Washkewicz College of Engineering

Orbital Research Video Telemetry

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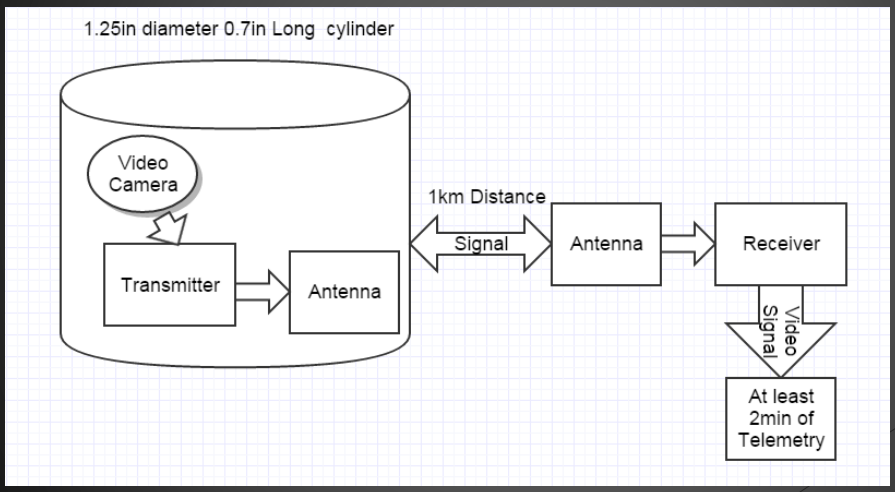
Project Requirements:

- Size 1.25” diameter cylinder .7” long
- Weight under 200g
- Resolution of 640x480 @ 30fps
- Power less than 3.3W
- At least 2min of Telemetry
- Transmit over 1Km @ 1.25Mbps

Video Telemetry System

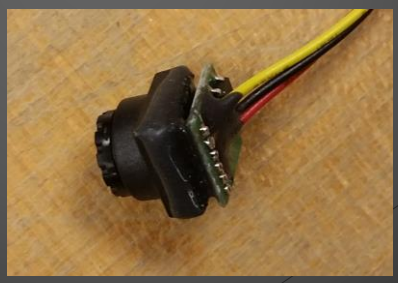


Camera Requirements:

- 30 FPS
- 640 x 480 Resolution

Camera Solution:

- NTSC Standard
- Resolution 658 x 496
- Weight 1g
- Size 9 x 9 x 11 mm



Camera Solution Cont.

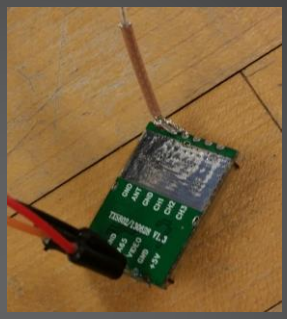
- Wide Angle Lens
- Doubles viewing angle from 55° to 110°
- Does not significantly change weight or dimensions

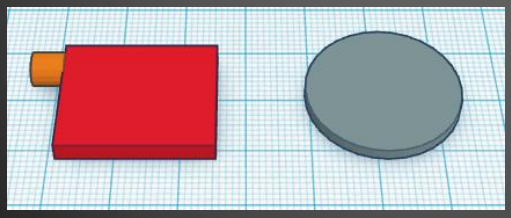
RX/TX Requirements:

- Data rate > 1.25 Mbps
- 1KM Range
- Transmitter 31.75mm diameter x 17.78mm long cylinder

TX Solutions

- Transmission Module TX5802M
  - 5.8 GHz 200mW=23dB
  - 3.3V-5.0V
  - 24mm x W20mm x H3mm

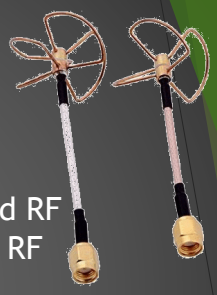




RX Solution

- RC 305 Receiver
  - 5.8GHZ 8CH 200mW
  - -92dBm receiving sensitivity

Antenna



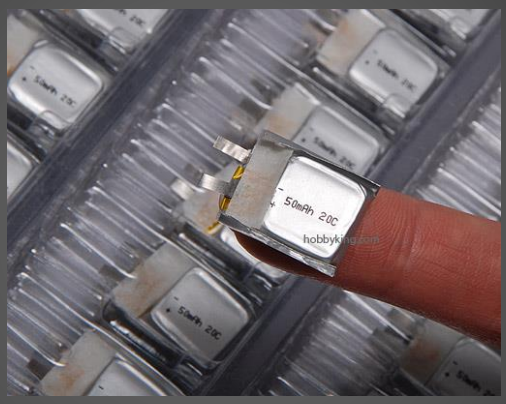
- 5.8Ghz Circular Polarized Clover Leaf Antenna
  - Circular polarization will basically ignore reflected RF so you won't experience nearly as much reflected RF interference
- Directional Antenna

Calculations

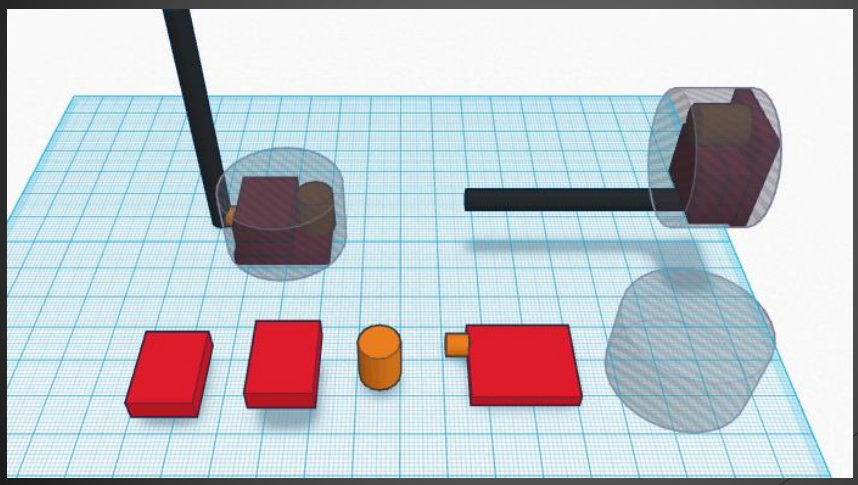
- Link budget
- Received Power (dBm) = Transmitted Power (dBm) + Gains (dB) − Losses (dB)
- Maximum Path Loss= Transmit power – receiver sensitivity + gains – losses – fade margin
- PL = 23 dBm Transmit power – (-92dBm) receiver sensitivity + 2 dBi Antenna – 7 dB MarginEr
- Distance= $10^{PL-32.45-20\log(Frequency\ in\ Mhz)}$
- Distance= $10^{PL-32.45-20\log(5800)}$= 1.3km
- That is if Transmitter emitting its stated power, and perfect line of sight between Tx and Rx and disregarding all other losses

Power

- ZIPPY Battery
  - 50mAh 20C
  - **3.7V**
  - **19x14x5mm**



Visual Perspective



Estimated Cost

Transmitter:	$21
Receiver:	$17
2x Zippy Batteries:	$5
Antennas:	$21
Camera+lens:	$50
Total Estimated Cost	$114

Design Advantages

- Theoretically meets the range and size requirements
- Cheaper then other alternatives
- 5.8GHz less likely to get interference from other frequencies, its not used as much as 2.4 GHz

Design Possible Drawbacks

- The antenna does not fit the size restriction of the problem
- 5.8GHz transmitter need a clear line of sight, obstacles might interfere with the signal
- 5.8GHz transmitter Signal travel less distance compared to other lower frequencies
- Power Limitation of the design restrict a prolonged usage

Possible Alternatives

- The use of different transmitter modules
  - 2.4 Ghz (Travel further then 5.8GHz, but might get interference from Wifi, RC transmitters)
  - 1.3 Ghz (Travel further then both 5.8 and 2.4 and good around objects, but for small size its more expensive and might get interference from 2.4GHz)
  - 900 Mhz (Best distance, but might get interference from cell towers)
- Make a new design were a smaller antenna is used that would fit the 1.25in by 0.7in cylinder while still getting a 1km range

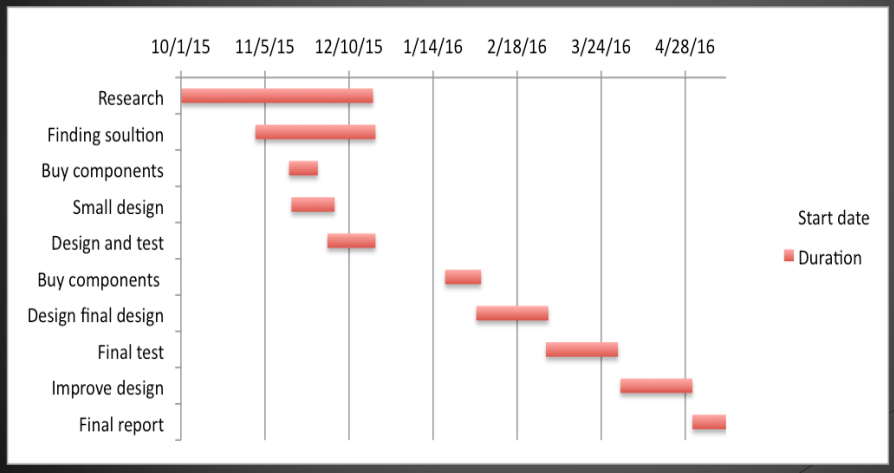
Regulations

- Amateur Radio is regulated by the Federal Communications Commission (FCC) under the Communications Act of 1934
- In the US, there are many restriction on the frequencies that the general public could use. To access the Amateur Frequencies a license is needed
  - **The Technician License**
  - **The General License**
  - **The Amateur Extra License**
- To be able to test our design we will need to apply for the Technician License, or find a licensed individual to assist us in the testing

Market Potential

- Unmanned aerial systems
- Military applications
- Commercial Drones
- Surveillance systems

Timeline



Questions?