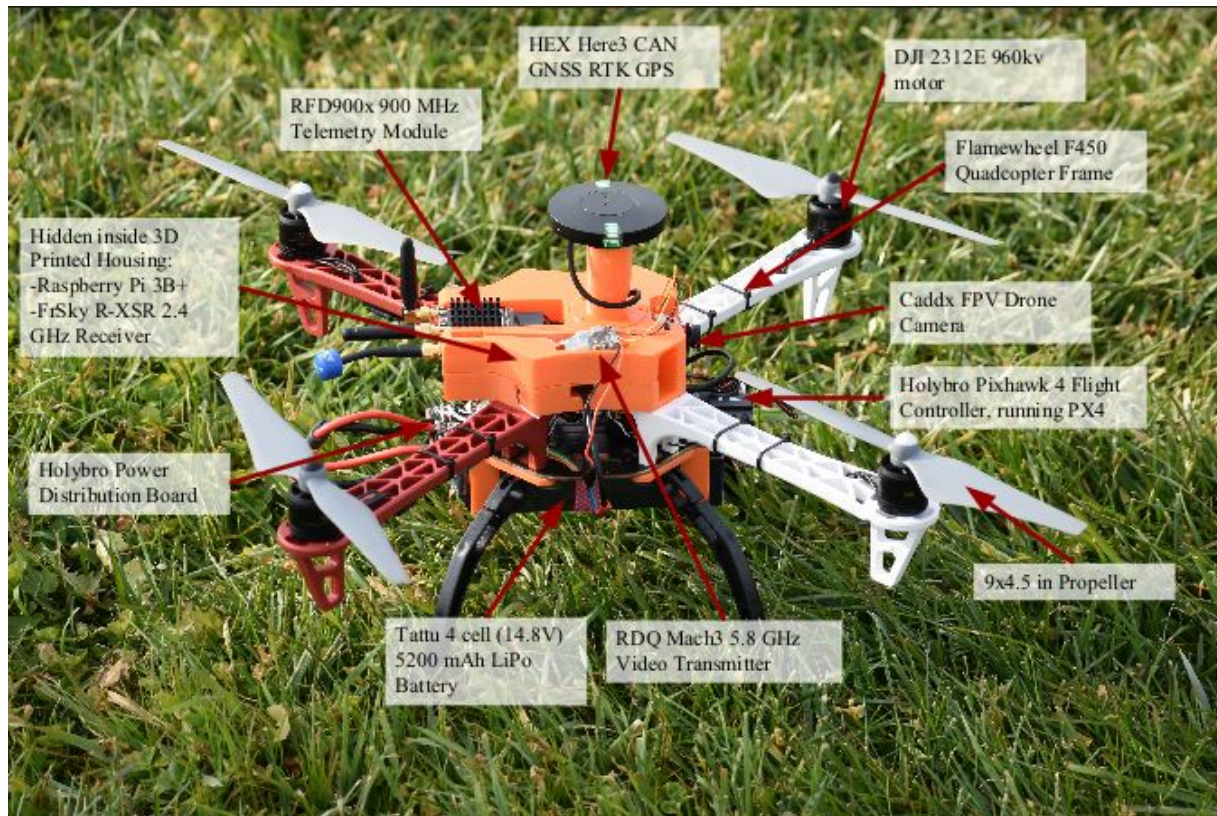


# How to Build Quadditch Drones



# 1) Gather Parts



Flamewheel f450 frame  
Don't need top plate



Pixhawk 4 with Power  
Distribution Board



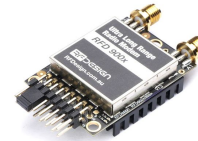
DJI 2312E Motors (4)



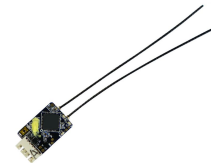
DJI 430 Lite ESC (4)



Here3 RTK GPS



RFD 900X Telemetry  
Radio  
With wire to Telem1 port



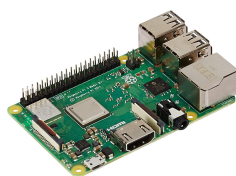
FrSky RXSR Receiver  
With wire to DSM/SBUS  
port



Caddx FPV  
Camera



RDQ Mach3  
Video  
Transmitter



Raspberry Pi



Screws:  
M3 Heated Insert (10)  
M3 Socket Screw (10)  
DJI Screws (24)



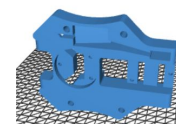
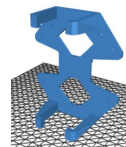
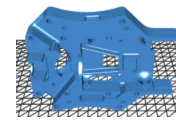
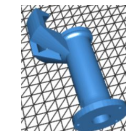
5V BEC



DJI Legs



Micro USB  
Cable (2)



3D Printed Parts:

Bottom Plate, Top Plate, Battery Holder,  
GPS Holder  
Available at  
<https://github.com/Quadditch/quadditch-hardware/tree/main/STL>

## 2) Assemble Frame

- Use DJI Screws for motors
- Connect motors to ESC and use zip tie to attach to frame
- Using double sided sticky tape, attach Pixhawk to front of bottom plate and PDB behind it
- Solder ESC wires onto PDB (4 wires per ESC)
- Use cables to connect power and I/O PWM from PDB to Pixhawk





### 3) Add Extra Wires to PDB

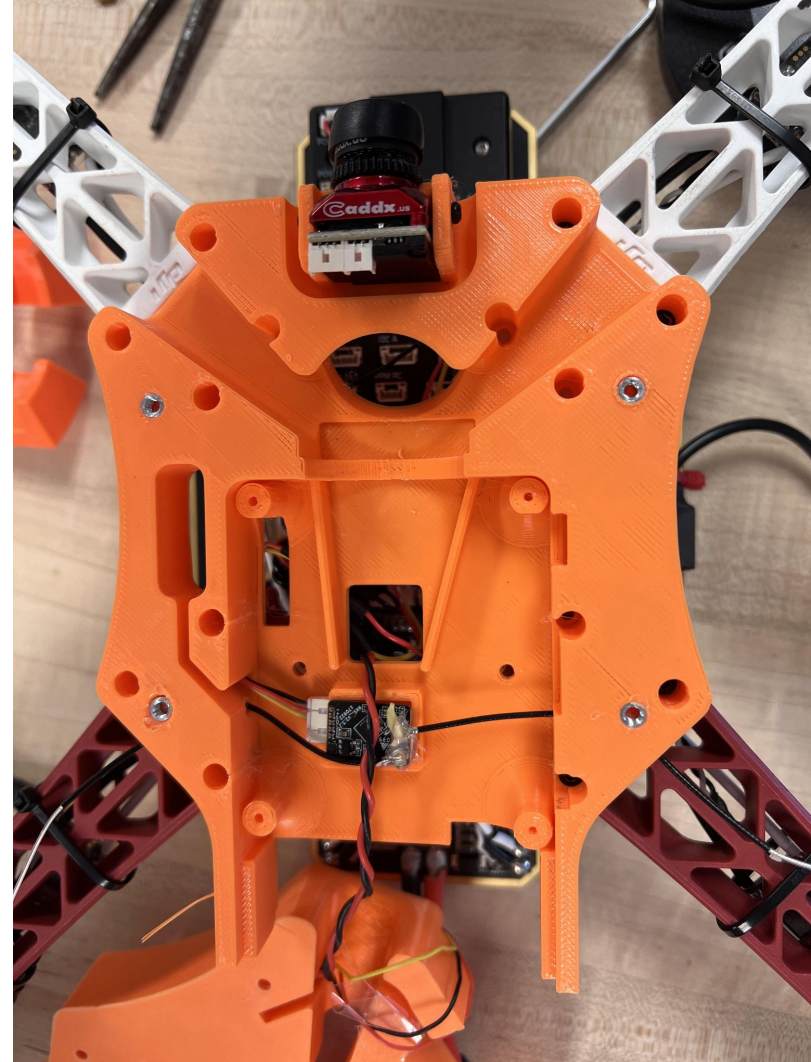
- Connect 5V BEC to any positive and negative port on PDB
- Strip Micro USB cable and connect to output of 5V BEC
- Cover BEC in heat shrink



- Add another positive and negative wire to any power out on PDB for video transmitter
- Make this one longer as it needs to reach transmitter on top plate

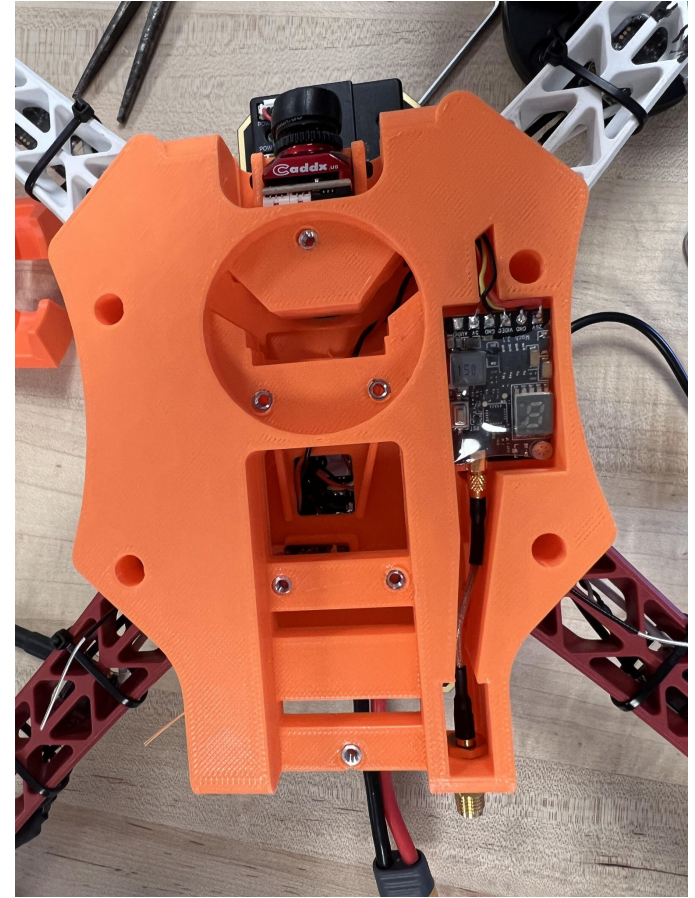
## 4) Assemble Bottom Plate

- Use solder tip to add 4 3M Alunimum inserts to set holes on bottom plate
- Attach Caddx FPV Camera using included screws
- Insert FrSky RXSR Receiver into slot
  - Need to use knife to remove antenna adhesive and rotate one antenna wire 180\*. Add super glue to hold into place
  - Feed antenna wires through designated holes, and feed connector to Pixhawk 4 DSM/SBUS port
  - Bind to transmitter (look up how to do this)
- Insert raspberry pi (pressure fit) so no need for screws
- Screw in bottom plate using 16 DJI screws



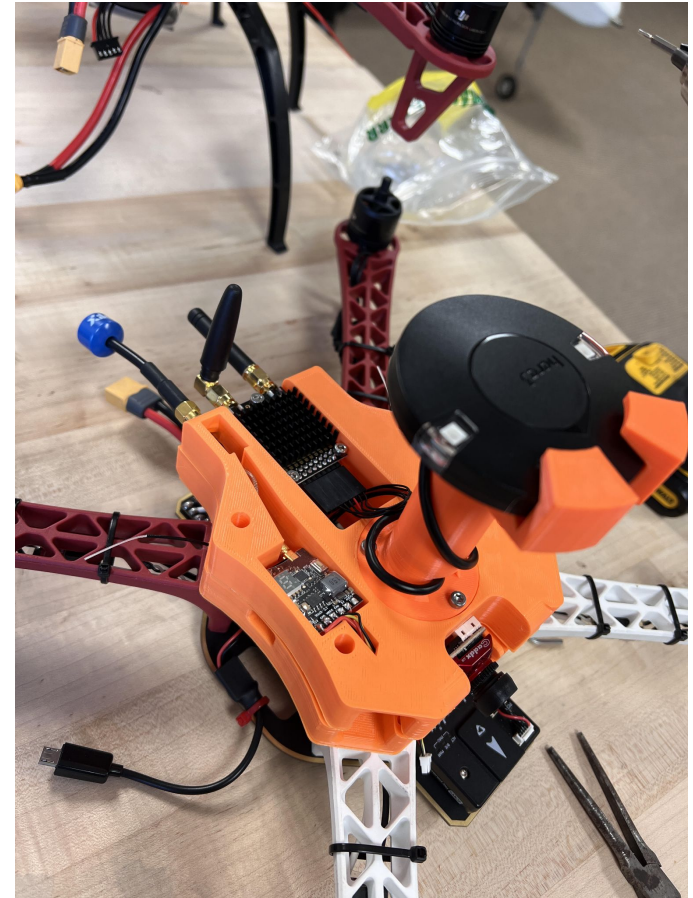
## 5) Assemble Top Plate

- Use solder tip to add 6 3M Inserts to desired holes
- Insert video transmitter
  - 5V, GND, and Video go connect to camera
  - 26V and GND go to PDB (wire added in step 3)
- Use 4 M3 socket head screws to attach top plate to bottom plate



## 6) Finish top plate

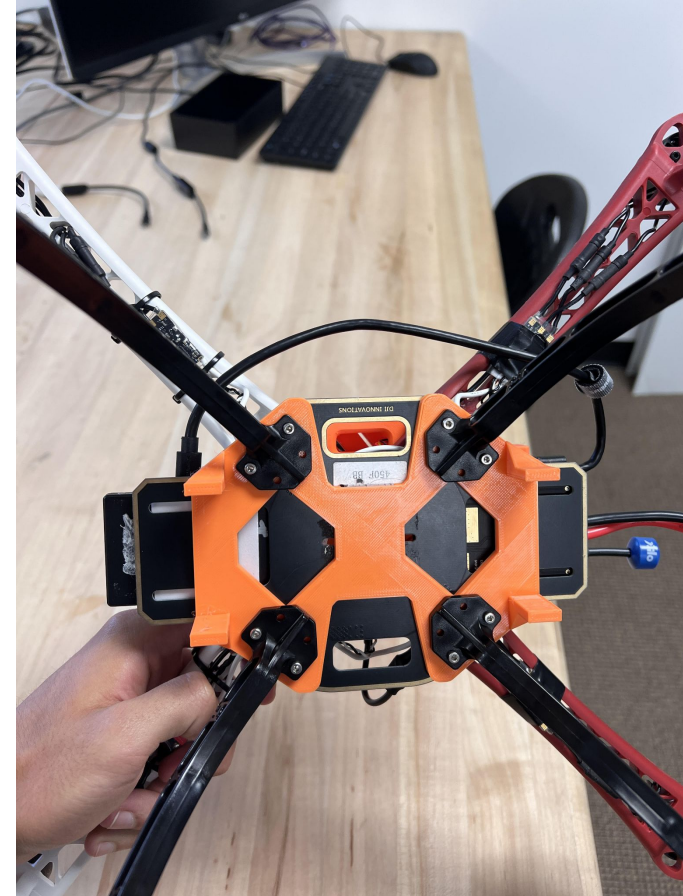
- Screw in 3d Printed GPS holder using socket screws
  - Pressure fit Here3 into place and feed wire through hole to Pixhawk4 CAN port
- Screw in RFD900x telemetry radio (heat sink side up) and feed wire to Pixhawk4 Telem1 port
- Connect video transmitter wire to FPV camera
- Add video transmitter antenna





## 7) Battery Holder and Legs

- Place battery holder beneath bottom aluminum plate and legs beneath that, screw into place using socket screws
- Add micro usb cable from Pixhawk to Raspberry Pi





# Tips

- After soldering, use a multimeter under continuity setting to check for any shorts before plugging in battery
- Set up wires first, as they can be hard to manage once top and bottom plate are screwed in
- Use QGroundControl to ensure all parts working as expected

# Setting up RFD900X Telemetry Radios

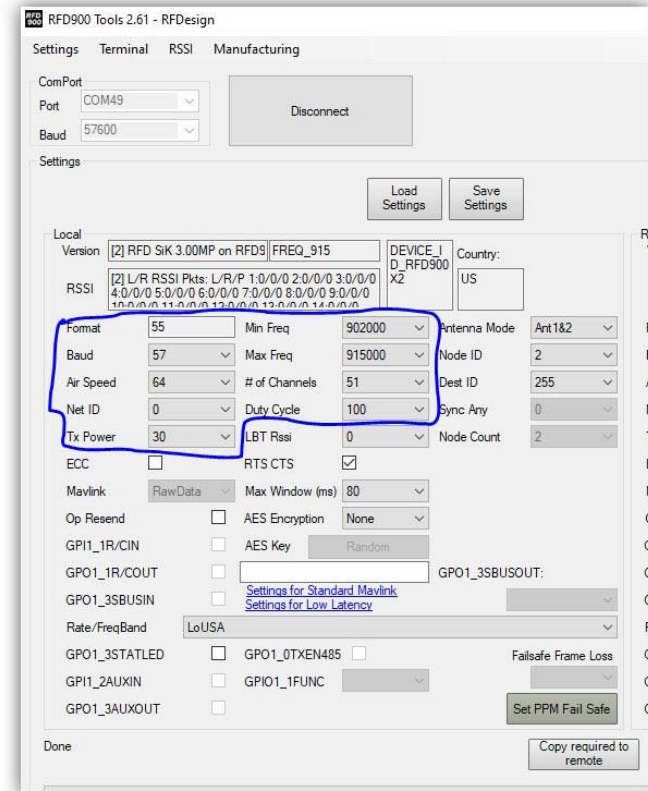
## Parts:



- RFD900x radio (2)
- Long Antennas (2)
- Short Antennas (2)
- 6 pin to USB (1)
- 6 pin to TELEM1 (1)
- RFD900 Tools Application  
(<https://files.rfdesign.com.au/tools/>)

# Point to Point configuration (1 ground radio per UAV)

- 1) Download latest RFDSIK firmware (V2 for US version, V1 for non-US)
  - a) <https://files.rfdesign.com.au/firmware/>
- 2) Connect each modem to computer via USB cable, upload latest firmware using RFD900 tools
- 3) For 2 radios to communicate, ensure the following settings are identical
- 4) Set Net ID to any number from 40-49, two radios need the same NetID to communicate
- 5) US Version will work with non-US version as long as the settings circled are the same





# Multipoint Configuration (1 ground radio for all UAV)

- 1) Download latest multipoint firmware (V2 for US version, V1 for non-US)
- 2) Connect each modem to computer, change NetID to desired value and ensure settings circled on previous slide are the same in GUI
- 3) Open the terminal within RFD900 tools
- 4) Wait a second for it to load and type "AT" + enter, should see "OK" response

# Sample configuration for 3 UAVs

At Commands for each modem in order

Node 1(Master) Network 0	Node2 (UAV1)	Node 3 (UAV2)	Node 4 (UAV3)
'+++ No enter before or after, wait 1.2 seconds before and after also	'+++ No enter before or after, wait 1.2 seconds before and after also	'+++ No enter before or after, wait 1.2 seconds before and after also	'+++ No enter before or after, wait 1.2 seconds before and after also
'ATS6=1' then 'enter key'	'ATS6=1' then 'enter key'	'ATS6=1' then 'enter key'	'ATS6=1' then 'enter key'
'ATS13=1' then 'enter key'	'ATS13=1' then 'enter key'	'ATS13=1' then 'enter key'	'ATS13=1' then 'enter key'
'ATS24=1' then 'enter key'	'ATS24=2' then 'enter key'	'ATS24=3' then 'enter key'	'ATS24=4' then 'enter key'
'ATS25=255' then 'enter key' 225 is broadcast mode.	'ATS25=1 then 'enter key' 1 means to communicate back to the master node	'ATS25=1 then 'enter key' 1 means to communicate back to the master node	'ATS25=1 then 'enter key' 1 means to communicate back to the master node
'ATS26=4' then 'enter key'			
'AT&W' then 'enter key'	'AT&W' then 'enter key'	'AT&W' then 'enter key'	'AT&W' then 'enter key'
'AT&M0=0,4' then 'enter key'	'ATZ' then 'enter key'	'ATZ' then 'enter key'	'ATZ' then 'enter key'
'AT&W' then 'enter key'			
'ATZ' then 'enter key'			

Note:

Set 'ATS25=255' for all nodes, not 'ATS25=1'

For 4 UAVs, change master commands 'ATS26=5' and 'AT&M0=0,5'

The terminal is pretty buggy and commands don't seem to work unless they are types perfectly before hitting enter (no backspace to fix any typos)

RFD900 Tools 2.64 - RFDDesign

ComPort  
Port COM7  
Baud 57600

Disconnect

Terminal

```
AT
AT
[1] OK
ATS6=1
ATS6=1
[1] OK
ATS13=1
ATS13=1
[1] OK
ATS24=1
ATS24=1
[1] OK
ATS25=255
ATS25=255
[1] OK
ATS26=4
ATS26=4
[1] OK
AT&W
AT&W
[1] OK
AT&M0=0,4
AT&M0=0,4
[1] OK
AT&W
AT&W
[1] OK
ATZ
ATZ
```

Settings Terminal RSSI

ComPort  
Port COM7  
Baud 57600

Disconnect

Terminal

```
ATI5
[1] S0:FORMAT=55
[1] S1:SERIAL_SPEED=57
[1] S2:AIR_SPEED=64
[1] S3:NETID=0
[1] S4:TXPOWER=30
[1] S5:ECC=0
[1] S6:RXFRAME=1
[1] S7:OPPRESEND=0
[1] S8:MIN_FREQ=922000
[1] S9:MAX_FREQ=928000
[1] S10:NUM_CHANNELS=21
[1] S11:DUTY_CYCLE=100
[1] S12:LBT_RSSI=0
[1] S13:RTSCTS=1
[1] S14:MAX_WINDOW=80
[1] S15:ENCRYPTION_LEVEL=0
[1] S16:RESERVED=0
[1] S17:RESERVED=0
[1] S18:RESERVED=0
[1] S19:RESERVED=0
[1] S20:ANT_MODE=0
[1] S21:GPO1_3STATLED=0
[1] S22:RESERVED=0
[1] S23:RATE/FREQBAND=0
[1] S24:NODEID=1
[1] S25:NODEDESTINATION=255
[1] S26:NETCOUNT=4
[1] S27:SERBREAMS10=0
[1] S28:RESERVED=0
[1] S29:MAX_PACKET=380
[1] S30:BUFFSIZE=640
[1] S31:AIR_FRAMELEN=120
[1] R0:TARGET_RSSI_dBm=0
[1] R1:HYSTERESIS_RSSI_dBm=5
```

Can type 'ATI5' to look at all settings

As of 7/29/22, can only get multipoint to work with MissionPlanner and non-US radios.

With US radios, command 'ATS26=4' spits out an error (working with support team on this)

Also working with support team on getting it to work in QGroundControl