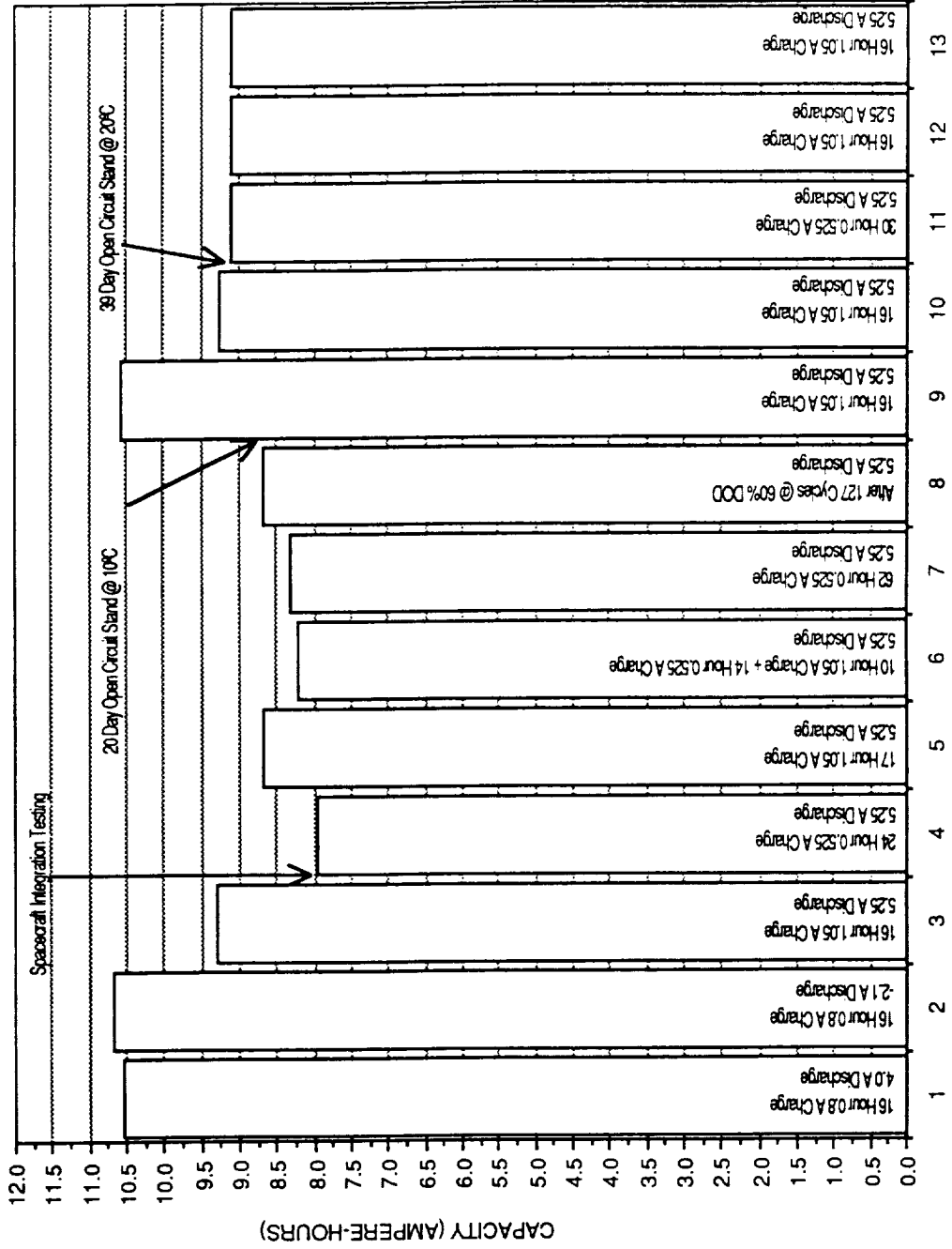
# CONCLUSIONS

- Capacity lost during storage can be regained as useable capacity.
- Storage conditions did not appear to effect ability to retain capacity.
- Useable capacity lost cannot be regained a second time.
- Future Plan is to LEO cycle cells to investigate capacity retention during cycling.

NASA BATTERY WORKSHOP NIH2 CAPACITY FADE WORKSHOP  
 QUALIFICATION NIH2 CPV BATTERY



QUALIFICATION NIH2 CPV BATTERY



FLIGHT NIH2 CPV BATTERY

