**Background info:**

100,000 Feet Altitude (The balloon for the 50th launch went to 94,000ft)

100,000 ft =30,480 m

We will be in the stratosphere (12-50 km).

NASA:

The upper stratosphere model is used for altitudes above 82,345 feet.

T = -205.05 + .00164 \* h

p = 51.97 \* [(T + 459.7)/ 389.98]^-11.388

Minimum Temp: T=-205.05+.00164\*100,000=-41.05 degrees F=-40.58 degrees C

Minimum Atmospheric Relative Pressure: p = 51.97\*[(-41.05+459.7)/389.98]^-11.388 = 23.17 lbs/ sq ft. = .161 psi = 11.1 mb=1.11kPa

How long does it take for the balloon to reach 100,000 ft?

**Components:**

GPS: Adafruit Ultimate GPS Logger Shield - Includes GPS Module

20mA current draw

Voltage?

Micro SD not included

<http://www.adafruit.com/products/102>

SD/MicroSD Memory Card (4 GB SDHC) from adafruit

Do we have to use an external antenna? There is u.FL connector to connect an antenna.

Dimensions(PCB only): 69mm x 53mm x 6.7mm

Mass (w/o GPS module): 24g

Operating temperature? (maybe >40 degrees C?)

Pressure Sensor: Altimeter Module MS5607

One for internal pressure, one for external

Noted that it works above 120,000 ft.

Operating Temperature of -40 to +85 °C (will work at min temp)

Pressure range of 10 –1200 mbar (will work at min pressure)

Voltage: 1.8 to 3.6 V

Current: 1.74mA@3.3 VDC

mass?

Dimensions: 2.16 X 2.03 cm

Datasheet: <https://www.parallax.com/sites/default/files/downloads/29124-MS5607-02BA03-Datasheet.pdf>

Valve: I am still not sure

Criteria for proper valve:

1. Flow rate has to be fast (larger orifice)
2. small mass
3. controlled by arduino
4. Function in min atmospheric and temperature
5. Within voltage range

Create a valve:

Use PVC to create the valve

Have tube with orifice move from end of tube

Orifice size: .25 in and .5 in and 1 in

estimate max relative pressure: 5 psi

area of bottom of valve: estimate- square inch

compression springs: <http://www.leespring.com/browse_catalog.asp?springType=C>

Fsp=-k \* delta s

spring would have to provide 5+ lbs of force if orifice of 1 in or provide 2.5+ lbs of force of .5 in.

1.25 lbs of force for .25 in

high torque- t =f\*d d=of arm=.25in

f needed to move surface: f from torque \* cos theta

f of torque=5+lb/costheta

f of torque=2.5+lb/costheta

f of torque=1.25+lb/costheta

<http://www.robotshop.com/en/hitec-hs422-servo-motor.html>

torque of motor: 3.56 lb/in sq

may not work

<http://www.robotshop.com/en/hitec-hs-485hb-servo-motor.html>

Torque (Kg-cm/Oz-in): 5.2/72(4.8V), 6.4/89(6V)

Speed (sec/60o): 0.20(4.8V), 0.17(6V)

<https://www.servocity.com/html/hs-485hb_servo.html#.ViFzjhCrSgQ>

**Control System:** +Pulse Width Control 1500usec Neutral

**Required Pulse:** 3-5 Volt Peak to Peak Square Wave

**Operating Voltage:** 4.8-6.0 Volts

**Operating Temperature Range:** -20 to +60 Degree C

**Operating Speed (4.8V): 0.22sec/60° at no load**

**Operating Speed (6.0V): 0.18sec/60° at no load**

**Stall Torque (4.8V): 66.6 oz/in. (4.8kg.cm)**

**Stall Torque (6.0V): 83.3 oz/in. (6.0kg.cm)**

**Operating Angle:** 45 Deg. one side pulse traveling 400usec

**Continuous Rotation Modifiable:** Yes

**Direction:** Clockwise/Pulse Traveling 1500 to 1900usec

**Current Drain (4.8V):** 8mA/idle and 150mA no load operating

**Current Drain (6.0V):** 8.8mA/idle and 180mA no load operating

**Dead Band Width:** 8usec

**Motor Type:** 3 Pole Ferrite Motor

**Potentiometer Drive:** Indirect Drive

**Bearing Type:** Top Ball Bearing, Lower Bushing

**Gear Type:** Karbonite Gears

**Connector Wire Length:** 11.81" (300mm)

**Dimensions:** See Schematic

**Weight:** 1.59oz (45g)

Flow rate?

<http://hitecrcd.com/products/servos/ultra-premium-digital-servos/hs-7980th-mega-torque-hv-coreless-titanium-gear-servo/product>

<http://www.surabayahobby.com/produk_2675_hs-5085mg-premium-metal-gear-micro-servo.html>

Battery:

is this the right equation?

Battery capacity(mAh)=battery life(h) \* load current(mA)

Battery Capacity = (estimated time of project)\*(20+1.74\*2+(20 mA )) FAN

how do you incorporate the mA for the valve if it is only on for a fraction of the total time?

**Questions:**

Do we need a formal bill of material?

Do we need a mass estimation table?

What else do we need?