EmComm,
CERT, QRP

Battery Box
by Tony Gawel W6TNY

CERT (Community Emergency Response Team)
EmComm (Emergency Communications)
QRP (Low Power Operation; example ham radio; 5 watts output / 10 watts input)
Bio

• Director of Information Technology for a large international school and laboratory
• Interest in electronics since elementary school building kits, TV and radio repair.
• Working in computer and electronics field since the 1970s
• Passion for communications, networking, WI-FI, and digital systems
Background

• Always looking for better ways to plan, prepare and to make our lives easier.
• Looking first to what is already available (off the shelf)
• Repurposing reusable items headed to the e-waste
• These attributes are what attracted me to amateur radio (Ham Radio)
• Ability to exercise my engineering and creativity skills to design, experiment and then share it with others.
Lawyers

• Any lawyers in the audience?
DISCLAIMER

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Current Power Options

• Cell phone travel charger

• EmComm Boxes

HARDEN Power Juice Box
https://www.portableuniversalpower.com/

Quick Sliver Go-PWR Plus XL™ 80 Ah. Battery Box
Project Concepts

Provide CERT, EmComm teams and amateur radio organizations with a *Emergency Battery Box* project that is:

- Low cost
- Fun and simple to build
- Easy to transport
- Requiring minimal tools to assemble.
Objective

- A good group/club project
- Low cost
- Gets people involved
- Anyone can do it
- Expandable
- Gets people excited
- Provides a platform people can build on, experiment, and personalize
Uses

• Home preparedness
• Emcomm teams
• Races
• Fire Watch
• Race events
• Disasters
• Meet and Greet Events (PD or Fire Open House)
  — Draw people into the booth to charge their phones
  — Attract attention of the curious
Planning and Selection

• Identify potential uses
  – Charge cell phones
  – Charge or operate HT with a battery eliminator
  – QRP
  – Mobile on low power
  – Mesh Node
  – LED lighting
  – Fans
  – ETC.
CHALLENGES
Challenges

- Creating a simple to build
- Small
- Lightweight
- Easy to transport
- Affordable
- Expandable
- A concepts that can be used in future projects
- Something that anyone can do and have fun
Possible Power Sources
Possible Power Sources

• Dilithium Crystals
Possible Power Sources

- Flux Capacitor
Possible Power Sources

• Power of the Sun
Power Source

• 7 - 12 - 15 Ah AGM battery
  – They low cost (some cases free)
  – Plentiful
  – Lightweight

• Maserati Battery LIPO4
  – 8 Ah LIPO4
  – 12 Ah LIPO4
  – 20 Ah LIPO4
Battery Types

• Before we get too far into the project we need to talk about battery types

• Safety

• What works

• What doesn’t
Safety
Safety

• **Never** disassemble a battery under any circumstances. The materials in a battery are often toxic and can cause severe burns and can damage your clothing.
• **Red wire goes to the Positive**
• **Black wire goes to the Negative**
• Never use a fuse larger than one that is rated or recommended for this project
• (Keep some spare fuses in your box)
• **Do not short circuit a battery by crossing the positive and negative terminals** as you can damage the battery and other electrical equipment components. It can also cause burns and/or injury to you.
• Never throw batteries into a fire as they can split, cause toxic fumes and leak acid.
• Don’t reverse the polarity of the battery or you can damage your equipment and the battery.
• Don’t use old and new batteries together. This can degrade the batteries.
• Always charge the battery at the correct voltage and amperage after use. Don’t over-charge the battery as this can damage the battery and cause it to leak. Follow the charging procedures from the manufacturer.
• Store batteries in a sealed cool dry place when not in use (battery box).
Battery Types

• Starting/ Cranking
  – High current and short duration
  • Cars and Truck starters
Battery Types

• Deep Cycle
  – Lower Current steady power over long duration
    • Motor Homes
    • Boats
    • Golf Carts
    • Amateur Radio
Deep Cycle Batteries

• Floated Lead Acid
• Gel Cells
• Absorbed Glass Matt (AGM) *
• LiPO
• LiFePO4 *
BioEnno
LiFePo4

Bioenno Power 12V, 12Ah LFP Battery and BMS
K2 Energy
LiFePo4

K2 Energy K2B12V10EB 12V 10Ah Lithium Iron Phosphate Battery and BMS
Zippy Flightmax
LiFePo4

ZIPPY Flightmax 8400mAh 4S2P 30C LiFePo4 Pack
Battery Capacity Level

• On standard batteries you can use voltage as an indicator of the charge level of the battery
# SLA/AGM Battery Charge Level

<table>
<thead>
<tr>
<th>State of Charge</th>
<th>AGM battery</th>
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<tr>
<td>100%</td>
<td>12.80+</td>
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<tr>
<td>75%</td>
<td>12.6</td>
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<tr>
<td>50%</td>
<td>12.3</td>
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<tr>
<td>25%</td>
<td>12</td>
</tr>
<tr>
<td>0%</td>
<td>11.8</td>
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</tbody>
</table>
Battery Care

• For long battery life store your battery fully charged and check it once quarter
• This minimizes sulfating of the plates which can happen over time

Batteryminder.com
Sulfating

- Sulfating happens when lead sulfate crystals build up on the lead plates.
  - Loss of capacity, shorter run times
  - Premature failure
  - Longer charging times
  - Excessive heat build up
  - Cells causing loss of capacity and early failure
Charging

• Flooded Lead Acid
  – Constant current, constant voltage (CC/CV)
  – about 13.8 to 14.4 v Float 13.2 - 13.4
  – 12 to 16 hours

• AGM
  – Sensitive to overcharging
  – Multi stage charger to reduce over heating and prevent gassing
  – Charge 14.4 Float 13.5 - 13.8 v

• LiFePo4
  – Depends on battery
What is C

• The C rating specifies the how fast a battery should discharge or charge.

• A 1C rate, the battery will charge or discharge as the marked Ah rating of the battery.

• At .5C the current rate is ½ the marked rate and the time doubles.
Proper Charging

• Single stage charger
  – Single output charge voltage and no shut off when fully charged
    • Can overcharge battery
    • Cause overheating
    • Premature battery failure
Charging

• Multistage Charger (Low and Slow)
  – Bulk
  – Additional Stages
  – Trickle
  – Float
  – De-sulfate
Charging Schematic
Solar Charging

• 5 Watt solar panel

• Charge Controller
Discovery

• Experimenting to find the right combination
Mounting

• **Solid**
  – Dense foam to protect the box and the accessories you can pack inside

• **Spray in Foam**
  – It was fun
  – Messy and it takes overnight to set up
Battery Tie Down

• Tie wrap and cable tie mounts

• Nylon strap and buckle

• Moved to double sided Velcro
Project Selection

- **Basic**
  - Simple Battery
  - Fuse
  - 12v Socket

- **Cadillac**
  - Battery
  - Fuse
  - 12v socket
  - USB Charger
  - Anderson
Battery Capacity

• With a bigger box you can add a larger battery and more accessories
Basic Parts List

- Ammo box
- Battery
- Fuse holder and fuse
- 12 v Marine Grade Cigarette Lighter Socket
- Velcro Battery trap
- Dense Foam padding
Parts

• Plastic ammo boxes are available at Harbor Freight and sporting good stores

• Most of the other parts are available on Amazon
Cadillac Parts List

- Ammo box
- Battery
- Fuse holder and fuse
- Astra Depot Triple Function Dual USB Charger + Voltmeter + 12V Outlet Socket Panel
- Anderson connectors (optional)
- Battery strap
- Foam padding
Schematic
Battery Pack Adapters

Harden Power BatPac RBC2

Quick Sliver Batt-Mon 12Ah Battery Plate

Harden Power RBC2 (7 & 9AH) battery:

Harden Power BatPac Solar
Binding Post Wiring
<table>
<thead>
<tr>
<th>QTY</th>
<th>Description</th>
<th>Source</th>
<th>Price</th>
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<tr>
<td>1</td>
<td>30 Cal Plastic Ammo Box</td>
<td>Harbor Freight</td>
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<tr>
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<td>17 ah battery AGM</td>
<td>Amazon</td>
<td>18.00</td>
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<tr>
<td>1</td>
<td>12 ah Battery AGM Optional</td>
<td>Amazon</td>
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<td>1</td>
<td>1 Astra Depot Triple Function Dual USB Charger + Voltmeter + 12V Outlet Socket Panel Jack</td>
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<td>1</td>
<td>Powerwerx Anderson connector</td>
<td>HRO</td>
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<td>125 Amp terminal barrier strips</td>
<td>Amazon</td>
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<tr>
<td>1</td>
<td>18 position double row screw terminal covered barrier</td>
<td>Amazon</td>
<td>6.00</td>
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<tr>
<td>1</td>
<td>Momentary push button (optional for meter)</td>
<td>Amazon</td>
<td></td>
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<tr>
<td></td>
<td>Female F2 Push on Fully Insulated connector 12 AWG</td>
<td>Walmart/Auto Parts</td>
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<td></td>
<td>12 AWG Forked Terminal connectors (Accessories)</td>
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<td></td>
<td>12 AWG Red and Black stranded 2 conductor speaker wire</td>
<td>Walmart/ Amazon</td>
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<td>AFUNTA 5 pcs Mini USB LED Light Adjust Angle Portable Flexible Led Lamp with usb</td>
<td>Amazon</td>
<td>5.00</td>
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*Source links have been removed for brevity.*
Future Improvements

• Charging circuit
• Larger battery box
• Larger battery
• Led lighting
• Solar charging
• LIPO4 battery
• Inverters
• Additional battery packs for increased capacity
• Internal and external accessories
Essential Accessories

• Led Lighting
Acessories

• Cellphone universal charging cable
Essential Accessories
Essential Accessories
Accessories

Adapter to add Power Pole Connectors to 12 socket
Accessories

Adapter to Parallel multiple boxes through Power Pole connectors
To increase battery capacity
Accessories

12v DC to 110volt AC inverter
Other Designs

[Images of different designs]
Other Designs

- Hammo-can
- Quick Silver Radio
Solar Charging

- The solar part was an afterthought on how to keep the battery topped off in the trunk of my car without over charging the battery. I was going to leave the charger on the rear deck of my car and run the wire through to the trunk.
Thanks

• Special Thanks
  – Joe Gardeski N6JO K6FRI Oceanside CERT
  – Tom Cowart W6ETC OCARC
  – Nicholas Haban AF6CF OCARA
  – Ray Hutchinson AE6H SOARA
  – Charley E Speelman WA6RUZ SOARA MV Races
  – Craig Leventhal KI6WPL SOARA Red Cross

  – And a host of others thanks for your inspiration

  – Material came from over 30 years of personal experience and a number of web sources including BatteryUniversity.com
Questions
THANK YOU

by Tony Gawel W6TNY
Email: tgawel@dslextreme.com