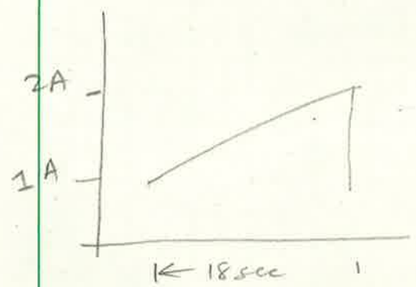
Camera Tripod Power budget

Test of strobe thought to be 400W-sec - but maybe 200W-sec shows



@ 29 V

1.5A × 29V × 18sec = 783 W-sec

Per Strobe fire =>

$783\,W\text{-}sec \times \frac{1\,hr}{3600\,sec} \times 2\,strobes$

$= 0.435 \frac{W\,Hr}{Image}$

Li Batt Pack Details

Cell type CSC93 - 30AH 3.5 V_{nom} 3.9 V_{oc}

Pack is 8S6P → 8 × 3.9V = 31.2 V_{oc}
8 × 3.5V = 28 V_{nom}

Derate each cell for temp from 30AHr to 25 AHr

Pack capacity approximately = 6 × 25 AHr × 28V = 4.2 KWHr

Each image charges 2 strobes so Energy per image is:

$2 \times 783\,W\text{-}sec = 1566 \frac{W\,sec}{Image}$

Images per battery pack =>

$\frac{4.2\,KWhr}{1566 \frac{W\,sec}{Image}} \times \frac{3600\,sec}{1\,hr} = 9630\ images$

$\Rightarrow \frac{9630\ images}{24 \frac{images}{day}} \Rightarrow 401$ days of pictures > 356 days per year

* This based on energy measured using 1 strobe on bench compare with using camera + 2 strobes at Whitsup to measure power.

Bench test of system

- Camera + watts up on all the time
- 102 images capture

Watts up record : 4.371 A Hr, 116.7 WHr, 27V

Test lasted ~ 17 hrs total load = 27V @ 0.178A = 4.8 W

4.8W x 17 hrs = 81.7 WHrs Subtract from total

116 W Hr - 81.7 WHr = 34.3 WHrs

Lets round to 35 WHr for 102 images

$$\frac{35\ \text{WHr}}{102\ \text{images}} = .343\ \frac{\text{WHr}}{\text{Image}}$$

Which is less than calculation based on 1s strobe

(Possibly 200 W-sec vs. 400 W-sec? Probably not enough difference)

If temp derating to 25 AHr is good estimate, and

Camera power estimated to be 20.6 $\frac{\text{W sec}}{\text{Image}}$ based on direct

measurement. => 0.0055 WHr/image

Then worst case using 0.435 $\frac{\text{WHr}}{\text{image}}$ for Strobes

$$0.435\ \frac{\text{WHr}}{\text{Image}} + .0055\ \frac{\text{WHr}}{\text{Image}} = 0.440\ \frac{\text{WHr}}{\text{Image}}$$

For 4.2 KWHr pack

$$\frac{4.2\ \text{KWHr}}{0.44\ \frac{\text{WHr}}{\text{Image}}} = 9545\ \text{images} \quad \frac{9545\ \text{images}}{24\ \text{images/day}} = 397\ \text{days}$$

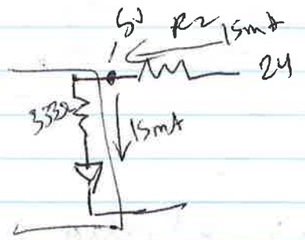
Using best case numbers:

$$.343\ \frac{\text{WHr}}{\text{Image}} + 0.0055\ \frac{\text{WHr}}{\text{image}} = 0.3485\ \frac{\text{WHr}}{\text{Image}}$$

$$\Rightarrow \frac{4.2\ \text{KWHr}}{0.3485\ \frac{\text{WHr}}{\text{Image}}} = 12051\ \text{images} \quad \frac{12051\ \text{images}}{24\ \frac{\text{images}}{\text{day}}} = 502\ \text{days}.$$

For 12mA @ 24V DC

2000 - 332 Ω = 1668 Ω



$R_2 = \frac{24-5}{15mA} = 1.26k\Omega$

Watts R_2 = .285 W

Time-series 2/21/13

Data - Bruce to depth of 1000 m
1) Numbers of drift species per volume at a given depth
2) other measurements: CTD, O_2 (very sensitive to calibration for low levels of O_2)
3)

From pigment & light you can estimate flux

Measuring isotopes

Camera Tripod Power #5 2/26/13

Test 102 images, camera & anywhere USB on all the time, 4,371 AHR, 116.7 WHr, 27V

116

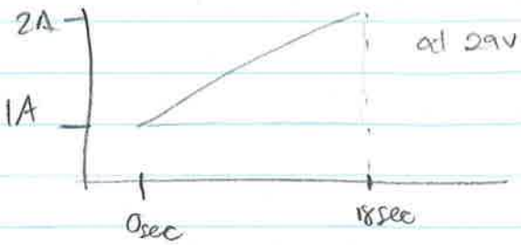
I think test was 17hrs so if hotel load is
27V @ 0.178 A = 4.8 W x
x 17 hrs
81.7 WHr

116.7 WHr - 81.7 WHr = 35 WHrs

35 WHr for charging strobes 102 times
$\frac{35 WHr}{102} = 0.34$ WHr / charge of 2

0.17 WHr per charging 1 strobe
1 time

Other tests show this charge profile for 400W-sec strobe



Energy = 29V × 18sec (1.5A) = 783 Wsec × $\frac{1hr}{3600sec}$

Energy per Strobe Charge = 0.2175 Whr ≈ 0.22 Whr

heck if calcs match -

Test w/ Watts up ⇒ Energy per strobe charge = 0.17 Whr

Current measurement + Calculation ⇒ = 0.2175 Whr

sume worst case → E_{strobe} = 0.22 Whr

Camera power = 71mA × 15sec 1.07 Asec

313mA × 5sec 1.57 Asec

2.64 Asec at 7.8V

= 20.6 W-sec per Image

= 0.006 W Hr

Camera = 0.006 Whr

Strobes (2) = 0.22 × 2 Whr

Total = 0.446 Whr per Image

LiBatt

48 cells × 80 Whr per cell

$\frac{3.84 \text{ KWHr per pack}}{0.446 \text{ Whr per Image}}$ ⇒ 8615 Image

8615 images $\frac{1 \text{ day}}{24 \text{ hr}}$ × $\frac{1 \text{ month}}{30 \text{ day}}$ = 11.96 months

AA batt

19 cells × 7 layers = 133 Dcells

Dcell = 14 AHr × 1.2 V = 16.8 WHr

temp derate 30% = 11.76 WHr

1 pack = 1.6 KWHrs

2 packs = 3.2 KWHrs

$\frac{3.2 \text{ KWHrs}}{0.446 \text{ WHr}}$ = 7014 images ⇒ 9.7 months

Tattletale

Hub @ 200mA at 8V for 5 min

Prog @ 9mA at 8V for 5 min

Amps Per hour 0.2 × mA/hr + 0.075 mA/hr

Hub { 0.2 mAHr + 0.075 mA } Routine

9mA @ 8V = 0.072 watt

72mW

$\frac{120\text{ w-hr}}{72\text{mW}} = 1.66$ 17 Hours

= 2.3 months

Li controller pack =

3 × 40 w-hr = 120 w-hr

120 w-hr

0.002 w-hr

200uA × 8V for $\frac{59.5}{60}$ Hr

9mA × 8V for $\frac{0.5}{60}$ Hr

@ 200uA × 8V × $\frac{59.5}{60}$ = 1.6 mW

+

9mA × 8V × $\frac{0.5}{60}$ = 0.6 mW

Continuous draw = 2.2 mW per Hr

$\frac{120\text{ w-hr}}{2.2\text{mw-hr}}$ = 54545 Images = 75 math

1 image

200uA × 8V × 59/60

Li batt voltage 11V

200uA × 11V × $\frac{59}{60}$ = 2.16 mW

+

9mA × 11V × 1 = 1.65 mW