Emergency Power

Loads, Sources & Management

Presented by

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Amateur Radio . . . when all else fails

Equipment Selection

Define the mission:

-Duration (hours, days or weeks?)

-Type of duty (net control / ICP or occasional reporting?)

-Bands and modes

-Location (fixed or moving? indoors or out? crowded or remote?)

-Daytime, nighttime or around-the-clock operations?

Equipment Selection

AC- or DC-Powered?

-AC is easier to distribute over longer distances

-AC supports higher transmit power levels, if needed

-Generator-derived AC may be less reliable or in greater demand

-Generator-derived AC is dependent on fuel availability

-DC is more flexible as to mobility and number of sources

-Most amateur portable gear is designed for 12vdc power

Equipment Selection

Converting between AC and DC

-Inverters make AC from DC

- -Consider waveform, efficiency and RF noise
- -True sine-wave type is preferable

-Power Supplies make DC from AC

- -Linear (transformer-based) supplies are rugged but heavy
- -Switching supplies are lightweight, but choose RF-quiet type
- -Protect power supplies from damage when connected to battery

Equipment Selection

Consider power requirements of equipment

-Power sources may be limited

-Careful choices can extend operating time

-Watch range of usable / safe input voltages !

-Know your gear's power consumption

  -Receive or stand-by, transmit-low, transmit-high

  -Find specs in manufacturer's manual or take measurements

  -Look for settings that reduce power drain (panel lights, etc.)

Developing a Power Budget

Balance loads, sources and storage for a given operational duration and duty cycle

A spreadsheet will handle the math and let you adjust your assumptions

Developing a Power Budget

What % of time will each piece of gear be:

Off? RX / stand-by? TX-Low? TX-High?

What is the transmit duty cycle?

FM: 100% CW 50% SSB 33%

Figure drain for lamps, laptops, modems ...

Developing a Power Budget

Equipment or Radio Type	Mode	Current (Amps)	% Time in Mode	Hours in Mode	Duty Cycle*	Amp-Hours Per Day
Elecraft K2 HF Transceiver	Off	0	0%	0.0	N/A	0
	On / Receive	0.25	80%	19.2	100%	4.8
	Xmit - Low	1.00	10%	2.4	33%	0.792
	Xmit - High	3.00	10%	2.4	33%	2.376
Icom IC-28H 2m Fm Transceiver	Off	0	0%	0.0	N/A	0.0
	On / Receive	0.50	60%	14.4	100%	7.2
	Xmit - Low	3.00	30%	7.2	100%	21.6
	Xmit - High	6.00	10%	2.4	100%	14.4

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Developing a Power Budget

Charging Sources (e.g., solar panel, AC supply)	Mode	Current (Amps)	% Time in Mode	Hours in Mode	Amp-Hours Per Day
BP-85 solar panel #1 (spring daylight conditions)	No Output	0	50%		0
	Low Output	2	30%	7.2	14.4
	Peak Output	5	20%	4.8	24
Xantrex AC charger (at est'd 30 minutes per day of generator availability)	No Output	0	98%		0
	Low Output			0.0	0
	Peak Output	40	2%	0.5	19.2

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Developing a Power Budget

	Charging Amp-Hours / Day:	96
Less:	**Daily load (from worksheet):**	115
	Net Battery Drain Per Day:	19

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Developing a Power Budget

Storage Battery Bank	Capacity Amp-Hrs *	Target Maximum Depth of Discharge	Target Maximum Net Drain
DEKA 8G31 Gel	96	50%	48
			0
			0
		Total Target Drain	48

Days Supported:	**2.6**

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Battery Considerations

Lead-Acid – Plate Construction

-Starting, “RV/Marine”, True Deep-Cycle

Lead-Acid – Electrolyte Choices

-Flooded, Absorbed-glass-mat (AGM), Gel Cells

Other Types: Alkaline, NiCd, NiMH, Li-Ion, Li-Po

Trade-offs: Weight, cost, safety and capacity (op time)

Battery Safety

Use protective eyewear

Avoid metal jewelry and long metal tools

Prevent electrolyte spills and splashing

Ventilate for out-gassing during charge

-AGM and Gel are safe for indoor use and transport

Observe proper charging regimen

Battery Safety – Fusing & Wire

Fuse + and - at battery end (system shorts)

Fuse individual equipment (unit fault)

Use wire sized for the load (250-500 cm/A)

Also consider round-trip voltage drop

-AWG #10 has ~ 1 Ohm resistance per 1,000 feet

Use Class-T fuses on big batteries / banks

Generator Safety

Ground if power goes into a building

Keep exhaust away from enclosed areas

Store fuel in safe containers and locations

Use USFS-approved spark arrestor

Keep fire extinguishers nearby

Avoid refueling spills onto hot engine

Photovoltaic (Solar) Panels

Renewable, pollution-free power source

Produce 5 to 12 watts per square foot

Purchase cost $6 to $12 per watt

Use a charge controller; unloaded >20 vdc!

Prevent reverse current flow at night

-using switch, diode, charge controller or relay

Wind and Other Sources

Wind can complement photovoltaic (PV)

Voltage varies more widely than with PV

Wider-range controller may be needed

Man-powered generators (bike, crank)

-Some fuel is still needed!

Reference Material on the Web

-areslax.org (power budget Excel worksheet files)

-http://www.westmarine.com/pdf/0660_ETRIC_MC04.pdf
(marine wiring capacity charts)

-http://www.eastpenn-deka.com/assets/base/0139.pdf
(AGM / gel battery technical manual with Q & A)

-http://www.buchmann.ca/ (rechargeable-battery handbook)

-http://www.ocraces.org/powerpole.html
(standard Anderson Powerpole wiring)

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Thank you!

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on the Web at http://n6vi.com

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