



SVP Drifter Developments

at

Scripps Institution of Oceanography

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Figure: U.S. Navy photo by Mass Communication Specialist 1st Class Lowell Whitman/Released



1st Generation

Electronics



- P.O.C. bench systems at 500+ days
 - PMT as Argos-2 PTT SVP
 - SST sampled 15 minutes
 - Drogue sampled 30 minutes
- 7 of 7 CCE LTER R/V cruise drifters at 400+ days
 - Drogue life less than 30 days
 - Synthetic tether



- High rate of battery failure
 - Deployment Impact
 - Cyclic impulses and vibrations
 - Drogue
 - Sea state

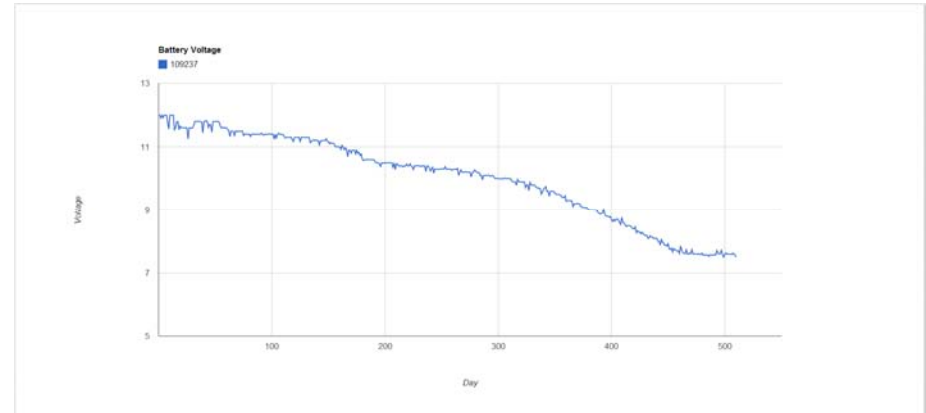


Figure: Battery discharge for Proof of Concept Bench Argos-2 SVP

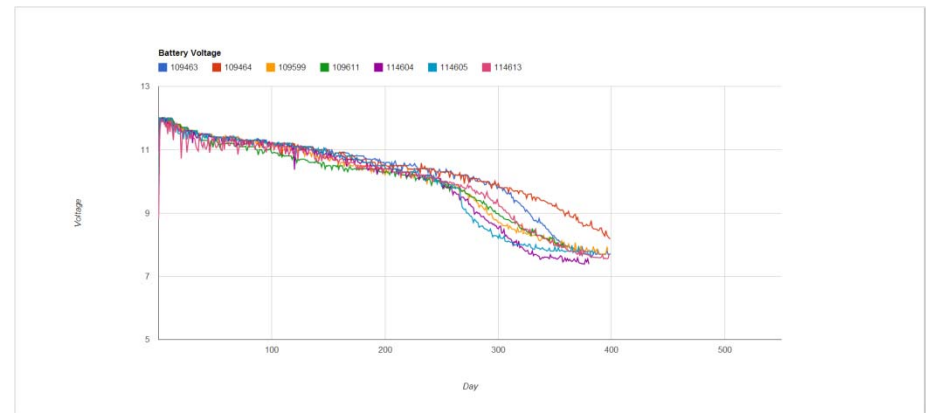


Figure: Battery discharge of 7 Argos-2 SVP deployed off California coast



1st Generation

Deployment Vessel



- Research Vessel (48 drifters)
 - Hand lowered to surface at less than 10 knots
 - **227 / 196** (mean/median) day lifetime*
 - 6% F.O.D.
 - 49% Battery failure
 - 8% Grounded /Picked-up
- Container ship (96 drifters)
 - Thrown over the rail from 15 meters at 15 knots
 - Improvised deployment box
 - **122 / 116** (mean/median) day lifetime*
 - 14% F.O.D.
 - 33% Battery failure
 - 30% Grounded/Picked up

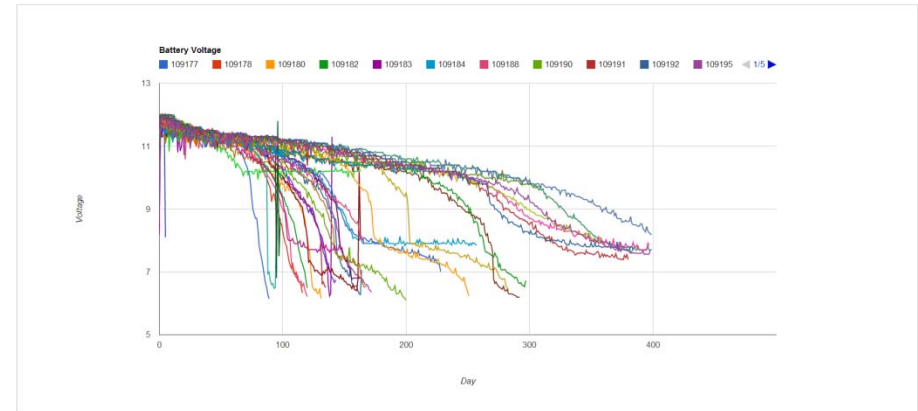


Figure: 48 1st generation Research Vessel deployments

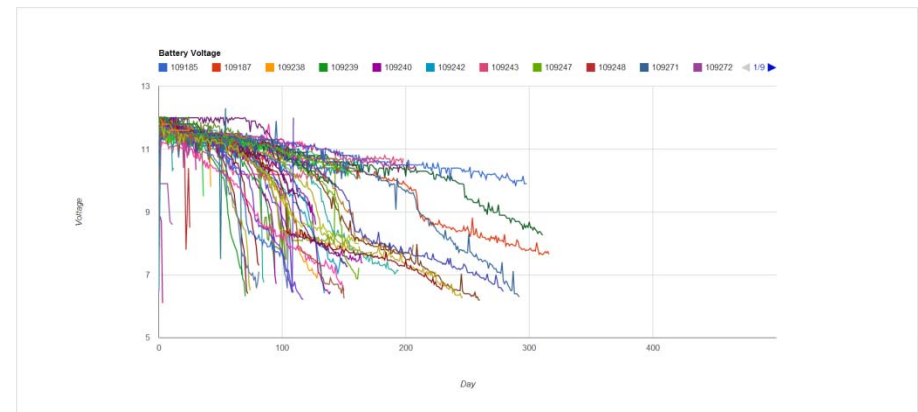


Figure: 96 1st generation Taiwan deployments from 15m at 15 knots

*Drifters grounded removed from mean/median



1st Generation

Failure Mode



- Battery Damage
 - Individual cell failure leads to string failure
 - 7-10 D-cells in series per string
 - 4 parallel strings in a 56Ah pack
 - Cells are not manufactured identically
 - Brand X vs. Brand Y
 - Collector pin assembly
 - Chemical separator material
 - Alkaline chemistry has small margins
 - More cells is **not** the simple solution
- Battery Solution
 - Pre and post assembly load testing
 - 3% packs do not pass
 - Improved hull packaging to minimize impact and vibrations
 - Impact proof battery pack
 - Can withstand 2 meter free-fall on to cement

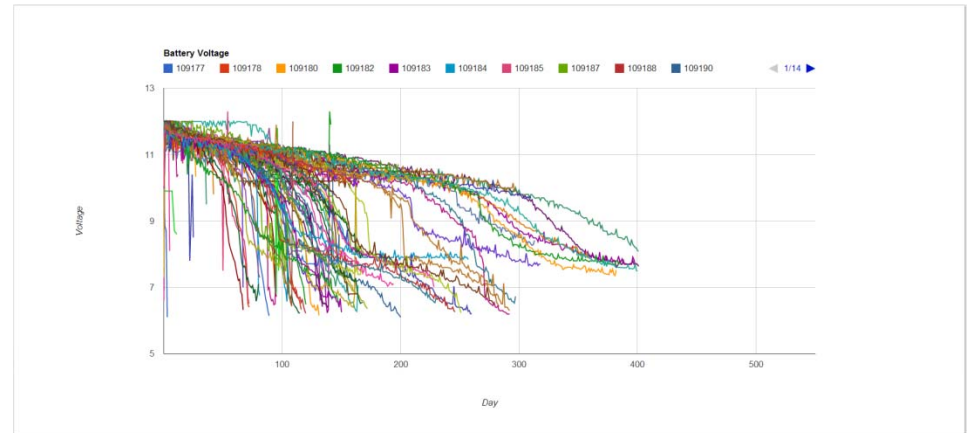


Figure: 40-cell 8s5p pack discharge with 1st generation hardware



2nd Generation

Mechanical



- Re-enforced design
 - Ruggedized battery pack
 - ¼" Space-lay tethers
 - Secondary waterproofing
- Power Conservation
 - Argos-3 and Iridium SBD
 - 1 hour sampling interval
- 2nd Generation Statistics
 - January 2013 and newer
 - 87 / 103 (mean / median) day lifetime
 - 170 day maximum lifetime

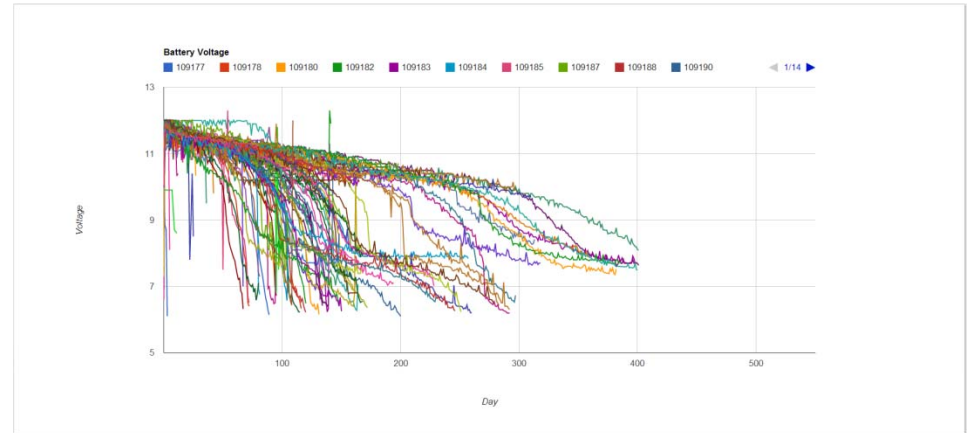


Figure: 1st generation hardware configuration

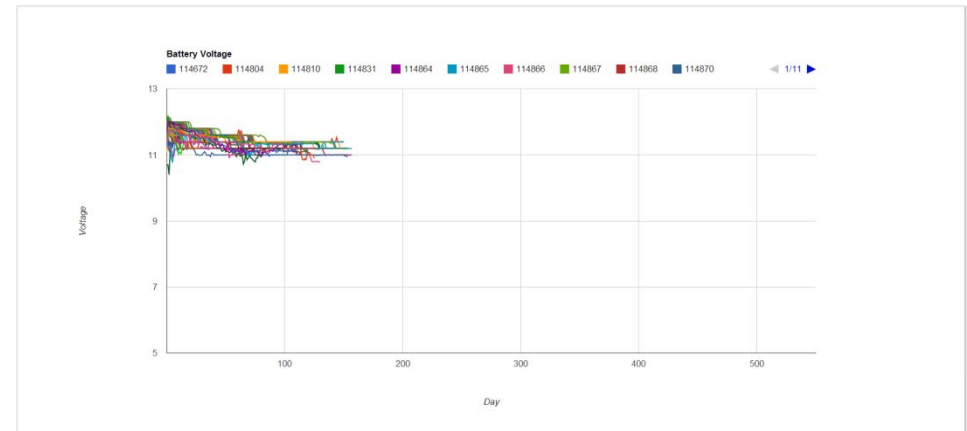


Figure: 2nd generation hardware configuration



2nd Generation

Argos-3



- Argos-3 Random Mode
 - 4hrs of data continuously transmitted
 - Sensors sampled at the top of the hour
- 0.01 resolution SST reporting
 - +/- 0.05c accuracy
- Hirschmann antenna
 - Evaluation performed by CNES
 - Validated for A3 uplink and downlink frequencies
 - Revealed blind spot near horizon
 - K2 Parameter change issued remotely via Argos-3 capabilities
 - Modified minimum satellite elevation and Rx listening window
- 100+ deployed as of Sept. 2013

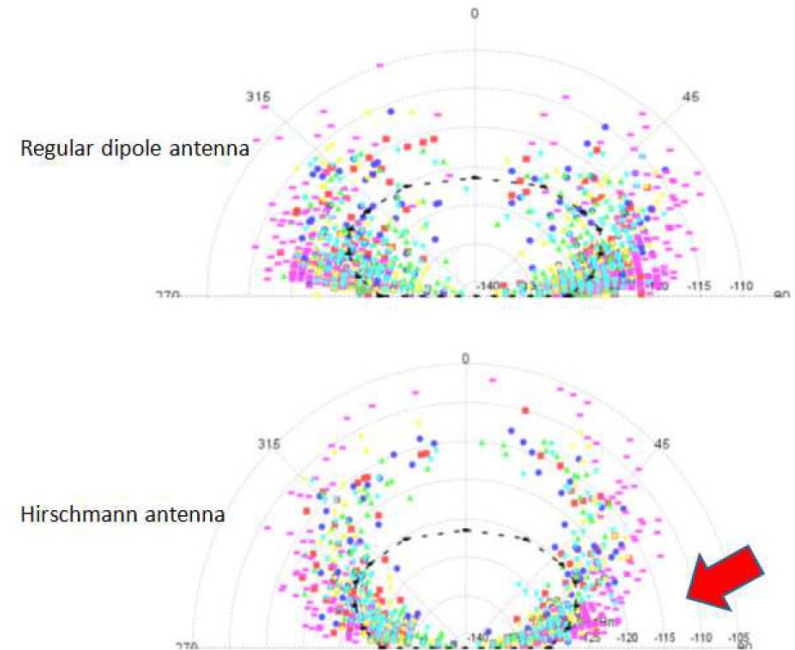


Figure: Hirschmann radiation pattern vs. roof mounted dipole



2nd Generation

Iridium SBD



- Satellite management
 - GPS and Iridium Timers
 - Active transmission management
- Added Benefits
 - Can determine Drogue-off using satellite parameters
 - TTFF, # satellites, etc.
 - High resolution sampling available via 2-way SBD
 - Wave Spectra (development)
- 10 deployed as of Sept. 2013
 - 50+ shipped, ready for deployment

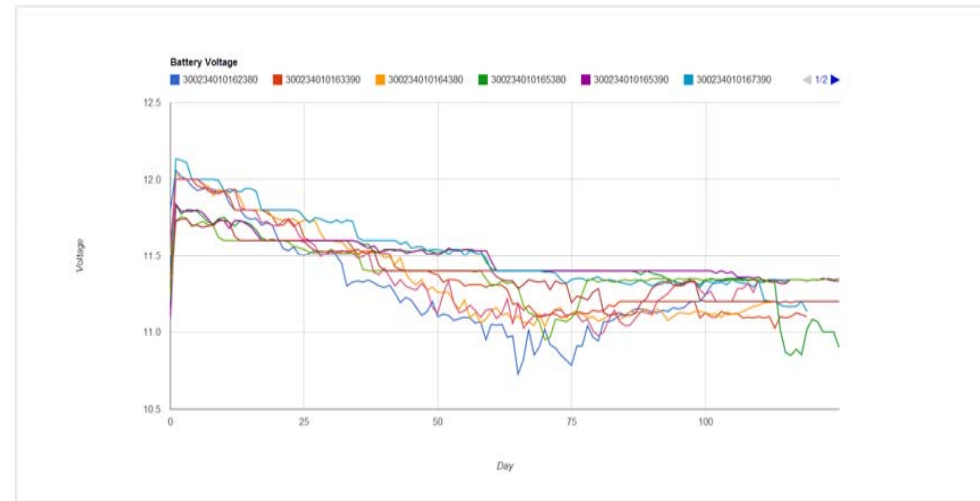


Figure: SVP-Iridium battery discharge at 150 days



Recommendations



- Deployment Packaging
 - Minimize F.O.D.
 - Decrease initial battery damage
- Ruggedized battery pack
- Conserve power where possible
 - 4 hour strain sampling
 - Argos-3 or Iridium SBD

