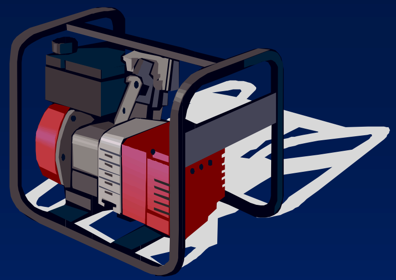
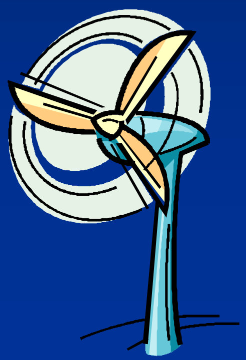
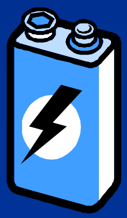
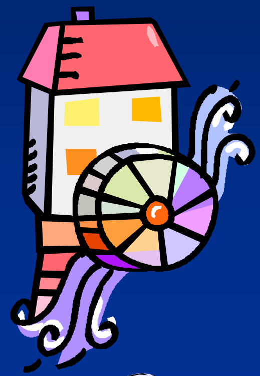


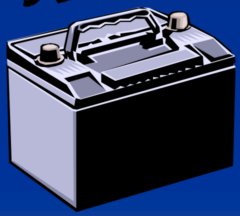
Are you prepared ?

Emergency Power









What do I need?

What do I need?

Ask yourself these questions:

- What equipment do I plan to operate?
- How long will I need to operate it?
- What is my equipment power requirement?
- How will I get the power source selected to the operating site?
  - Where will I be operating it from?
  - Fixed or moving Location
  - Location access
  - Availability of alternate power at location

How much emergency power is needed?

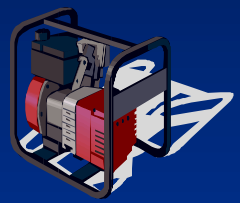
For the radios and associated equipment I need to operate:

- What is my anticipated standby current requirement (non Transmitting)?
- What is my anticipated current when transmitting at the needed transmit power output level?
- What is my anticipated transmit duty cycle?

Continuous Emergency Power

Motor Driven generator

- Must be operated outdoors away from Radio operation area
- Requires Fuel sufficient for the duration of the emergency
- Noisy (acoustical and electrical)



Solar power

- Good for keeping battery charge topped off or for long term charging. To produce enough power to operate a 50/100 Watt radio it would take a very large Solar panel.

Water/wind/ other mechanical generation

- Good for permanent site power generation
- Generally not portable – need wind or water

Continuous Emergency Power
(Continued)

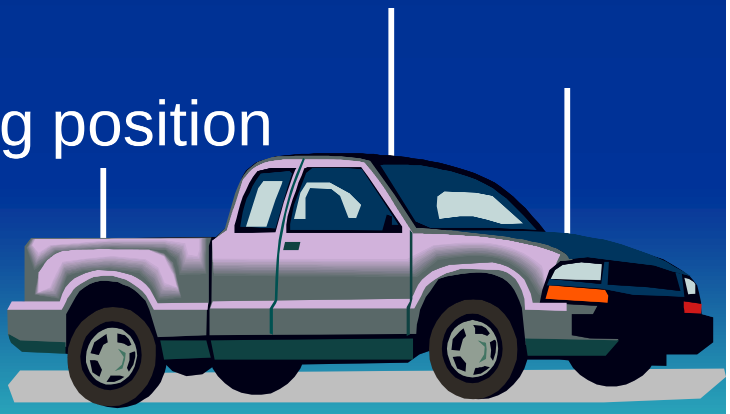
Wind, water and human power (continued)

- There have been articles on home built wind powered generators based on automotive alternators and the fan blade from a 20" or larger window fan.
- A water wheel could also can be used to turn an automotive alternator
- A stationary exercise bike could be used to turn an automotive alternator (there was an article about a Doctor who had his kids TV set powered this way to make sure they got enough exercise).

Continuous Emergency Power
(Continued)

Vehicle Power

- An automotive battery provides high current
- Running the engine charges the battery
- You can charge other batteries
- Does requires vehicle access to operation site
- Great antenna platform
- Provides a protected operating position

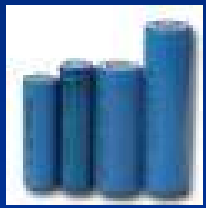


Stored Emergency Power Choices
(Batteries)

Disposable alkaline batteries

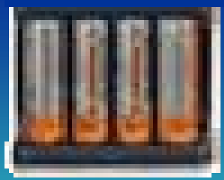
- Readily available (AAA through D cells available everywhere)
- Long shelf life (years)

Rechargeable batteries (NICAD and NIMH)



- High self discharge rate (short shelf life, Months)
- High energy storage capacity vs size and weight
- Charge at 1/10 the battery rating (200 ma for 2 AH battery)

Lithium Ion batteries

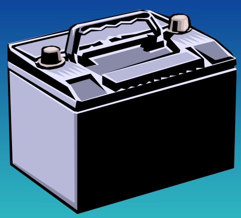


- Low self discharge rate (very good shelf life)
- High energy storage capacity vs. size and weight
- More expensive

Stored Emergency Power (Continued)

Lead Acid Batteries

- **Flooded or wet cells**
  - Must be kept upright in vented area
  - Require maintenance (maintaining electrolyte level)
  - Will withstand abuse (very high charge-discharge rates)
  - Automotive batteries are designed to provide high current for short periods of time (ie: starting a vehicle)
  - Deep cycle batteries are designed for a deep discharge of up to 80% of the battery capacity
  - Charge condition measured by specific gravity of electrolyte
  - ~ 12.7 to 12.8 VDC when fully charged
  - 14.2 to 14.7 VDC charging voltage
  - Can accept high charge rates



Stored Emergency Power (Continued)

Lead Acid Batteries (Continued)

- **Gel Cells**
  - – Thickening agent added to electrolyte
  - – Sealed, can be mounted in any position
  - – Do not require maintenance or venting
  - – Float charge voltage 13.5-13.8 VDC (Current limited)
  - – Readily Available new and used
- **Absorbed Glass Mat (AGM)**
  - – Fiberglass like plate separator which holds electrolyte –No voids in electrolyte
  - – Can do everything a gel-cell can do only better
  - – Higher cost
  - – Float charge 13.2 to 13.8 VDC

Stored Emergency Power (Continued)

Choosing your emergency power source

- – Emergency Power requires understanding the requirement and pre-planning before the need
  - What type of power source
  - Storage/maintenance to insure readiness
- – Understand the operating environment
  - Can batteries be charged during event /emergency?
  - Will generator or commercial power be available?
  - How much transmit power needed (effects operating time)?
  - What is the accessibility like for the operating location?
    - – Drive in - Hike in – Other access
- – Anticipated duration of operation
  - Determines emergency power requirement

Stored Emergency Power (Continued)

- ***Choosing your emergency power source (Continued)***
  - Generators
    - Require fresh fuel
    - A maintenance and test plan
  - Batteries
    - Require re-charging
    - Require float, smart or periodic charging
    - Should be tested for capacity annually
    - For HT’s a back up plan with disposable batteries

More on Gel Cell Batteries

Gel cells are one of the most common portable power sources used for amateur Radio communication

- Most are 12 volt and are a convenient transportable way to power your equipment and readily available at hamfests
- The larger the AH rating of the battery the more energy you can store, and the longer you can operate
- Will discharge over time (without any use) and must be recharged. A gel cell will loose 50 % of its charge in 6-12 months (dependent on storage temperature).
- Gel Cells are a very low impedance sources, therefore can deliver very high currents.

DO NOT SHORT THE TERMINALS

Emergency Power Considerations

Battery Power For Extended Operation

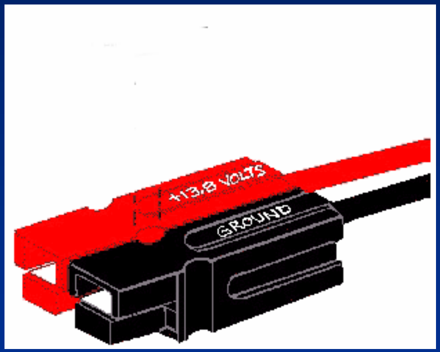
- Additional or larger AH Capacity batteries
- Run lower transmit power
- Provide a means to charge batteries

Battery Power Connectivity

- Standardize on connectors (Anderson Power pole recommended)
- Use common polarity convention (red **+** black **-**)
- Adapters to and from common connectors

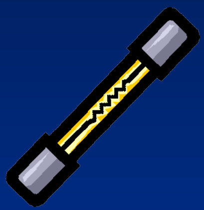
Open wire	Binding posts
Cigarette lighter	vehicle accessory connector
Common Radio Connectors	Other

Standardized Connectors for Interoperability



Emergency Power Consideration
(Continued)

Battery Safety

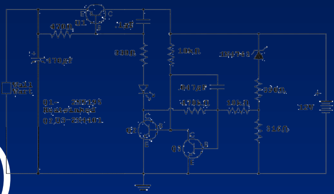


- Series fuse ***(A must for fire safety)***
  - Higher rating than equipment fuses
  - Located as close to battery terminals as practical
- Protect battery terminals from accidental shorts
  - The Battery high current capability can be dangerous
- Do not exceed the battery charge ratings, Specifically:
  - Limit max charge & in rush current
  - Limit maximum charge voltage (for smart chargers)
  - Limit maximum float charge voltage (13.8 VDC)
- Use proper Fuse and wire size for load

Emergency Power Considerations

(Continued)

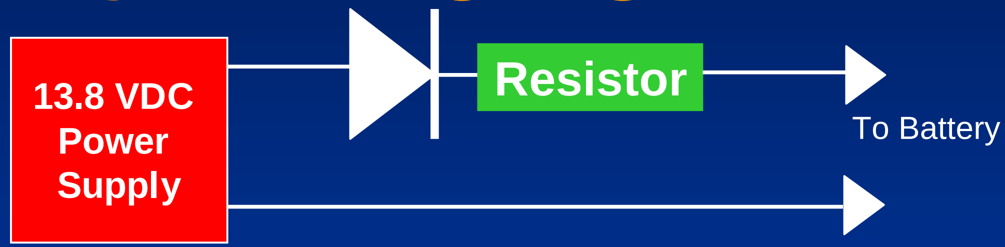
Battery Charging



- A smart charger (commercial / home built)
  - Does rapid initial charge, and a reduced charge rate as battery approaches full charge.
  - Chargers for automotive Flooded cells should not be used on gel-cells because they may exceed the inrush current & float voltage
- Wall wart charger ½ to 1 amp capacity, 12.5-13.8 VDC
  - Look at the hamfest flea market   Make sure the output is DC and voltage does not exceed 13.8volts with small load (~50 ma)

Emergency Power Considerations
(Continued)

Battery Charging (continued)



- You can use a DC power supply to charge gel-cells
  - Current must be limited to prevent high in-rush current
  - Series diode used to prevent reverse current when switched off (set PS voltage high by an amount equal to the diode forward voltage drop, ie: for a .6v drop diode set PS to 14.4VDC).

Emergency Power Considerations
(Continued)

Battery Charging (continued)

- Home built chargers
  - Many circuits available in Amateur handbook and on the web and as kits (see appendix for sites with more information)

Emergency Power Considerations

Alternative energy source charging

- Solar panels
  - Generally a slow charge rate
  - Generally expensive for higher charge rates
  - Solar panels sometimes available at hamfests.
  - Check RV accessories catalogs & Harbor Freight
  - Prevent reverse current flow with a series diode if connected directly to the battery.
  - Small units useful for charging batteries when not in use

Getting all the power to the radio

How far will the radio be from the DC Power source?

- You need to consider the voltage drop of the leads from source to the equipment
- The voltage drop of the connecting leads can be determined by:

V(d) = wire resistance per foot x Current x length x 2 (+ & - wires)

- For 20 ft of number 12 wire with a 20 amp load the loss would be:

V(d)=1.56/1000ft x 20 ft @ 20A x 2 wires

or ***V(d)=1.26 volts***

Wire Size	Current	Length -ft	Ω/1000 ft	Volt Drop
10	10	10	1	0.2
10	10	20	1	0.4
10	10	30	1	0.6
10	20	10	1	0.4
10	20	20	1	0.8
10	20	30	1	1.2
12	10	10	1.56	0.312
12	10	20	1.56	0.624
12	10	30	1.56	0.936
12	20	10	1.56	0.624
12	20	20	1.56	1.248
12	20	30	1.56	1.872
14	10	10	2.524	0.5048
14	10	20	2.524	1.0096
14	10	30	2.524	1.5144
14	40	10	2.524	2.0192
14	20	20	2.524	2.0192
14	20	30	2.524	3.0288

Overcoming voltage loss

Use a battery booster

A Battery Booster is a switching power supply that accepts a wide range of input voltage and delivers a fixed 13.8 VDC. Mounting the Battery booster near the radio insures it will have the13.8VDC it requires and to provide extended battery operating time. Typical battery boosters will operate with inputs as low as 10 volts.

http://www.powerstream.com/dc2.htm

Packaging Your Source

- Smaller batteries 7AH or less can be carried in a fanny pack, shoulder bag, or hunting vest

- Larger batteries can be housed in small fiberglass portable instrument cases, found at hamfests.

- Cabinets or cases with enough room for the radio and battery

- Back packs (generic or from the radio manufacturer, similar to what ICOM offers for the 703/706.)

The Appendix has Additional Resources

- Testing surplus Gel cells
  - Virginia State Races organization web site
  - Quick testing method from Nuts and Volts Magazine
  - Useful web Sites
  - Reference publications
  - Information on Anderson Power pole connectors

Appendix

Additional Resources

Testing A Gel Cell Battery

- The Virginia State Races organization has a web page that addresses how to test you gel cell, titled:
  Inspection and test of donated batteries for RACES
  on the web at:
  http://www.varaces.org/techrefs/donated_batteries.pdf

Quick Testing A Gel Cell Battery

1. Fully charge the battery
2. Disconnect charger and wait 10 minutes
3. Record open circuit battery voltage (V1) (should constant and at least 12.5 volts)
4. Connect a 1 amp load across the battery (12 Ω) for 10 seconds and record the battery voltage (V2). Remove the load.
5. Calculate the internal resistance of the battery

   (V1-V2)/load current

   Example: 12.74-12.72)/1 or .02/1 or .02 Ohms

   A new battery will have about 10 milliohms (.01Ω) resistance. When a battery has doubled its new or initial internal resistance its capacity will have decreased by ~50%

Useful Web Sites

- Nickel Cadimum charger information http://www.angelfire.com/electronic/hayles/charge1.html
- Battery charging circuits and information http://www.discovercircuits.com/B/batt-chrg.htm
- Battery Charger Ideas http://www.techlib.com/electronics/battery_chargers.html
- Car Battery Charger http://www.aaroncake.net/circuits/charger1.htm
- Sealed Lead Acid Battery Charger http://www.geocities.com/vk3em/sla-charger/sla-charger.html
- Sealed Lead Acid Battery Charging Basics http://www.powerstream.com/SLA.htm
- Low cost solar charger for Lithium Ion AA and AAA Batteries http://store.l-f-l.com/cgi-bin/cp-app.cgi?pg=prod&ref=AA-SOLAR
- Frequently asked battery questions http://www.buchmann.ca/faq.asp
- Deep cycle battery FAQ's http://www.repairfaq.org/ELE/F_deep_cycle.html#DEEPCYCLE_006

Additional Useful Web Sites

- http://www.spokaneprepares.org/
- http://www.spokanecounty.org/emergencymgmt/search.htm
- http://66.193.37.86/ (Spokane County ARES/Races)
- http://www.govlink.org/3days3ways/
- http://www.ocraces.org/powerpole.html
- http://www.w5fc.org/pse_docs/KNOWLEDGE/anderson_powerpole_instructions.htm

Emergency Power

As General Patton said

"you will know What you need to do"

to be prepared