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Nickel & Lithium Batteries for Ham Radio

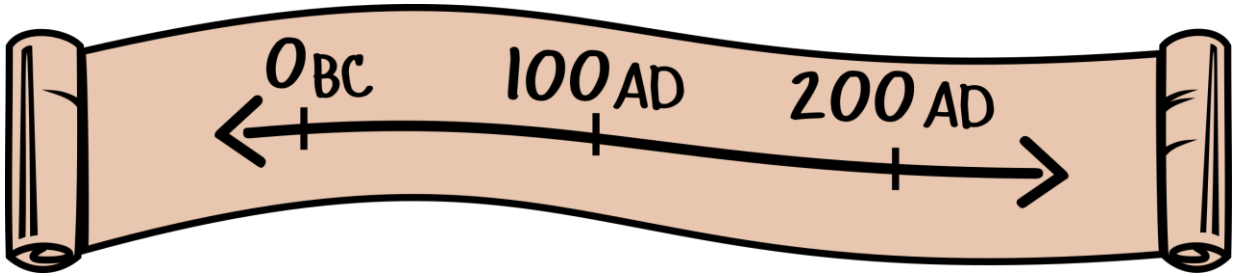
with Rick Tressler
WA3UOO

TechNet

Tonight's Topics

- Chronology
- Energy Density
- Self Discharge
- Voltage & Capacity Ratings
- High Capacity Batteries for Portable Operation
- Shopping for Batteries
- Charging Safety
- Useful Links

Chronology



Chronology

- The **NiCad** was the first rechargeable battery utilized in hand held (HT) radios
  - Chemistry originally invented in 1899. First NiCd pack probably when HT's hit the market in the 1970's
- **Nickel Metal Hydride** followed the NiCad with similar chemistry and as a voltage-compatible battery
  - Invented 1967 with first commercialized AA cells being offered in 1989
- **Lithium Ion** followed Nickel Metal Hydride and is now the standard issue battery type for the HT market
  - Invented 1970

Energy Density

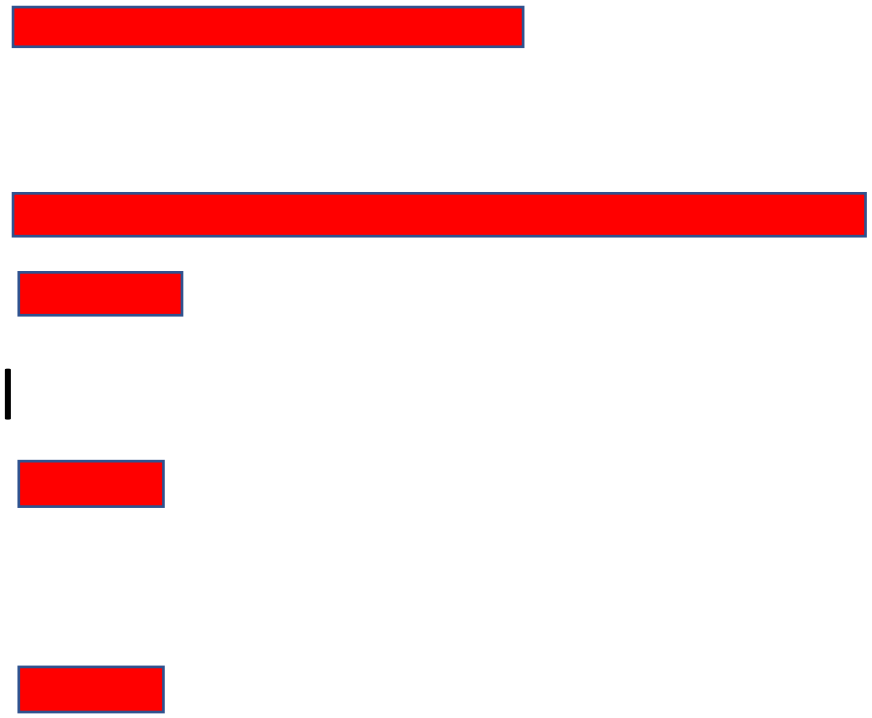
Energy Density

- Nickel Cadmium (NiCd) – 1.2V nominal
  - Energy density 
- Nickel Metal Hydride (NiMH) – 1.2V nominal
  - Energy density 
- Lithium Iron Phosphate (LiFePO) – 3.2V nominal
  - Energy density 
- Lithium Cobalt Oxide (LiCoO) – 3.7V nominal
  - Energy density 

Self Discharge Characteristics

Self Discharge Characteristics at Room Temperature

- Nickel Cadmium (NiCd) – 1.2V nominal
  - Self discharge rate 10%/mo.
- Nickel Metal Hydride (NiMH) – 1.2V nominal
  - Self discharge rate 15% standard cells
  - Self discharge rate % low loss cells 1.3 – 2.9%/mo.
- Lithium Iron Phosphate (LiFePO) – 3.2V nominal
  - Self discharge rate 1-2%/mo.
- Lithium Cobalt Oxide (LiCoO) – 3.7V nominal
  - Self Discharge Rate 1-2%/mo.



Voltages & Capacity Ratings

Capacity Ratings

- A popular method of user ratings of capacity is the ampere-hour
  - Merriam-Webster - a unit quantity of electricity equal to the quantity carried past any point of a circuit in one hour by a steady current of one ampere
  - 1 amp for 1 hour = 1AH
- The sizes of packs such as discussed here are rated in *milliampere-hours*
  - 1AH = 1000MAH
  - Divide MAH by AH to convert to AH
    - 4300MAH / 1000 = 4.3AH
- Milliampere-hour capacity is how pack are compared for size, need and price

NiCad & NiMH Sizes and Voltages

Icom
BP-173xe
800MAH, 9.6 for IC-W32A
$50

- Pack Voltages for HT's
  - 4 cell, 4.8V
  - 5 cell, 6.0V
  - 6 cell, 7.2V
  - 7 cell, 8.4V
  - 8 cell, 9.6V
  - 9 cell, 10.8V
  - 10 cell, 12V
  - 11 cell, 13.2V
- Capacities
  - 600MAH – 1600MAH across the voltage ranges offered
- Higher pack voltage frequently results in higher RF output
- NiMH packs offered today *may* use low self-discharge cells

Lithium Ion Sizes and Voltages

- Common Pack Voltages
  - 2 cell, 7.4V – majority of packs offered for HT's
  - 1 cell, 3.7V
- Capacities
  - 1600 – 4000MAH for 7.4V packs
  - 800-2400MAH for 3.7V packs

Kenwood
PB-42XL
4000MAH, 7.4V for TH-f6
$60

High Capacity Lithium for Portable Operation

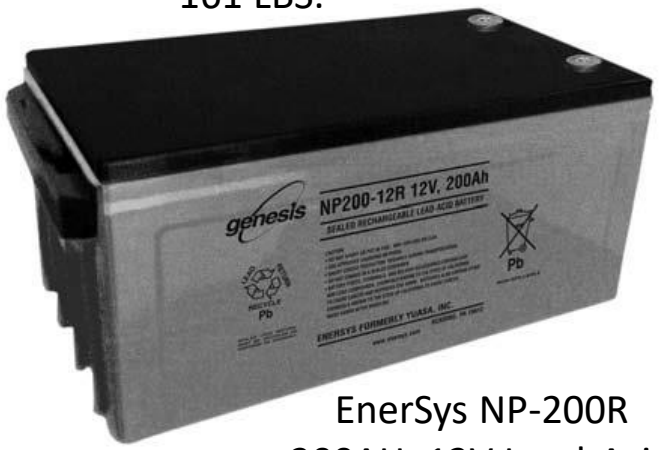
The Next Generation in Portable Power

- Lithium Iron Phosphate (LiFePO4) 12V Battery
- Capacity range - 12AH to 300AH
- Price range - $125 - $2,650
- Requires specific charger based on battery capacity

53 LBS.

Bioenno BLF-12200AS
200AH, 12V
$1,749

161 LBS.



EnerSys NP-200R
200AH, 12V Lead-Acid
$?

Bioenno Power
BLF-1212A
12AH, 12V
$125

Shopping for Batteries

Shopping for Batteries

- Key Considerations
  - Know your make and model radio
  - Check the rig manual for RF output at different pack voltages
    - Higher pack voltages usually get your more RF output *and higher discharge current*
  - What are your needs for capacity?
    - Occasional use?
    - All-day power for events
  - What is the wallet situation?
    - Lower capacity packs may cost less but not always

Safety

Be Safe!

- Regardless of chemistry and size, batteries can an enormous source of high energy for their size – ***especially Lithium Ion types***
- Always charge batteries with a charger designed to do the job for the particular type
- ***NEVER*** *use a lead-acid or NiCad charger to charge a Lithium Ion battery*
- Read all user instructions and safety precautions for ALL batteries you use
- Protect battery terminals from short circuits

Useful Links

- Wikipedia article on lithium ion batteries
  - https://en.wikipedia.org/wiki/Lithium-ion_battery#Electrochemistry
- Wikipedia article on nickel metal hydride batteries
  - https://en.wikipedia.org/wiki/Nickel%E2%80%93metal_hydride_battery
- Wikipedia article on nickel cadmium batteries
  - https://en.wikipedia.org/wiki/Nickel%E2%80%93cadmium_battery
- Batteries America – replacement HT batteries, chargers, accessories
  - https://batteriesamerica.com/
- W&W Manufacturing - replacement HT batteries, chargers, accessories
  - www.ww-manufacturing.com/
- GigaParts – Lithium Ion alternatives to lead-acid for portable operation
  - https://www.gigaparts.com/

Portable Generators

Thanks for checking in to the CORC TechNet this evening!

73 until next time!