

ARISSat-1

Critical Design Review

Orlando, Feb 15, 2010



AMSAT[®]
Radio Amateur Satellite Corporation



Battery

Anthony Monteiro

AA2TX@amsat.org

Introduction

- Russian space suit battery will provide power when solar panels are not illuminated.
- Scope
 - Requirements
 - Design
 - Safety Considerations
 - Verification
 - Operations
 - Status

825M3 Battery



825M3 Battery Specifications

Cells per unit (Ag-Zn)	18
Nominal voltage	27 V
Min. capacity	14.0 Ah
Initial capacity (typical)	20.5 Ah
Charge method: constant current	1±0.2 A
Max. charge voltage	35.8±0.15 V
Min. discharge voltage	20.5±0.5 V
Full charge/discharge cycles	5
Temperature range	+6..+45 °C
Min. pressure	1.33×10 ⁻⁶ Pa

Challenges

- 16 partial charge/discharge cycles *every day* versus rating of 5 full cycles
- Expected temperature range is -27.6 to +3.6 C versus specified range of +6 to +45 C
- No data available on battery operation outside of specified ranges
- ARISSat-1 power system does not provide specified charging method (constant current)
- Actual 825M3 battery not available for testing

Design

- Use commercial Ag-Zn battery (Yardney) to predict out-of-range capabilities
- Make measurements on *Flat-Sat* model to characterize charge/discharge environment
- Develop battery simulator for testing

Safety Considerations

- Ag-Zn technology is considered inherently safe – no thermal runaway issues
- “The 825M3 battery has a very large margin of safety in terms of quality of electrolyte, storage life (100% margin), stability and leak proofing.” - *Vadim Nikolaev, RSC-Energia*
- Similar battery (825M1) is already in use on ISS

Verification

- Test *Flat-Sat* model with commercial (Yardney) battery
- Test *Flat-Sat* model with simulated 825M3 battery

Operations

- Battery must be initially charged to activate satellite
- Battery is mission critical for first 15 minutes of flight (*to be reviewed*)
- Satellite will power down during eclipse if battery fails
- Satellite can operate without battery in sunlight

Status

- Commercial Ag-Zn battery (Yardney) has been purchased, assembled and charged
- ARISSat-1 power system not yet operational for charging battery
- Characterization and test effort just started