Arliss Budget Proposal

Damion Rosbrugh

February 13, 2016

motors,T-Motor MN-1806-2300KV Brushless Motor found here http://www.addictiverc.com/store/agora.cgi?product=T-Motor_Products#.Vj6OGSug5nt

propellers http://www.rctimer.com/product-1180.html

batteries Graupner RC LiPo Battery 1S6P 3.7V 6000mAh http://www.quadrocopter.com/Graupner-RC-LiPo-Battery-1S6P-37V
p_582.html

http://www.all-battery.com/li-ion1865074v7800mahflatrechargeablebatterymodulewithpcbandbareleadscustomize.aspx

Altimeter Module MS5607 https://www.parallax.com/product/29124

ESC http://www.aeroquadstore.com/Next_Level_20_Amp_Multi_Rotor_ESC_with_SimonK_Firm_p/esc-003.htm

microcontroller http://www.adafruit.com/products/2772

gps https://www.parallax.com/product/28509

accel https://www.adafruit.com/products/163

sd card reader https://www.adafruit.com/products/254

battery charger http://www.quadrocopter.com/Battery-Chargers_c_131.html

camera http://www.amazon.com/Arducam-Megapixels-Camera-Module-OV5642/dp/B012VPMY0A/ref=sr_1_12?srs=12723195011&ie=UTF8&qid=1449361925&sr=8-12

```
library(reshape2)
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.2.2
```

```
##
## Attaching package: 'dplyr'
##
## The following objects are masked from 'package:stats':
##
##     filter, lag
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

we compute the mass of our frame using the volume density relationship

```
abs_dens<-1.04#g/cc
inchconv<-2.54#inch to cm conversion factor
#these are the dimensions of the top and bottom plates
length<-4.5*inchconv
```

```
width<-4.5*inchconv
height<-(2/16)*inchconv
#these are the dimension of the arms
lengtha<-6*inchconv
widtha<-1*inchconv

cutout<-0#2*2*(1/8)*inchconv*abs_dens*2

heighta<-(2/16)*inchconv
volumea<-(lengtha*widtha*heighta)#/.01/1000
volume<-(length*width*height)#/.01/1000
frame_mass<-2*abs_dens*volume+4*abs_dens*volumea-cutout
frame_mass
```

```
## [1] 137.4055
```

Below is the weight and cost budget

```
qbudget<-data.frame(cbind(
#batteries<-c(bweight<-580,bcost<-149,1),     #two batteries at 140g cost $39.90
batteries<-c(bweight<-266*1,bcost<-65.00*1,1),     #two batteries at 140g cost $39.90 each
gps<-c(gwt<-9.1,gcst<-49.99,1),
feather<-c(mwt<-4.2,mcst<-19.95,1),
altimeter<-c(altwt<-1.7,altcst<-22.49,1),
#motors<-c(mtwt<-80*4,mtcst<-67.89*4,4),
motors<-c(mtwt<-18*4,mtcst<-22.89*4,4),
camera<-c(camwt<-9.1,camcst<-25.99,1),
accel<-c(acwt<-1.7,accst<-14.95,1),sdcard<-c(2,14.95,1),
hinges<-c(hngwt<-4*.7,hngcst<-4*2,4),
prop<-c(12.5*4,15.99,4),speed<-c(4*25,22.99*4,4),
pdb<-c(1,10.00,1),frame<-c(frame_mass,0,4),battchar<-c(0,109.95,1)))
wt_cst<-data.frame(rowSums(qbudget))
qbudget<-cbind(unit<-data.frame(c("weight","cost","quantity")),qbudget)
names(qbudget)<-c("unit","batteries","gps","feather","altimeter","motors","camera","accel","hinges","sd
qbudget
```

```
##       unit batteries   gps feather altimeter motors camera accel hinges
## 1   weight       266  9.10    4.20      1.70  72.00   9.10  1.70   2.00
## 2     cost        65 49.99   19.95     22.49  91.56  25.99 14.95  14.95
## 3 quantity         1  1.00    1.00      1.00   4.00   1.00  1.00   1.00
##   sdcard propellers speed control power dist board    frame charger
## 1    2.8      50.00        100.00                1 137.4055    0.00
## 2    8.0      15.99         91.96               10   0.0000  109.95
## 3    4.0       4.00          4.00                1   4.0000    1.00
```

```
totalwt<-wt_cst[1,1]
row.names(wt_cst)<-c("Total Weight (g)","Total Cost ($)","Number of Componants")
wt_cst
```

```
##                       rowSums.qbudget.
## Total Weight (g)             657.0055
## Total Cost ($)               540.7800
## Number of Componants          29.0000
```

Below are some logistical calculations

```
r=3
framewidth=4.5
hf<-sqrt(4*r^2-framewidth^2)#heightformula
hf
```

```
## [1] 3.968627
```

```
maxhieght<-hf #with 4.5 width

motorwithprop<-18.5+14.5
motorheight<-motorwithprop/25

batteryheight<-40
height.of.unit<-(motorwithprop+batteryheight)/25.4
maxhieght-height.of.unit
```

```
## [1] 1.094611
```

```
num_motor<-4
total_motor_thrust<-num_motor*c(259,335,410,486,535)
thrust_to_weight<-total_motor_thrust/totalwt
amps.per.motor<-c(3.9,5.6,7.3,9.4,11.1)
watts.per.motor<-c(43,62,81,104,123)
percentage.per.motor<-c(50,60,75,85,100)
mot<-cbind(total_motor_thrust,amps.per.motor,watts.per.motor,percentage.per.motor,thrust_to_weight)
battlife<-7800/((amps.per.motor*4*1000)*.75) #60*6/(amps.per.motor*4)

battlife2<-60*12/(amps.per.motor*4)
battlives<-data.frame(cbind(battlife,battlife2,mot))
battlives
```

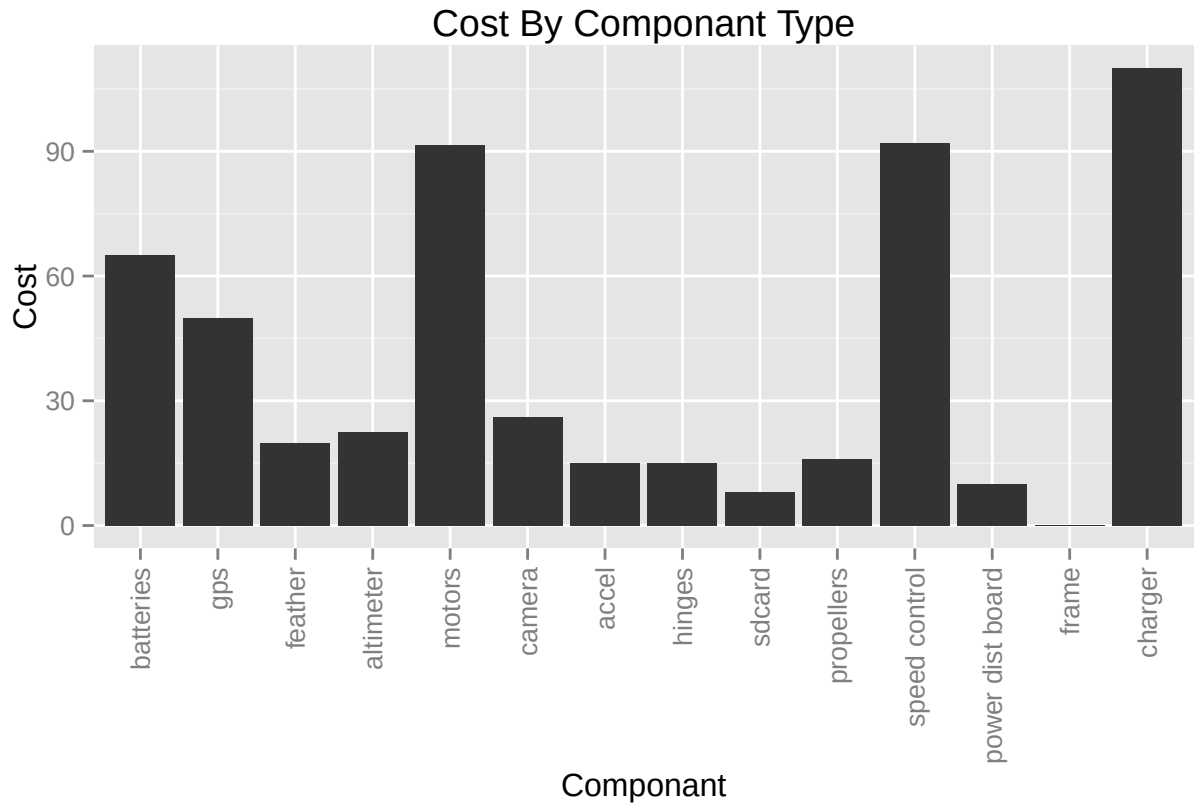
```
##    battlife battlife2 total_motor_thrust amps.per.motor watts.per.motor
## 1 0.6666667  46.15385               1036            3.9              43
## 2 0.4642857  32.14286               1340            5.6              62
## 3 0.3561644  24.65753               1640            7.3              81
## 4 0.2765957  19.14894               1944            9.4             104
## 5 0.2342342  16.21622               2140           11.1             123
##   percentage.per.motor thrust_to_weight
## 1                   50         1.576851
## 2                   60         2.039557
## 3                   75         2.496174
## 4                   85         2.958879
## 5                  100         3.257202
```

```
mudget<-melt(qbudget,id.vars = "unit")
names(mudget)<-c("unit","componant","value")
costs<-as.numeric(filter(mudget,unit=="cost")$value)

room_brunos<-100
nights_stay<-3
```

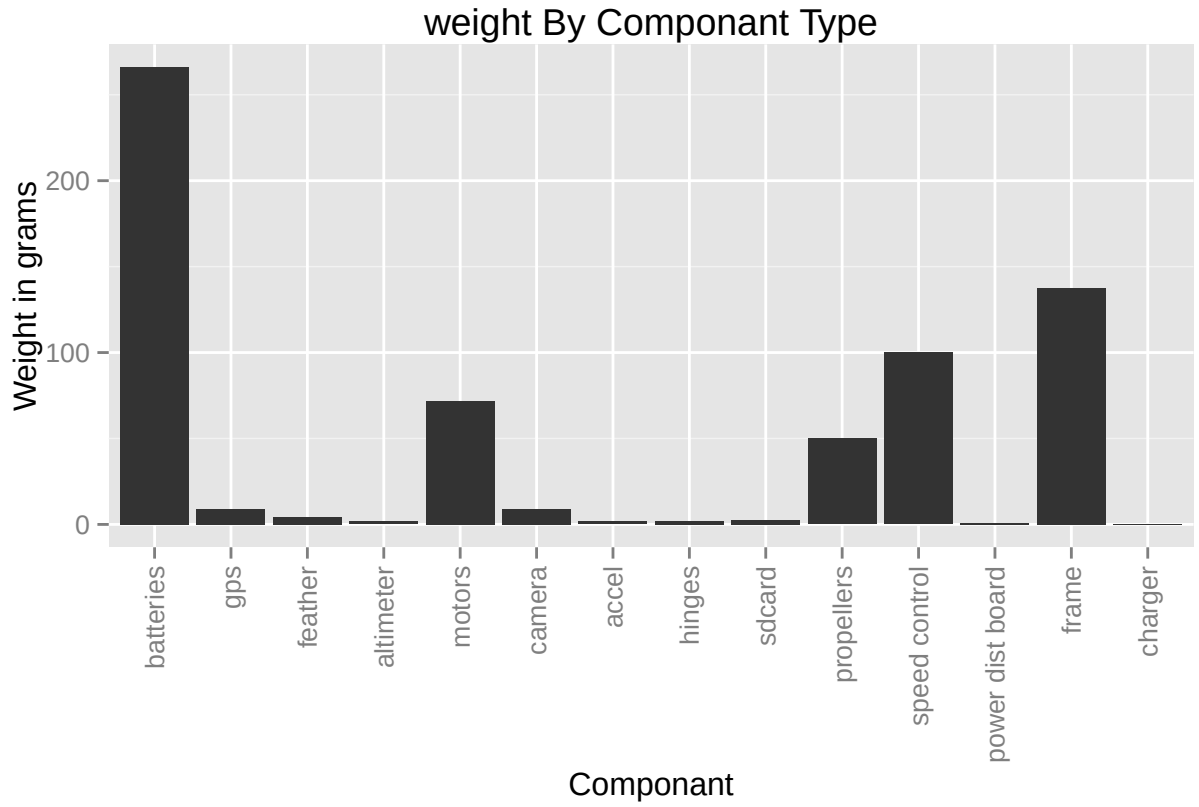
```
num_rooms<-1

planetx<-600
people<-3
quads<-3
total_budget<-sum(costs)*quads+planetx*people+nights_stay*num_rooms*room_brunos
total_budget
```

```
## [1] 3722.34
```

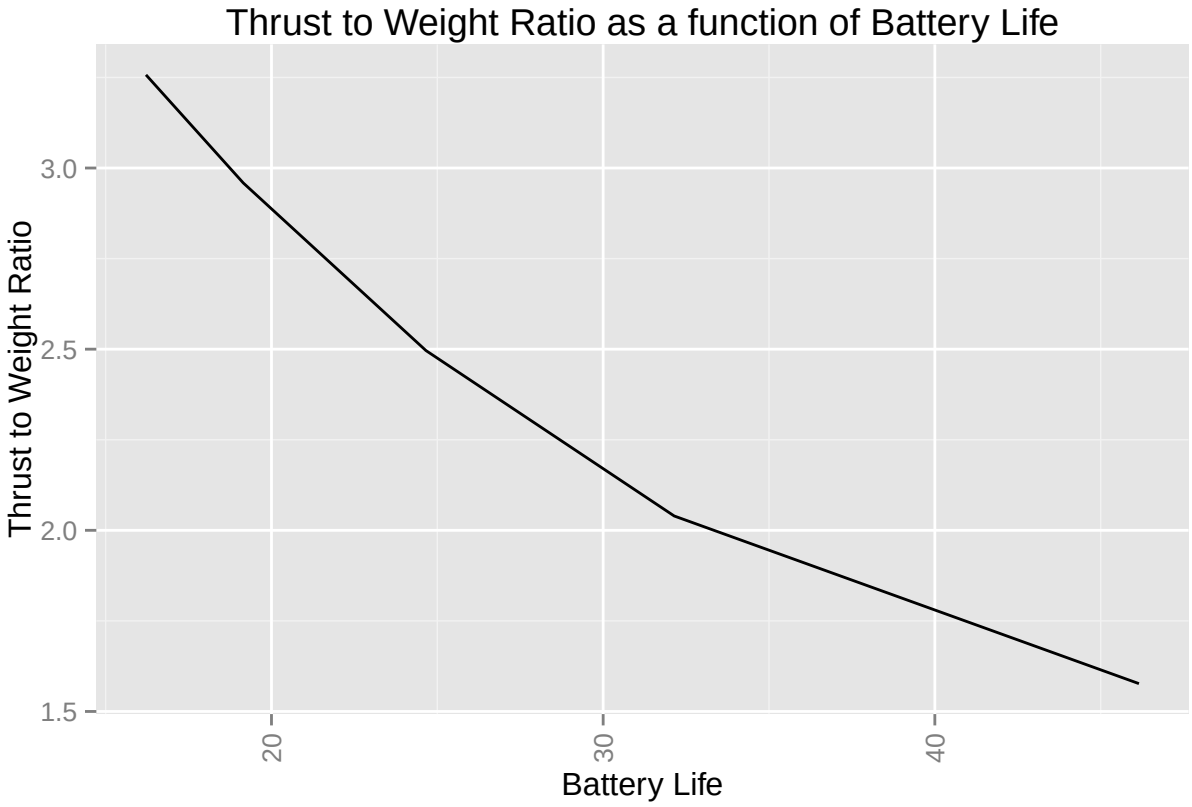
```
munget<-filter(mudget,unit=="cost")
mungwht<-filter(mudget,unit=="weight")

library(ggplot2)
ggplot(munget,aes(x = componant, y = value)) + geom_bar(stat="identity") +
xlab("Componant") + ylab("Cost") + labs(title = "Cost By Componant Type") + theme(axis.text.x=element_t
```




```
ggplot(mungwht,aes(x = componant, y = value)) + geom_bar(stat="identity") +
xlab("Componant") + ylab("Weight in grams") + labs(title = "weight By Componant Type") + theme(axis.tex
```




```
ggplot(battlives,aes(x = battlife2, y = thrust_to_weight)) + geom_line(stat="identity") +
xlab("Battery Life") + ylab("Thrust to Weight Ratio") + labs(title = "Thrust to Weight Ratio as a functi
```


Thrust to Weight Ratio as a function of Battery Life
Thrust to Weight Ratio
3.0
2.5
2.0
1.5
20
30
40
Battery Life