

SODIUM-SULFUR GROUP

EPI SODIUM SULFUR PROGRAM

- NaS program initiated in 1986.
- EPI selected by USAF as sole developer for NaS LEO cells.
- Over 200 cells constructed for a variety of applications.
- Developed a β " electrolyte production capability.



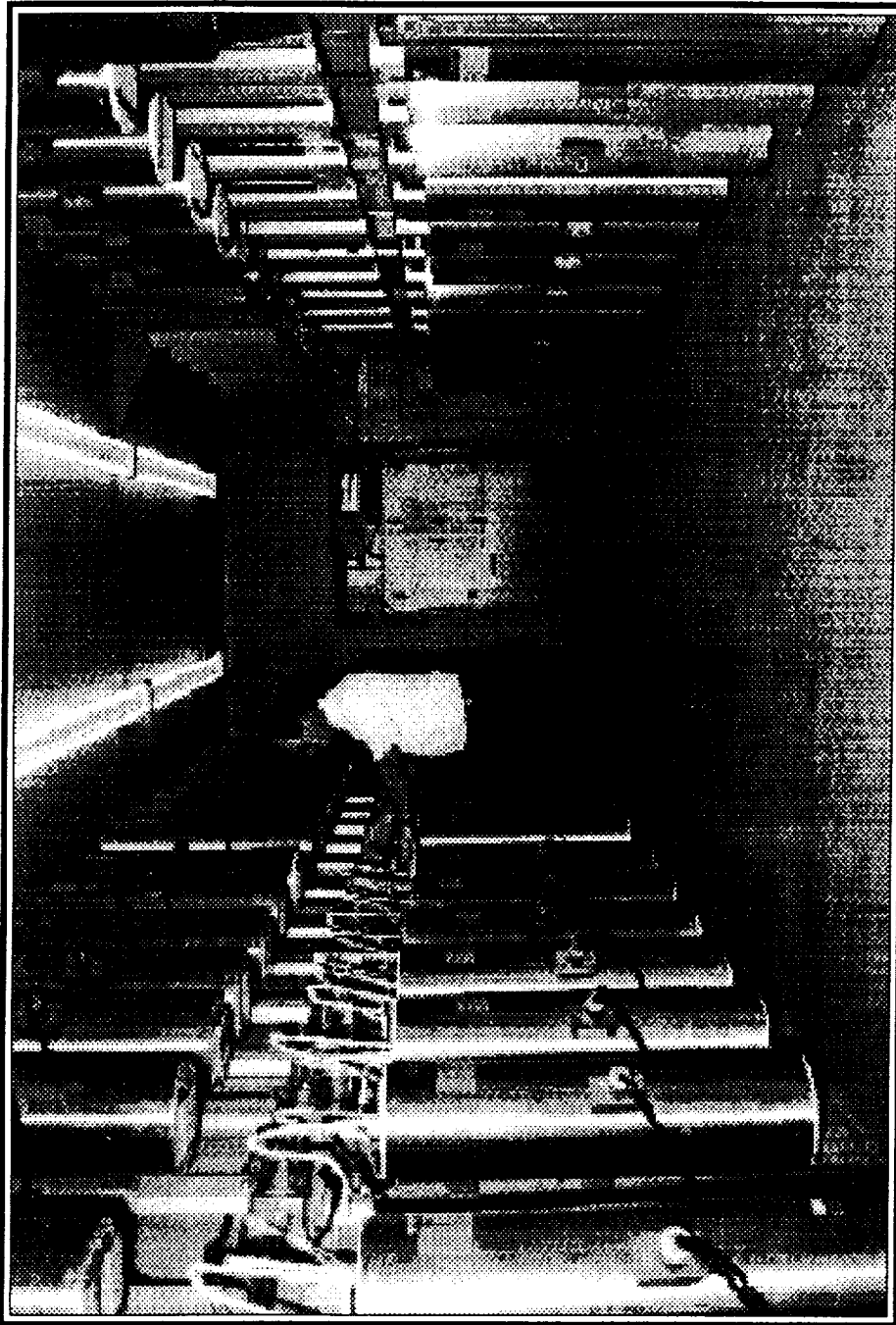
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ADVANCED SYSTEMS OPERATION

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EAGLE EPICHER

Electronics Division
Joplin, MO





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Joplin, MO

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CELL SIZES MANUFACTURED

50 AH

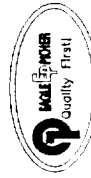
1.4" D X 12.3" L

600 gms (1.31 lbs)

40 AH

1.4" D X 9.0" L

500 gms (1.10 lbs)



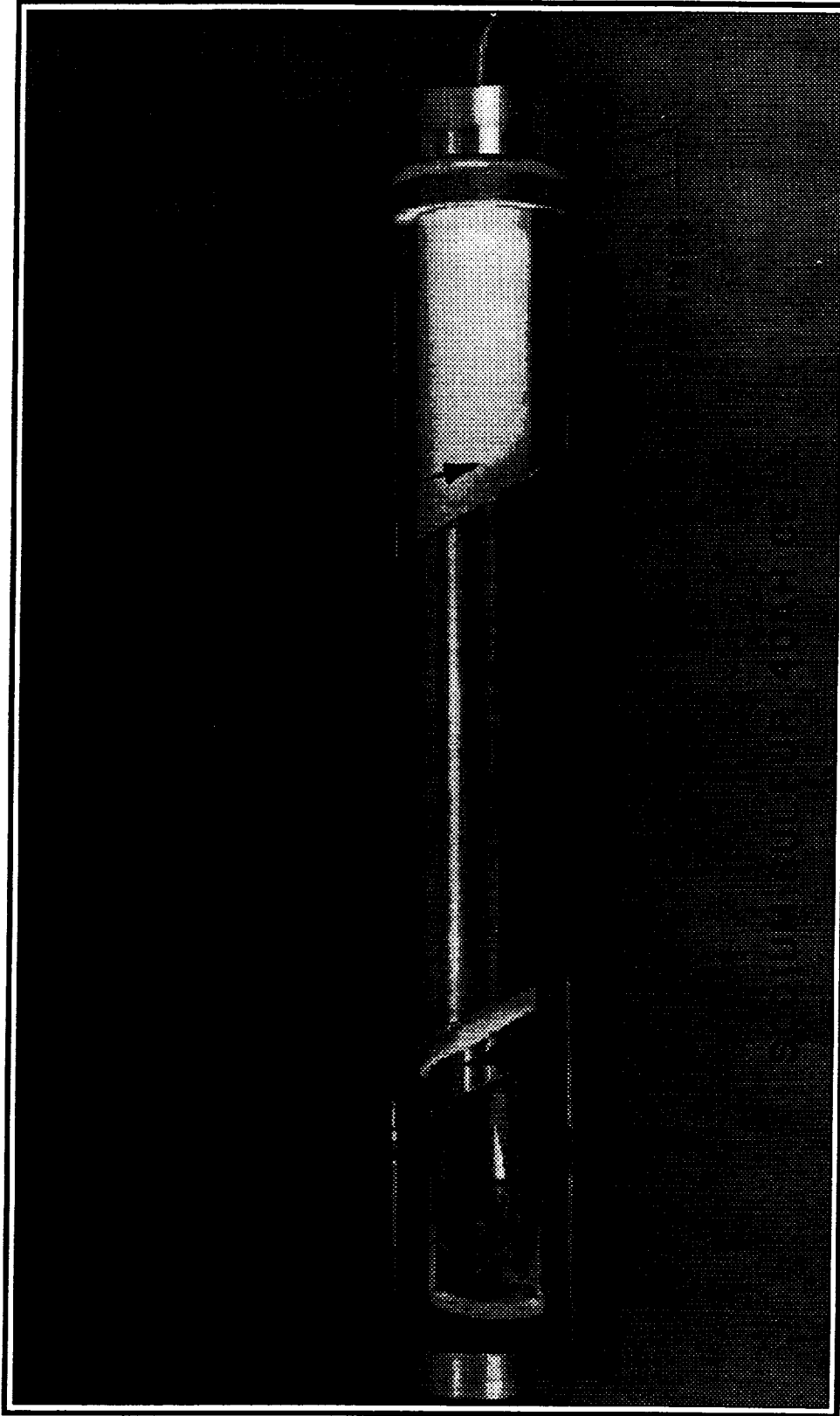
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ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



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AREAS OF IMPROVEMENT

- Resistance
- Cathode Performance
- Parts Count
- Weight
- Seals



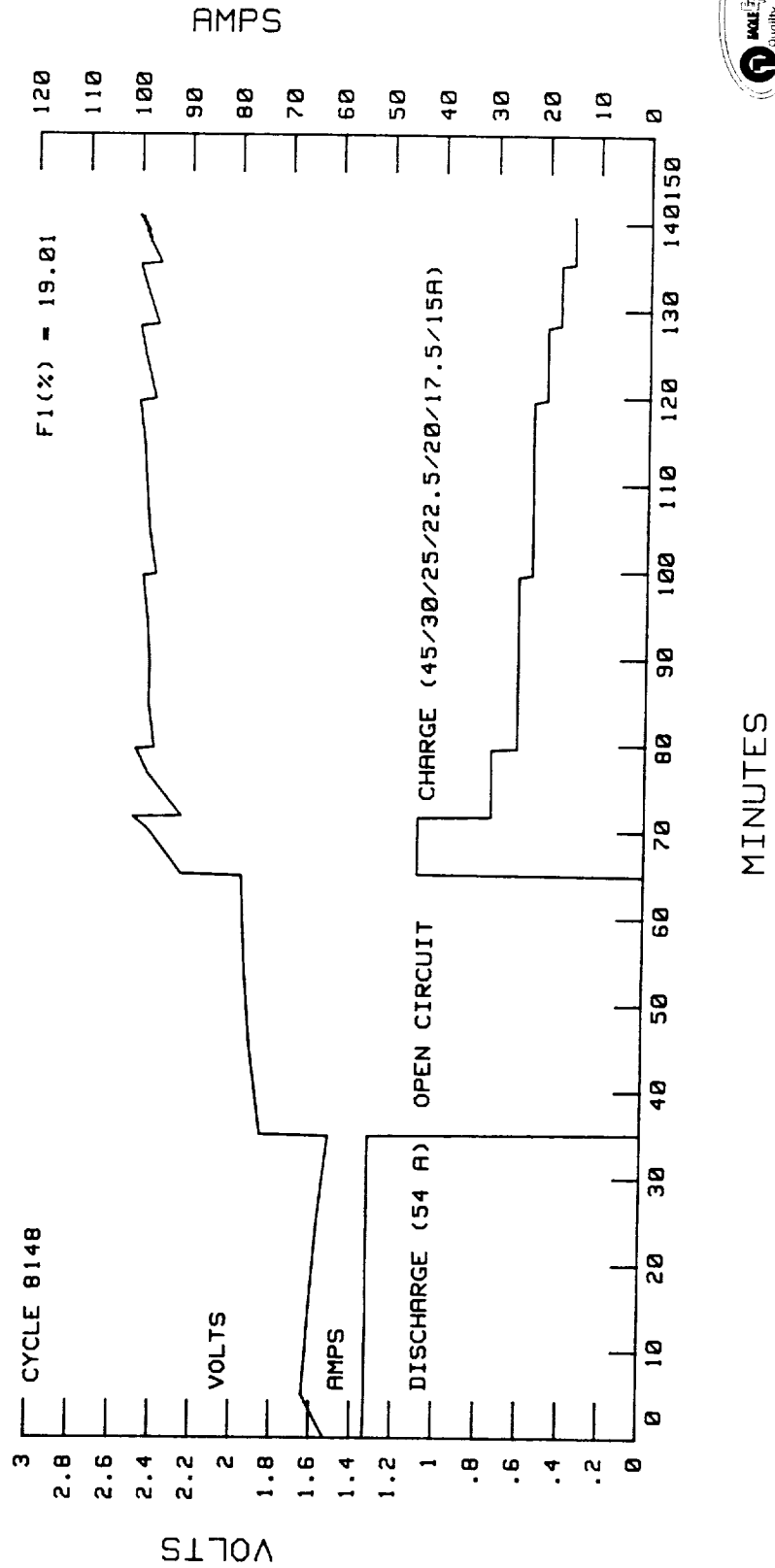
SODIUM-SULFUR GROUP**Performance Improvement Demonstrated
(16 Amp Discharge)**

	Weight (grams)	Avg. Volts (Discharge)	Resistance (mOhms)	Spec. Energy (Whr/Kg)	Energy Dens. (Whr/L)
Baseline	509	1.64	17.6	119.1	266.9
Intermediate	506	1.74	10.6	127.3	283.6
Improved	500	1.89	6.7	139.8	307.8
State-of-the-Art	455	1.95	5.8	158.5	334.0



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IMPROVED CELL PERFORMANCE (LEO 60% DOD)





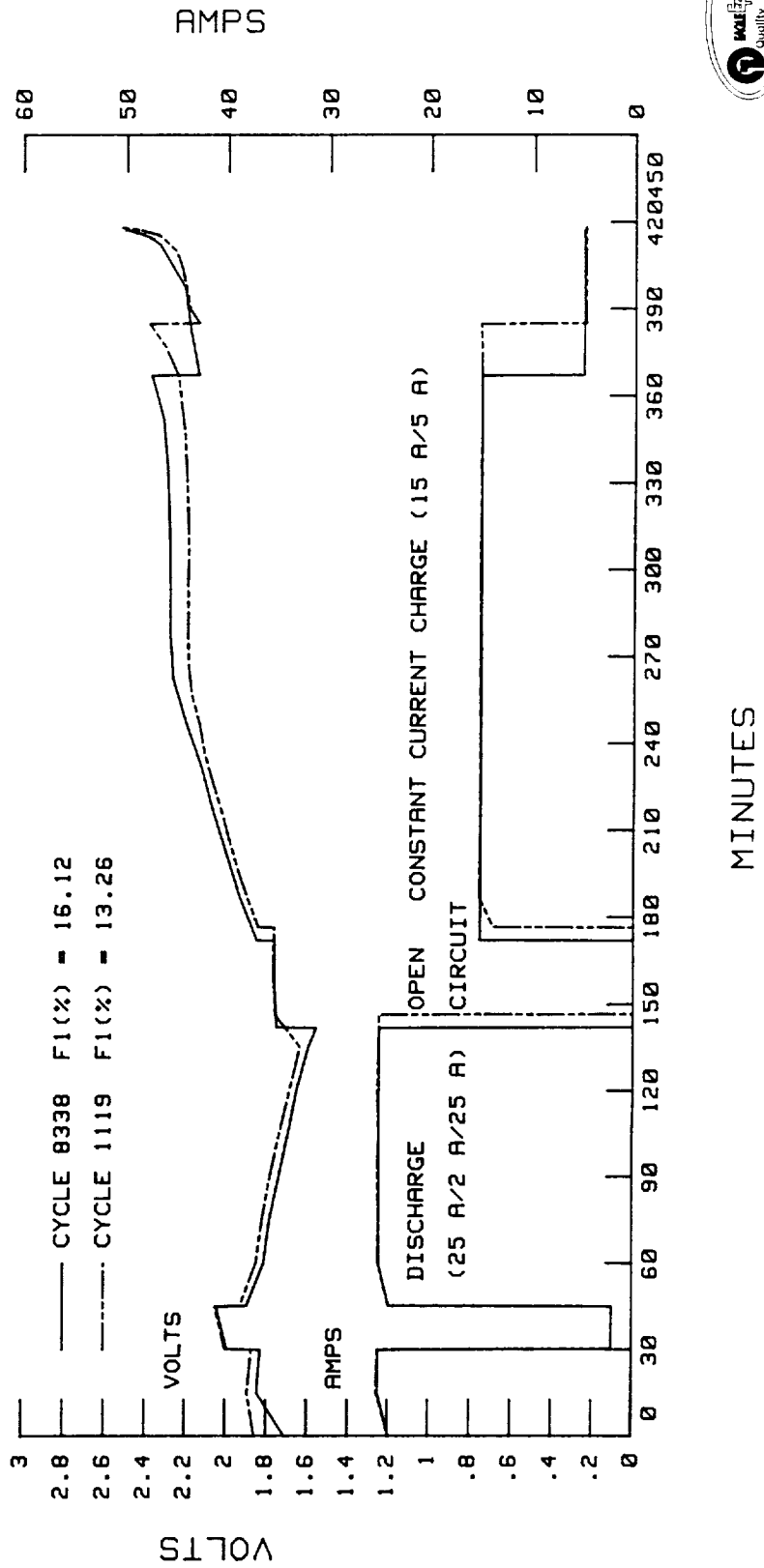
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IMPROVED CELL PERFORMANCE (CAP 95% DOD)



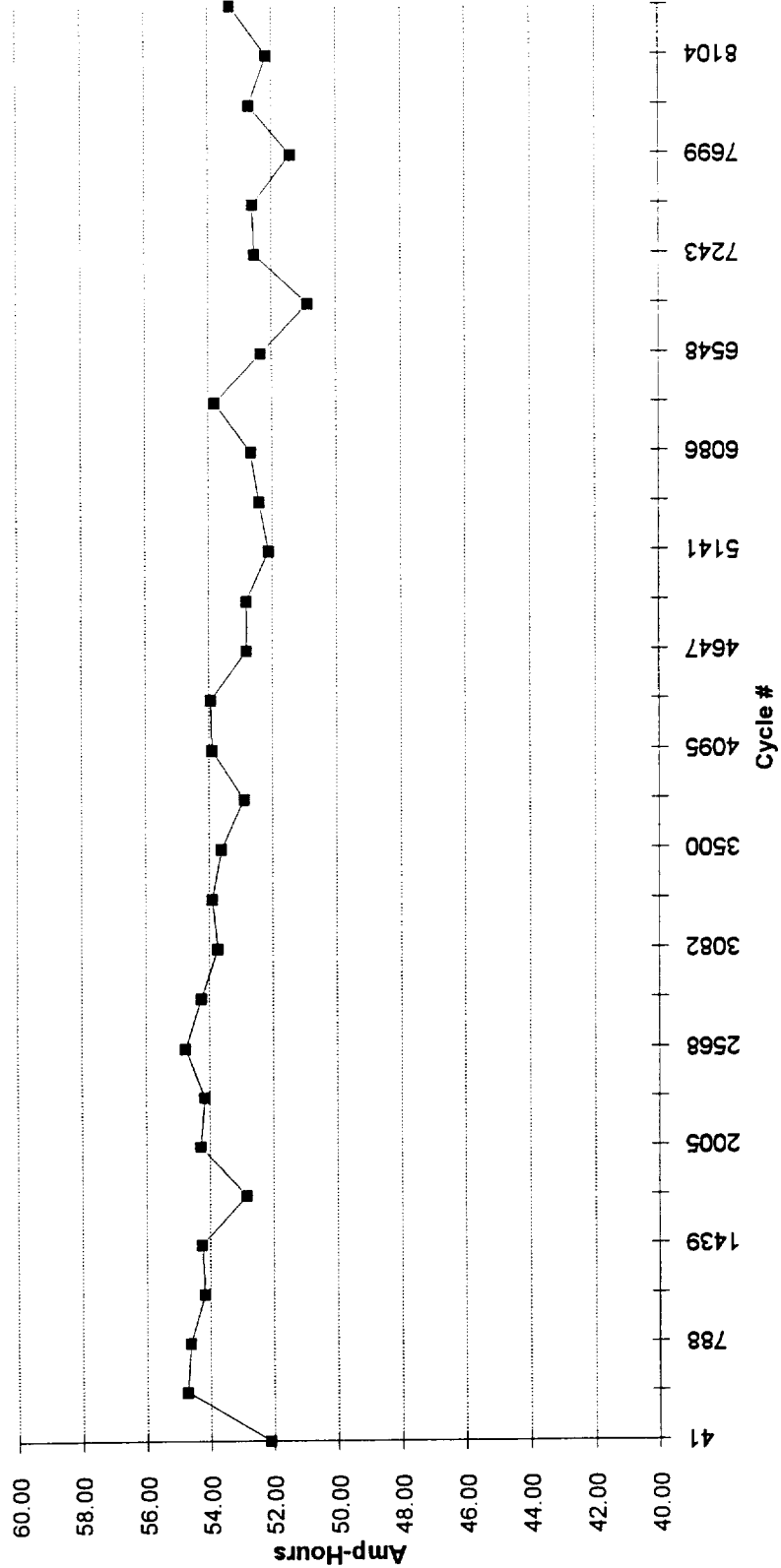
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Capacity - 50Ahr "Improved" Cell



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SINGLE CELL TEST MILESTONES

- Over 11,000 cycles to date
- 43 month calendar life
- 3,130 AHr/cm² in cell testing
- 5,900 AHr/cm² in sodium-sodium testing
- Discharge resistance < 5 milliohms
- F1 of less than 5 (low rate charge)





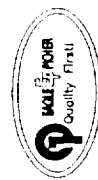
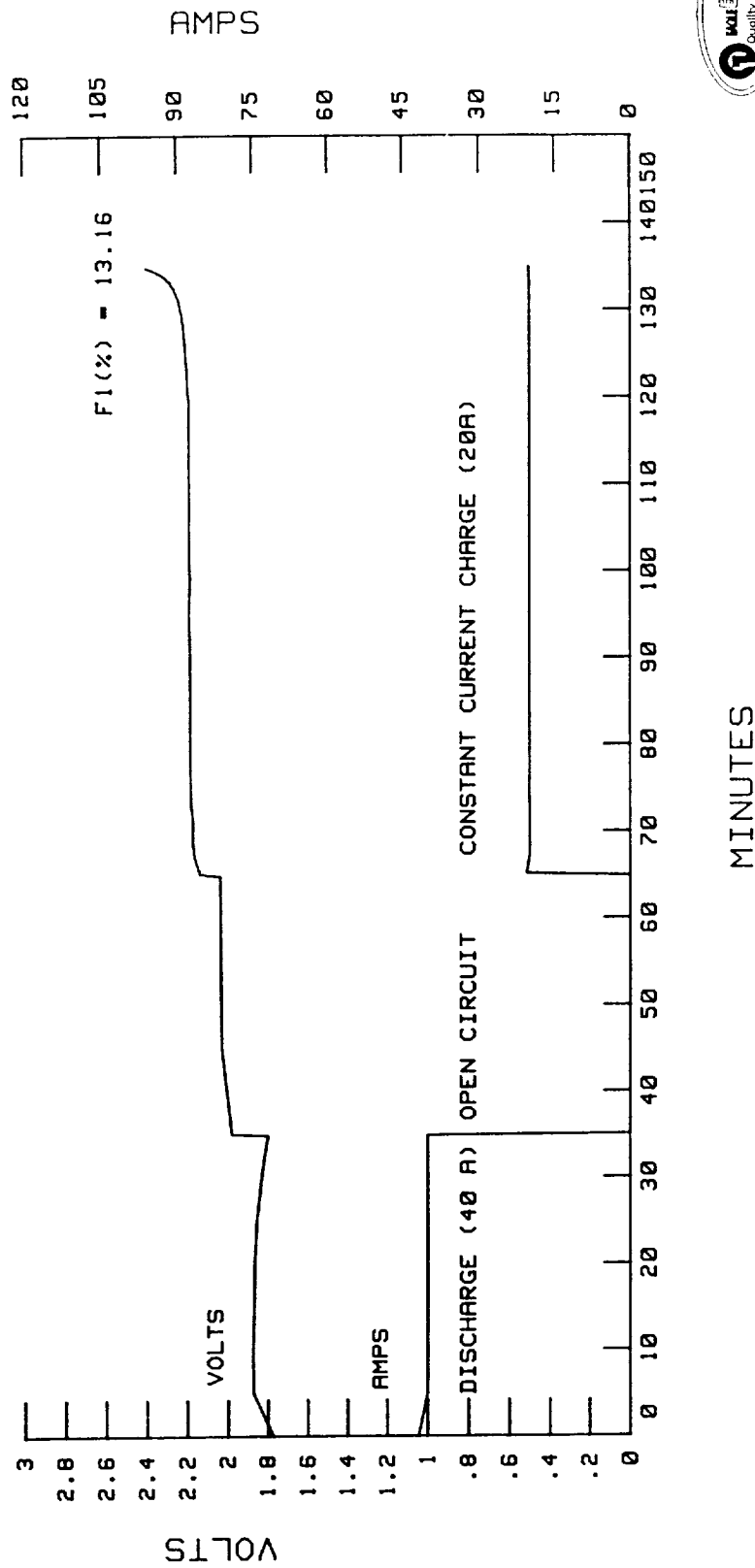
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STATE-OF-THE-ART CELL

TYPICAL CELL PERFORMANCE (LEO 60% DOD)



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ENTRY LEVEL BATTERY

- Effort funded internally 1990-1991
- Three cell module
- 1,000 cycles achieved
 - Constant current charge/discharge
 - Nominal 60% DOD (=30Ahr)
- 30 Whr/Kg
- Calendar life: 6 months

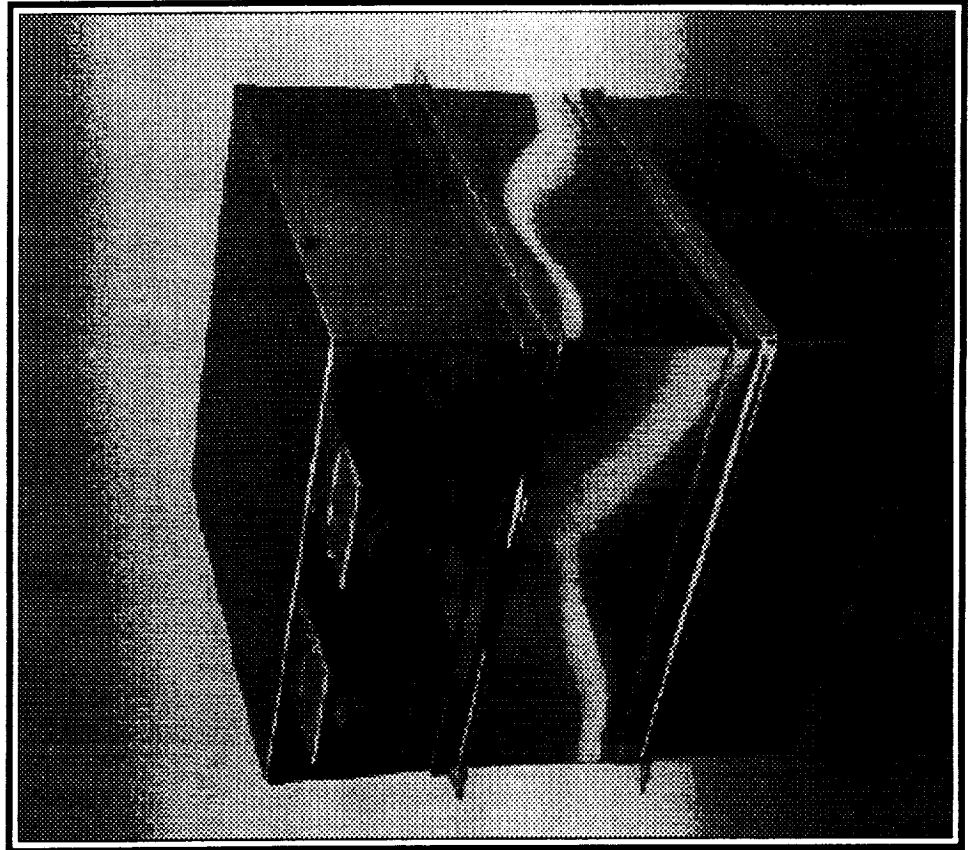


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NEXT GENERATION BATTERY PERFORMANCE PROJECTIONS

- 35 Amp-Hour cells
- 20 cell series string
- Battery OCV: 42 Volts
- Battery working volts: 38 Volts
- Weight: 13.5 Kg
- Volume: 30 L
- Energy Density: 100 Whr/Kg, 45 Whr/L





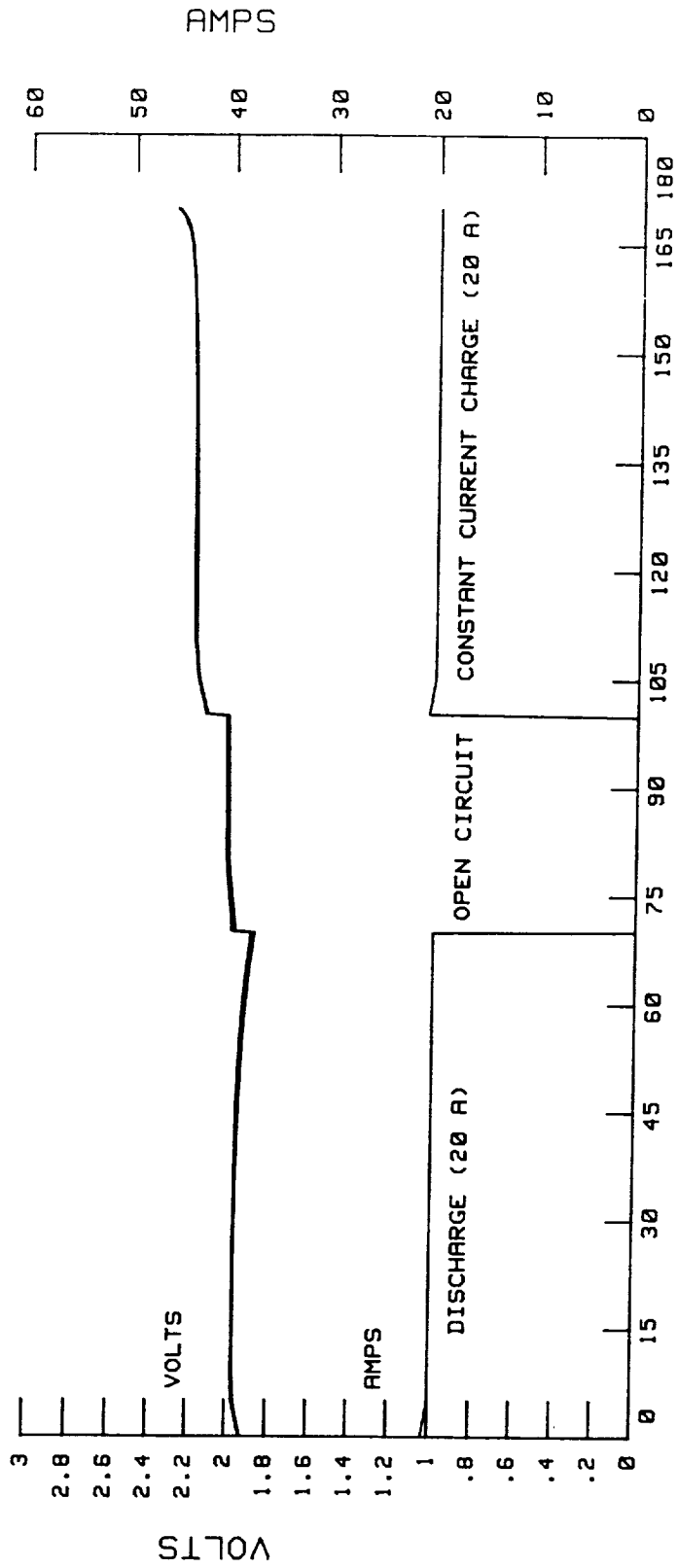
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STATE-OF-THE-ART CELL

TYPICAL THREE CELL GROUP



MINUTES



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STATE-OF-THE-ART CELL

TYPICAL THREE CELL GROUP

