Emergency Station Power

Considerations and Options

Rick Fletcher, W7YP

FVARC

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Define the mission:

- Duration (hours, days, weeks?)
- Type of duty (Net control or occasional reporting/assistance)
- Bands and Modes
- Location (Fixed or moving? Indoors or out? Town or remote?)
- Daytime, nighttime or around-the-clock operation?

Equipment Selection

- Assess station requirements
  - What equipment do you have now?
  - What might you need to add?
  - Will computer equipment need to be powered?
  - Lighting?
- Design backup power system
  - This presentation will focus on lead-acid battery systems
- Purchase and install
- Test at least quarterly

List all equipment to be powered

- Transceivers, tuners, interfaces, HT/smartphone chargers, etc.
- Computers and monitors
- Networking equipment
- Lighting
- Other household needs
  - Medical devices
    - CPAP
    - Oxygen generator
- Group by:
  - Voltage requirements
  - Peak current requirements
  - Duty cycle and duration

Typical Power Requirements

- HF Transceiver 100W TX: 20A RX: 1.5A
- HF Tuner > 1A
- VHF/UHF Mobile 50W TX: 12A RX: 1.0A
- Desktop PC 2.5A @120V
- Laptop (charging) 70W, 1.5A @120V
- Light-desk lamp 60W 0.5A @120V
- Small LAN Switch 0.15A @120V

Power Source Decisions

- Generator versus Battery System or Both

Power Source Considerations

- Automatic versus manual
- How long the source can provide needed power
- Portable versus fixed location
- Cost
- Maintenance considerations

Generator Systems

- Whole house
  - Automatic Transfer Switch (ATS) or manual
  - Utility company can provide peak usage data
    - Size to 120-125% of that figure for surge loads and generator longevity
  - Water or air-cooled (water cooled will last longer; typically runs at ½ RPM)
- Partial home backup
  - Only ‘critical’ circuits are powered, reducing size of generator needed
- Portable power generation
  - Radios generally prefer clean sine-wave power (e.g. “inverter” generators)
  - Hard to beat the Honda EU family of inverter generators
    - EU2200i - $1000
      - 2200 Watts surge; 1800W Continuous; 48-57dB noise level; 47 lbs.
      - 8 hours (25% load), 3.2 hours (rated load) on .95 gallons of gas
      - 12V, 8.3A DC output; Duplex 20A 125V AC outputs
      - Run two in parallel for twice the power

Portable Solar Power Generators

- GOALZERO
  - Portable power systems from 10 Wh to 3000 Wh
  - YETI 1250 (100Ah)
    - Integrated 1200W pure sine wave inverter
    - 120V AC and 12V DC outlets
    - USB charging outlets
    - PowerPole 12V charging and outlet ports
    - External 12V, 100Ah batteries
    - AGM Group 27 battery
    - 100W briefcase solar panels
      - 24-48 hours charge time
    - $1800
    - Weight:
      - Power Station – 103 lbs
      - Briefcase Solar Panels – 26 lbs

Portable Solar Power Generators

- Powerwerx BSP-120 and BPP-M400 Power Pack
  - 120W solar power (6.7A peak output)
  - 400Wh (35Ah) Lithium Iron Phosphate battery
  - PowerPole connectors
  - 2000+ cycle life rating
  - 300W pure sine wave inverter
  - USB charging outlets
  - Three 12V DC outlets
  - 200-400 CCA jump starter
  - $590

Battery Systems – Indoor versus Outdoor

Lead-Acid is the focus of this presentation

Outdoor Battery Systems

- Automotive/RV/Marine/Golf Cart batteries can be used
  - Deep cycle types preferred, especially if outages are frequent
- Large capacity
- Readily available and lowest price
- Hazardous to use indoors due to off-gassing
- Generally housed in a battery box which is insulated in cold climates
  - Ensure adequate ventilation (out-gassing)
- Maintain with a float charger or solar charger
  - BatteryMINDer
    - All battery types (Flooded, Gel, AGM)
    - Desulfator mode
    - Auto-restart after power failure
    - Up to 6 batteries at a time

Indoor Battery Systems

- Absorbed Glass Mat (AGM) or Gel
- Designed for indoor use
- Battery life is maximized by warmer temperature
- No spill (battery box still recommended)
- No explosive gas (hydrogen)
- AGM will take more abuse than Gel
- Gel must be charged at a slower rate
  - Heat damage if charged too quickly
- Charger must know how to handle these battery types
- UPS (Uninterruptible Power Supply)
  - Inverter type for modern PCs with Power Factor Correction (PFC)

DC Power Supplies with Battery Backup

- Astron “BB” supplies (e.g., RM-35M-BB)
  - Built-in float charger for AGM or Gel
    - Must leave supply turned on
    - 6.5A down to float
  - Automatic switchover (zero delay)
  - For most models, add the “-BB” to get backup
  - All models are linear supplies

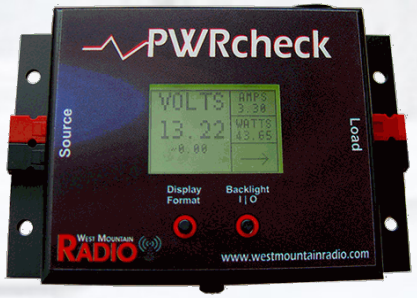
- Jetstream JTPS75BCMMKII
  - 65A continuous
  - Switching type supply
  - Some report noisy fan
    - Easily replaced with quiet PC fan
  - Instantaneous switchover to battery (AGM or Gel)

Astron BB-30M

- Add to your existing DC power supply
- Maximum 30A
- Float charger
  - 3.6A to float
- Fused on battery side
- Automatically switches load to battery
  - AGM or Gel
- Compact (3.8” x 4.5” x 1.93”)
- Front panel LED shows status
  - “Full”, “Discharging”, “Charging”
- Approximately $70

DC Power Management

- Monitor battery voltage to protect battery and load
  - Shut down when voltage falls to 11.75V
  - Battery is fully discharged at 10.5V
    - Battery might be damaged at this point
- Automated monitors are available
  - West Mountain Radio PWRcheck
  - Powerwerx Power Analyzer
  - More…



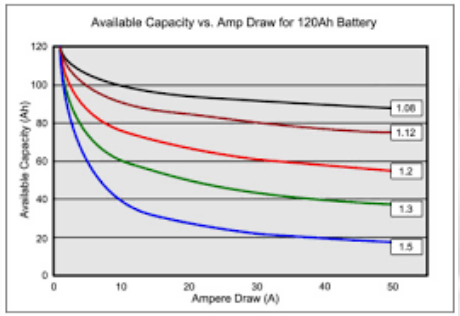
- Typically show Amps, Volts, Watts, Amp-Hours, Watt-Hours, Peak Amps, Sag Voltage, Peak Watts
- Some sound alarm at over/under voltage and/or disconnect load

Keep It Clean And Safe

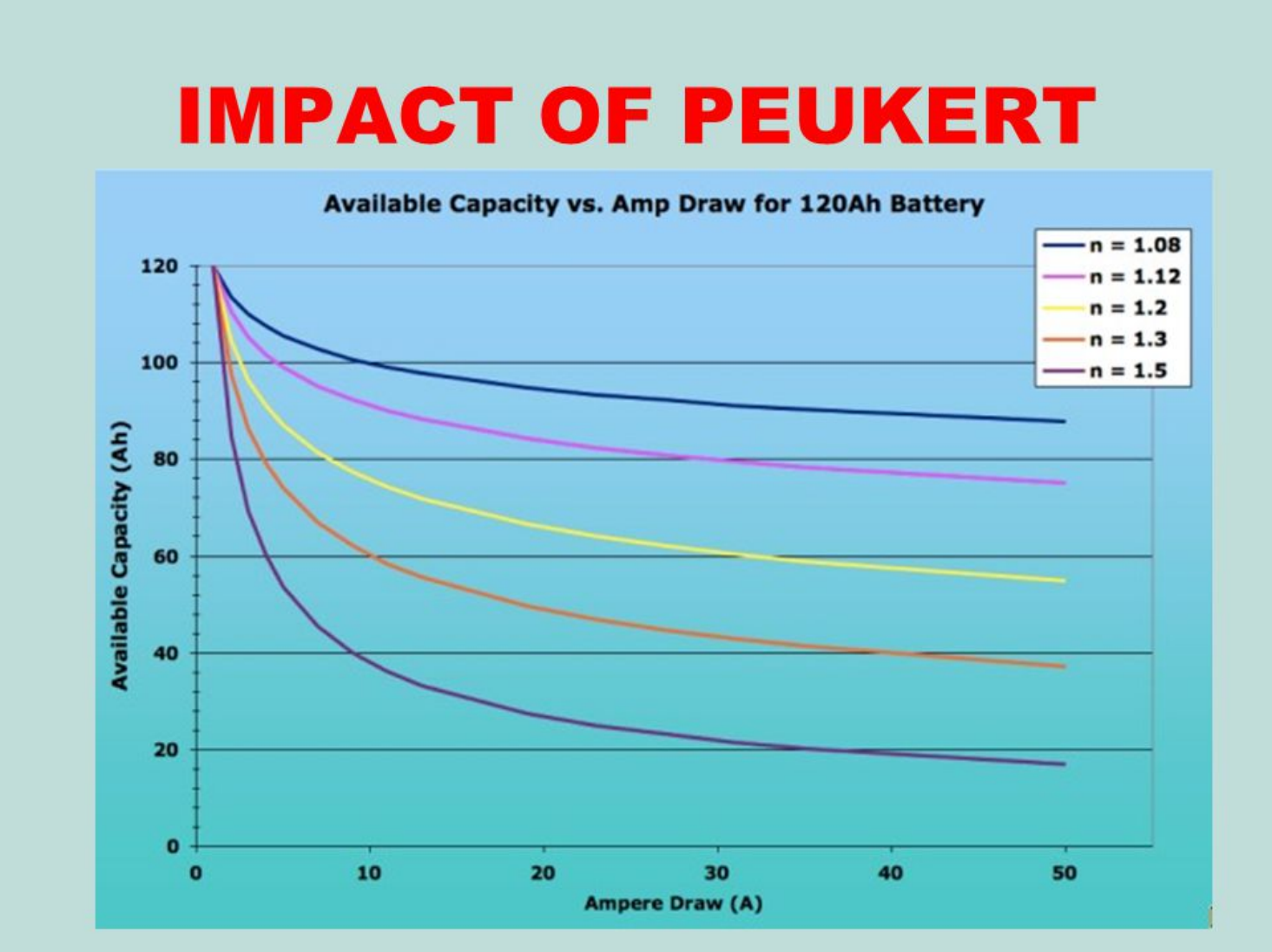
- Organize DC power runs and keep each load properly fused
- Highly recommend “PowerPole” DC distribution panels
  - West Mountain Radio RIGrunners
    - Up to 12 DC outlets, individually fused
      - Uses standard auto-type blade fuses
      - Up to 80A total load, 40A individual load
    - LEDs indicate normal, overvoltage or undervoltage
    - Anderson PowerPole connectors for each load
    - RIGrunner 4005i for full local/remote DC power control
      - Status and control via LAN and over the Internet
      - 5 outlets, up to 40A total
      - WiFi option
      - PowerPole connections in the rear
      - LCD shows status
        - Cycles through each output
      - Email alerts

Sizing Your Battery System

- Batteries are rated in Ampere Hours (Ah)
  - A battery with a capacity of 1 **amp-hour** should ideally be able to continuously supply a current of 1 **amp** to a load for exactly 1 **hour**, or 2 amps for 1/2 hour, or 1/3 amp for 3 hours, etc., before becoming completely discharged.
- But Peukert's Law shows that the real world isn't ideal
  - Presented by the German scientist Wilhelm **Peukert** in 1897, expresses approximately the change in capacity of rechargeable lead–acid batteries at different rates of discharge. As the rate of discharge increases, the battery's available capacity decreases, approximately according to **Peukert's law**.
    - A "Peukert" factor of 1.0 is perfect
    - A factor of 1.6 is bad
    - Varies with
      - The age of the battery
      - Temperature



Sizing Your Battery System



Sizing Your Battery System

- Typical 100W HF transceiver draws 1.5A in RX; 20A in TX
  - Let’s say you’re going to transmit 15 minutes out of each hour:
    - 20A x 0.25 hours = 5Ah
      - TX Duty Cycle will affect this
        - FM - 100%
        - AM - 50%
        - CW - 50%
        - SSB - 35%
        - Data - 100%
    - 1.5A x 0.75 hours = 1.125Ah
  - You’ll need 6.125Ah
  - Add in a 10% Peukert factor = 6.74Ah per hour of operation
    - Use of a 10% factor will approximate most real world situations for AGM and Gel
    - Use at least 20% for flooded lead-acid
    - Best to use actual testing of your battery system to find its real world performance and document it over time

Test and Maintenance

- Record discharge time under simulated ‘real’ conditions
  - Check battery voltage at ½ hour intervals
    - 12.1V is approximately a 50% charge level
    - Don’t let voltage fall below 11.75V
- Repeat tests at least quarterly
  - Keep a log and compare results
- Regularly inspect cables and contacts
- Check for corrosion or “white dust”
  - Evidence of overcharging, leaks or venting problem
- Keep a good supply of spare fuses on hand!


Q&A