EESAT 2007

U.S. Coast Guard National Distress System Performance Optimization using the ACONF System Controller

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Overview

- Typical Off-Grid Hybrid Operations
- Battery System Management
- What is ACONF
- Initial Coast Guard Project Overview
- Field Test Program
- Next Steps to Deployment

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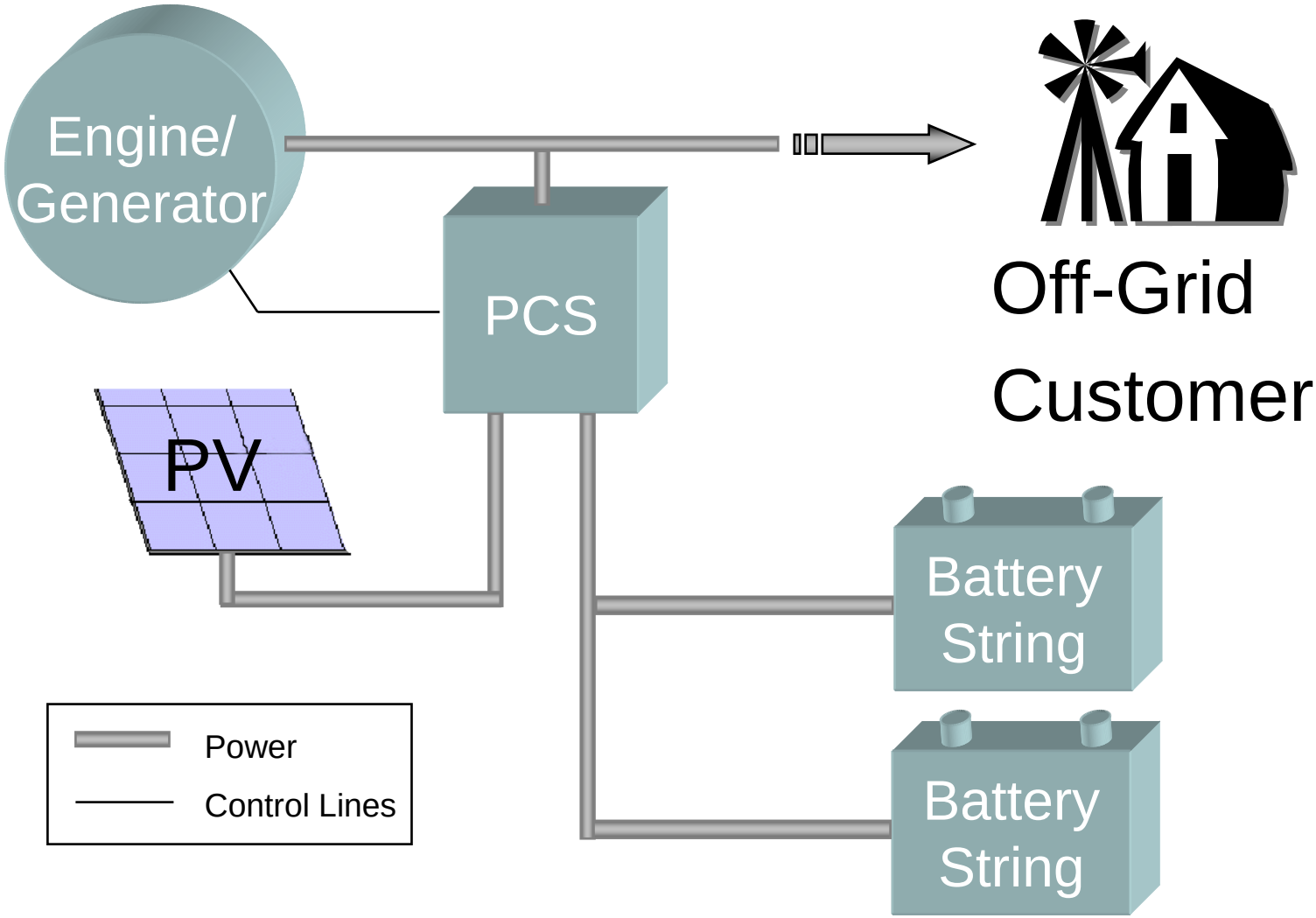
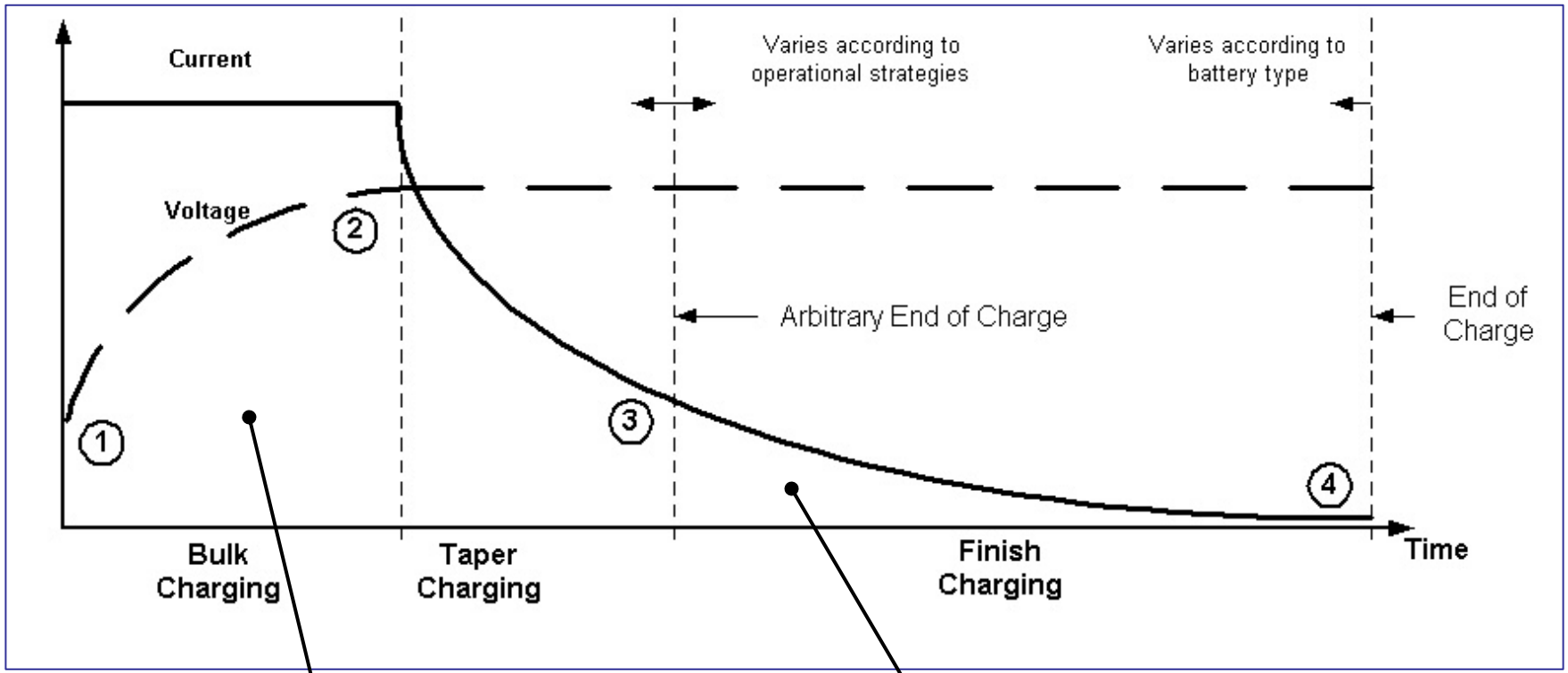
Typical Hybrid Power System



Fuel/Battery Tradeoff



Good charge acceptance

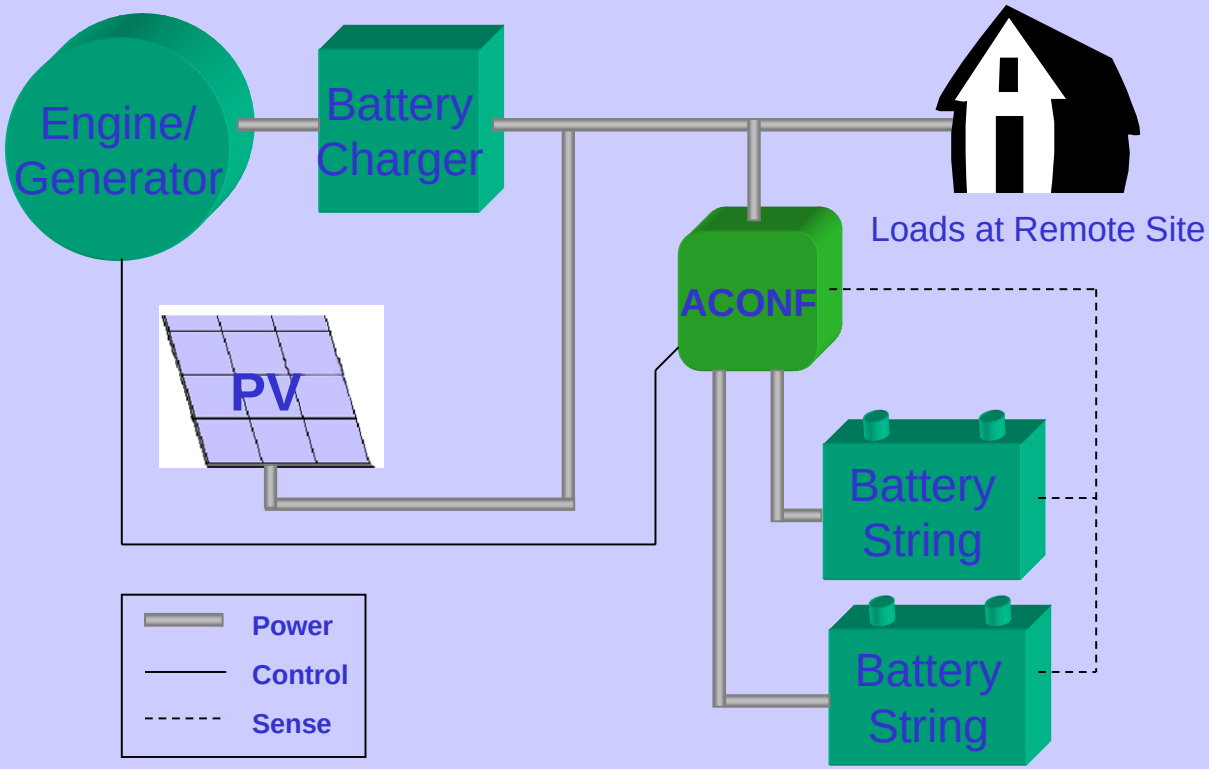
Efficient generator operation

Necessary to fully recharge

Poor charge acceptance

Inefficient generator operation

ACONF in Hybrid DC Power System



What is ACONF?

- Added circuitry between each string of batteries
- Hardware and software to control current to & from each string though the additional circuitry
- String currents controlled on the basis of measured parameters and battery characteristics

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ACONF Functionality

- Guarantees frequent finish charging of each battery string
- Guarantees complete finish charge
- Allows generator to operate at maximum efficiency
- Tracks battery state of health
- Collects, stores, and transmits data for daily operations

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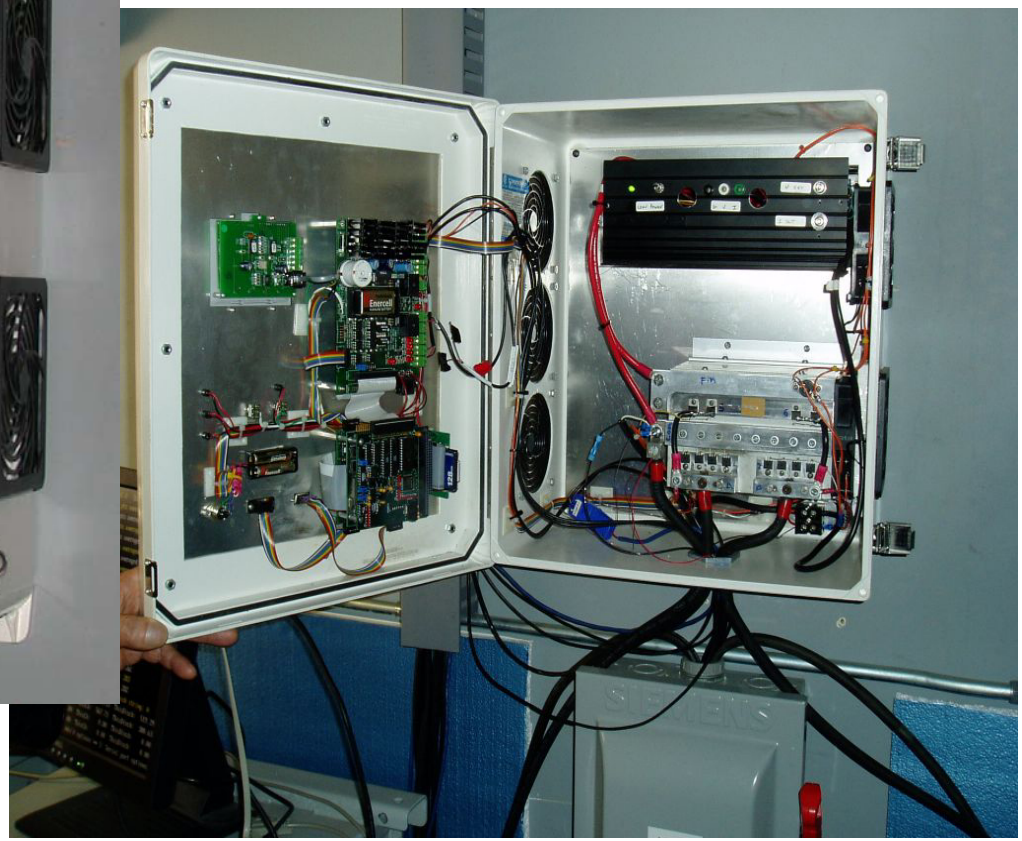
ACONF Controller



Initial Coast Guard Project

- **Two Identical Side-by-Side Systems**
- **Winter-Spring-Summer Simulations**
- **Metrics**
  - Propane Consumption
  - kWh Delivered to Load
  - Optimized PV Utilization
- **Results**

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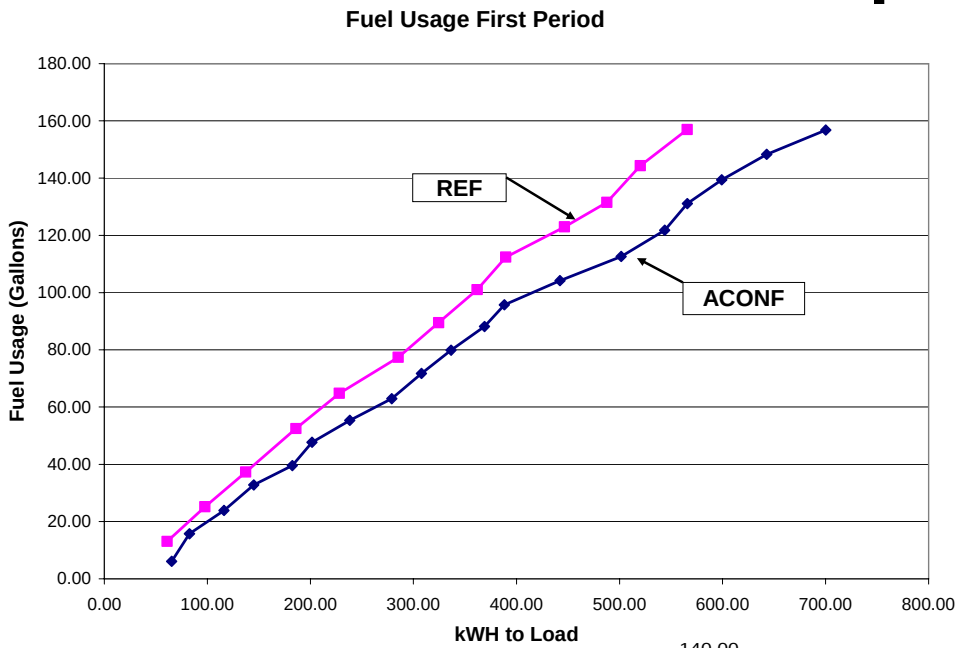
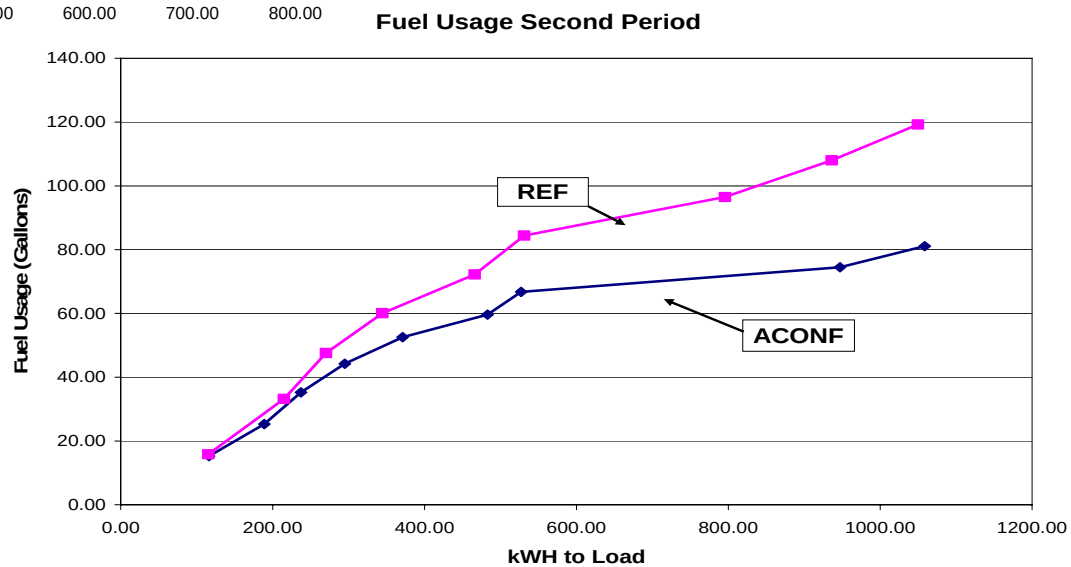
Fuel Consumption History





Outcome of Laboratory Test Program

- **Solar optimization enabled for second half of test program which reduced number of generator starts for ACONF System**
- **ACONF generator started 17% more frequently than REF generator, but generator run time reduced by ~38%**
- **For one-year simulation program, the ACONF system consumed an average of 25% less fuel than the REF system**

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Field Test Program

- **One year demonstration at operational site**
  - Duke Island (near Ketchikan, AK)
- **Installed Nov 2005**
- **Challenges**
  - Evidence of lightening strike at site
  - Failure to re-establish communications
  - Limited data to track ACONF operations
- **System functioned properly during entire period**
- **Duke Island site restored to original configuration – August 2007**

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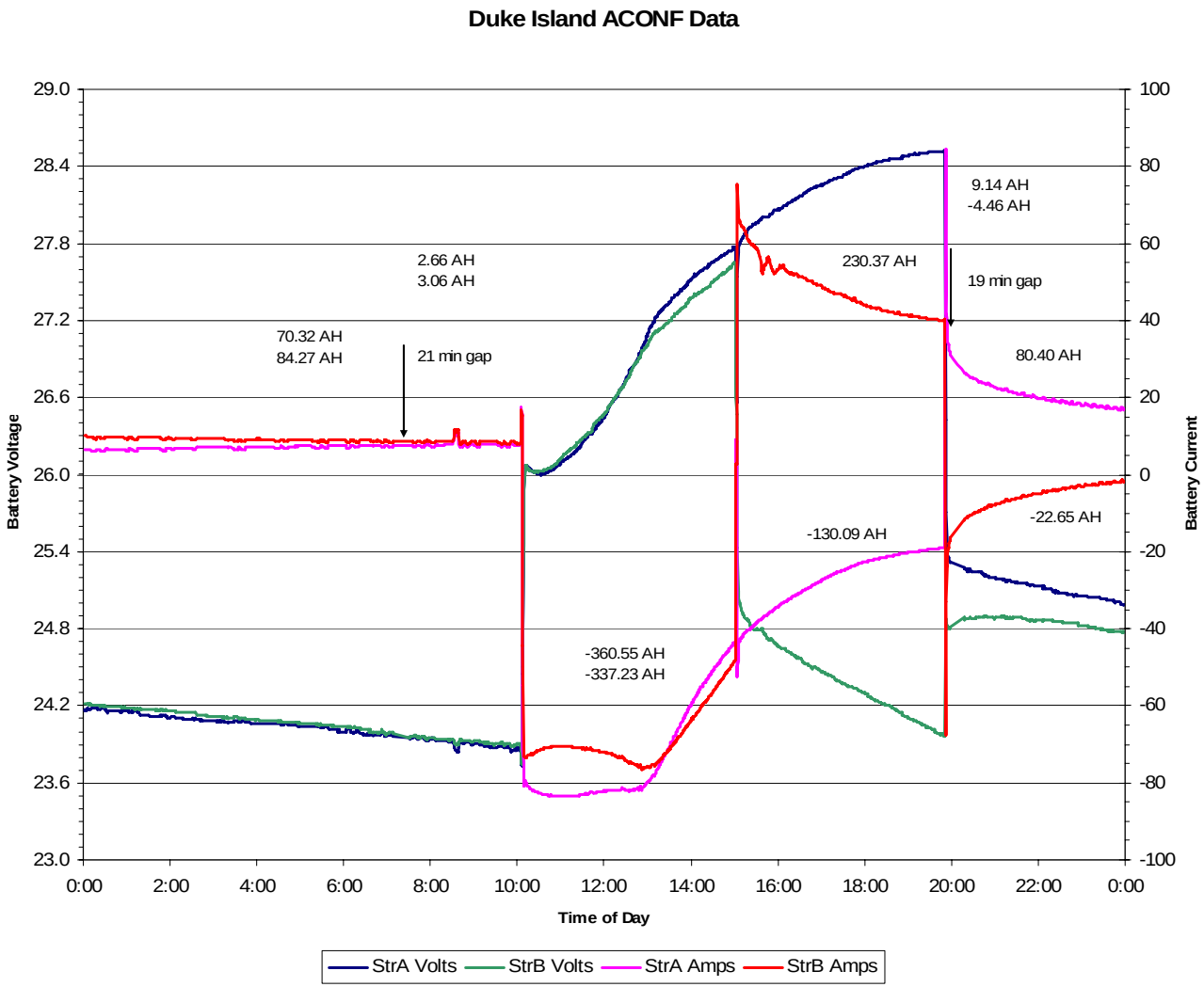
Typical Charge Cycle



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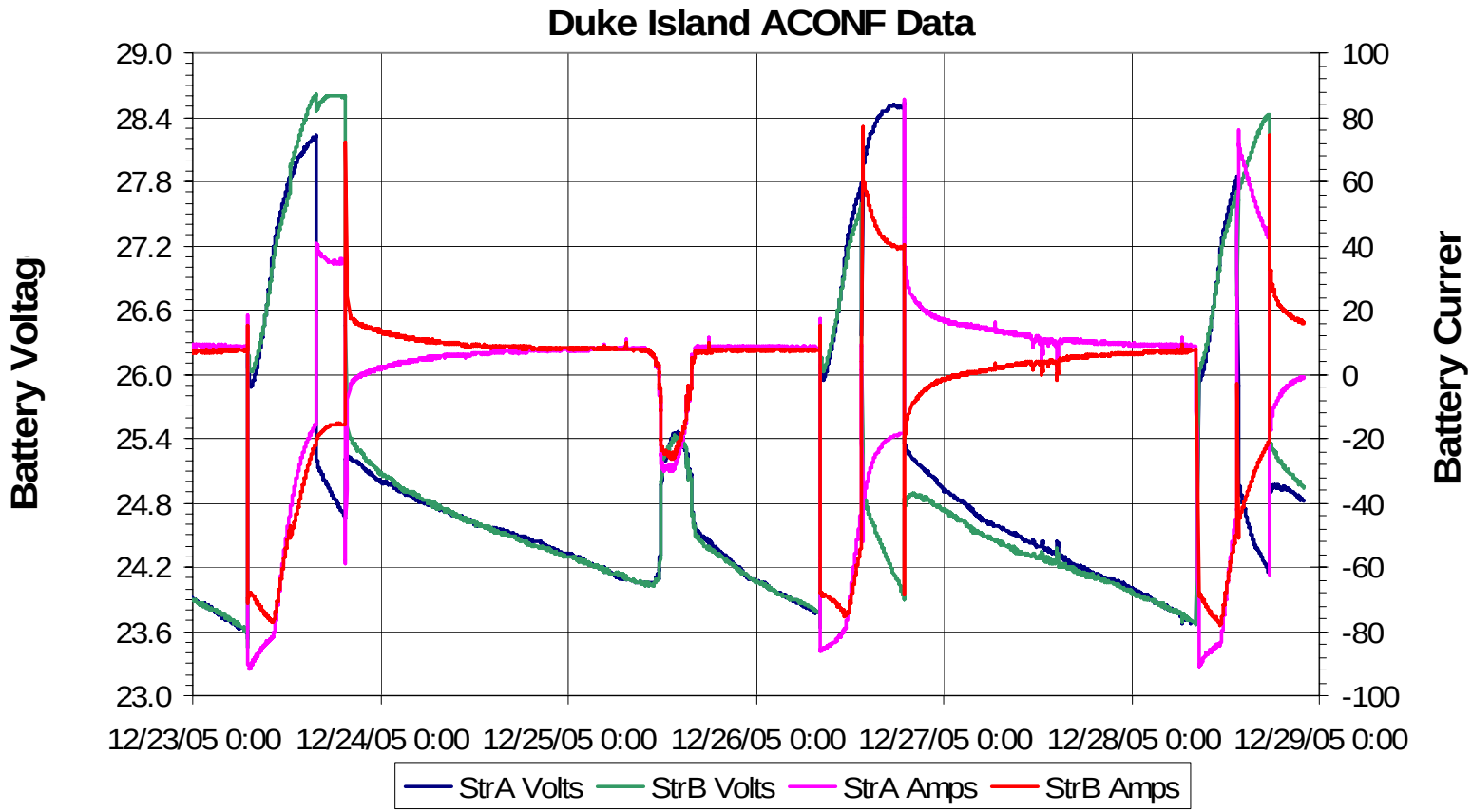
Typical Mid-Winter Cycle



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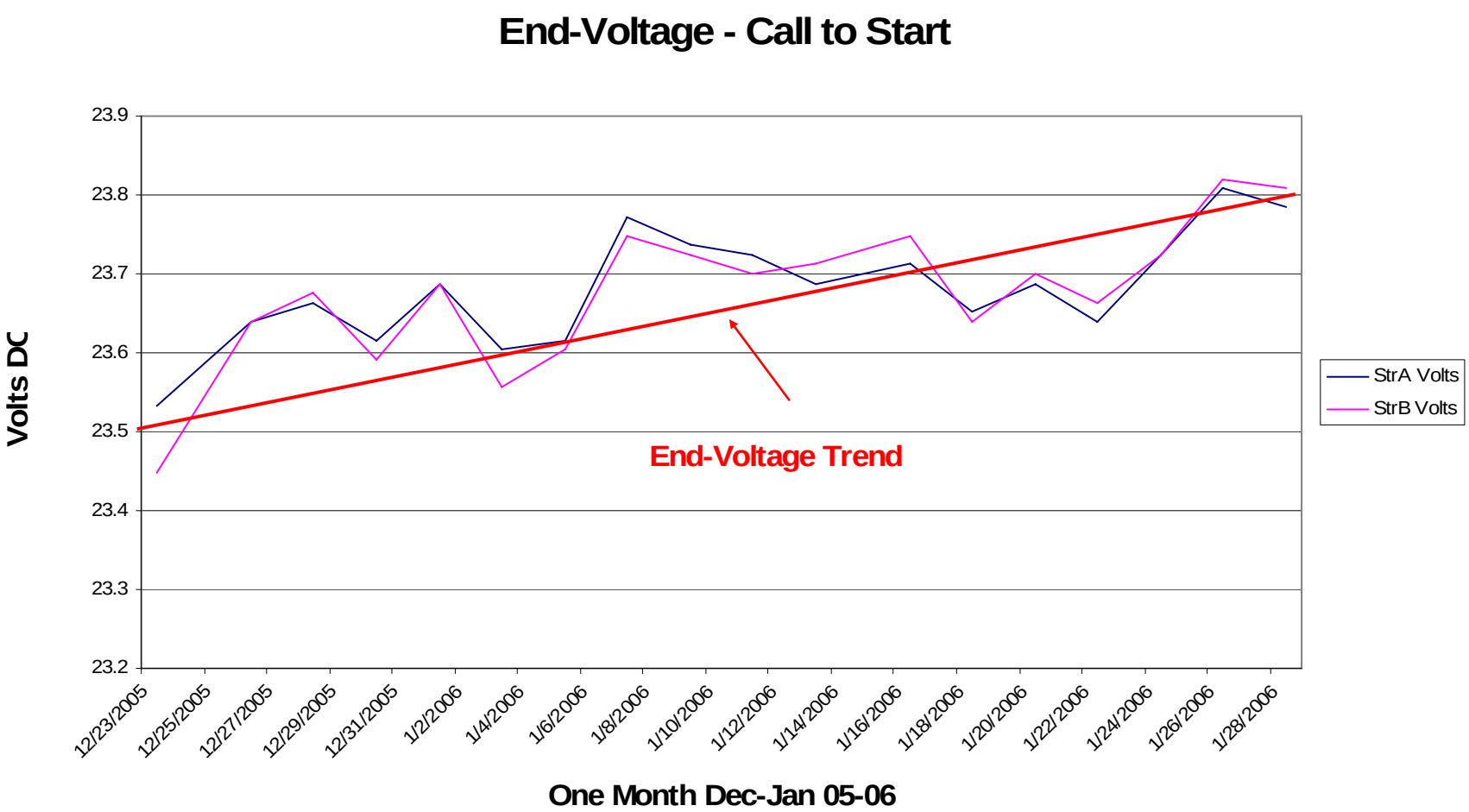
End-Voltage Trend



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Next Steps to Deployment

- **Complete Engineering Hardening**
  - Mechanical upgrades
  - Software conversion
  - Friendly operator interface
  - Improved Communications Package
- **Develop Manuals**
  - Installation Manual
  - O&M Manual
- **Acquire, Test, and Burn-in 9 Beta Units**
- **Develop Installation Plans for Summer 2008**

A Tribute to Dr. Philip Symons

- **Co-inventor of Original ACONF**
- **Brought device to maturity**
- **Instrumental in Success of Coast Guard Program**
- **In His Honor, The Development Team Has Renamed the Unit:**

Symons ABMAS Advanced Battery Management System **Controller**

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Installation Manual Title Page

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SYMONS
ABMAS ADVANCED BATTERY MANAGEMENT SYSTEM

Installation Manual

U.S. COAST GUARD

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