

Notes for PX4 Mixing Struggles

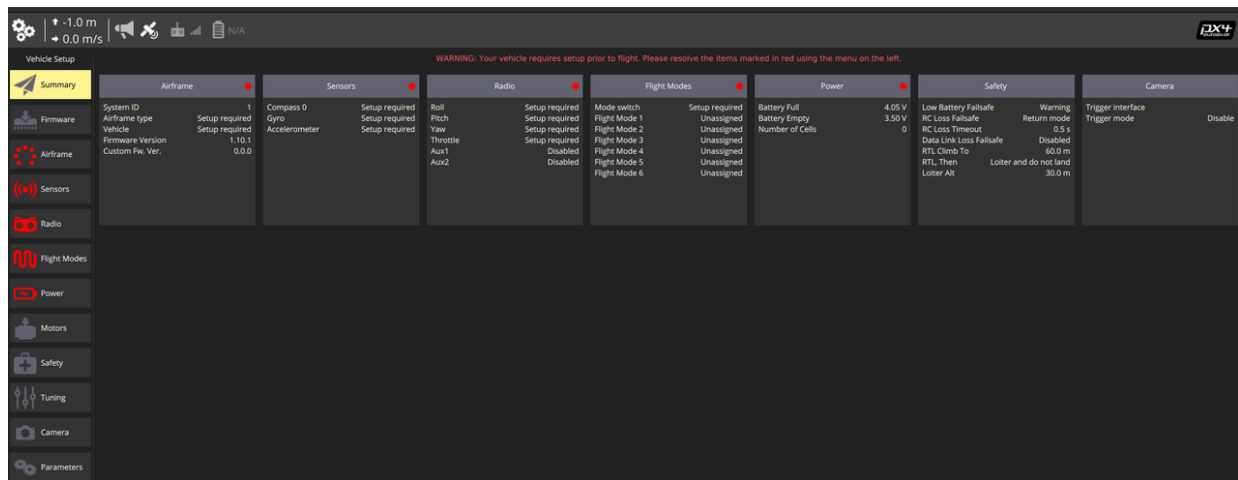
Pixhawk 2.1 (Cube) Experiment #1 5/27

Hardware Setup

- Cube #1
- Here2 GPS Connected
- TBS Crossfire Micro Connected
- Fresh SD Card (Dedicated to Debugging)

Software Setup

- PX4 Pro v1.10.1 Stable Release loaded via QGroundControl (Daily Build)
- Reset all parameters to firmware default



Console test before configuring:

Connected to the console via mavlink_shell.py

```
nsh> px4io status
ERROR [px4io] not started
nsh> fmu status
INFO [fmu] not running
```

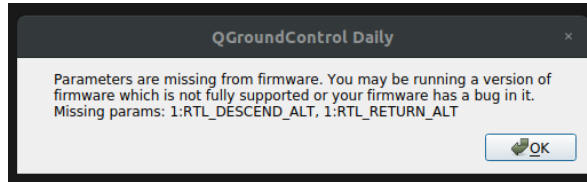
Configuring as VTOL Duo Tailsitter (Caiprioshka Duo Tailsitter):

Configured Airframe

Attempted CAL

- Compass Cal was different than usual - it did not ask for certain orientations.
- Eventually Cal failed
- Here2 Lights flashing green rapidly.
- Attempted reboot. Here2 lights flashing red now.

Pulled the plug
Reset all parameter values to vehicle default
Rebooted
Error Message at boot-up:



Reattempted Compass Cal - Success

Rebooted

Gyro Cal - Success

Accel Cal - Success

Airspeed Cal - No Sensor found.

Cal "Canceled"

CBRK_AIRSP_CHK set to 162128

Rebooted

Radio Configuration with T16 Tx bound to TBS Crossfire Rx -

- QGCS Warning: Config for RC3 rejected by IO
- Response still looks fine

Flight Mode Configuration - Success

Power Configuration - 2 Cell

Reboot

Setup complete - Closed QGroundcontrol to go back to Mavlink Console

Console Test After Configuration

```
nsh> px4io status
WARN [px4io] loaded
protocol 4 hardware 2 bootloader 3 buffer 64B crc 0x4756503d
8 controls 8 actuators 18 R/C inputs 2 analog inputs 0 relays
760 bytes free
status 0x2765 OUTPUTS_ARMED SAFETY_SAFE RC_OK SBUS FMU_OK MIXER_OK ARM_SYNC INIT_OK
alarms 0x0030 FMU_LOST RC_LOST
vservo 70 mV vservo scale 10000
vrssi 1275
actuators -10000 -10000 0 0 8210 6790 0 0
servos 900 900 900 900 0 0 0 0
reversed outputs: [_____] trims: r: 0.0000 p: 0.0000 y: 0.0000
18 raw R/C inputs 1495 1495 982 1493 982 982 982 982 995 995 995 995 1495 1495 1495 14
R/C flags: 0x0018 MAPPING_OK
mapped R/C inputs 0x000f 0:0 1:0 2:0 3:0
ADC inputs 32 1864
features 0x0008 RSSI_ADC
arming 0x0861 FMU_DISARMED FMU_NOT_PREARMED IO_ARM_OK INAIR_RESTART_OK ALWAYS_PWM_ENAE
rates 0x000f default 50 alt 400 sbus 72
debuglevel 0
controls 0: 154 307 3916 0 0 0 0 0
```

```
controls 1: -10000 947 0 0 0 0 0 0
controls 2: 0 0 0 0 0 0 0 0
controls 3: 0 0 0 0 0 0 0 0
input 0 min 1000 center 1500 max 2000 deadzone 10 assigned 0 options 0x0001 ENABLED
input 1 min 1000 center 1500 max 2000 deadzone 10 assigned 1 options 0x0001 ENABLED
input 2 min 982 center 982 max 2005 deadzone 10 assigned 3 options 0x0001 ENABLED
input 3 min 982 center 1492 max 2005 deadzone 10 assigned 2 options 0x0001 ENABLED
input 4 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 5 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 6 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 7 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 8 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 9 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 10 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 11 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 12 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 13 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 14 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 15 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 16 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 17 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
failsafe 900 900 0 0 1500 1500 0 0
disarmed values 900 900 900 900 0 0 0 0
IMU heater off
```

```
nsh> fmu status
INFO [fmu] not running
```

```
nsh> pwm info
device: /dev/pwm_output0
channel 1: 900 us (alternative rate: 400 Hz failsafe: 900, disarmed: 900 us, min: 1080 us, max: 1080 us)
channel 2: 900 us (alternative rate: 400 Hz failsafe: 900, disarmed: 900 us, min: 1080 us, max: 1080 us)
channel 3: 900 us (alternative rate: 400 Hz failsafe: 0, disarmed: 900 us, min: 1000 us, max: 1000 us)
channel 4: 900 us (alternative rate: 400 Hz failsafe: 0, disarmed: 900 us, min: 1000 us, max: 1000 us)
channel 5: 0 us (default rate: 50 Hz failsafe: 1500, disarmed: 0 us, min: 1000 us, max: 1000 us)
channel 6: 0 us (default rate: 50 Hz failsafe: 1500, disarmed: 0 us, min: 1000 us, max: 1000 us)
channel 7: 0 us (default rate: 50 Hz failsafe: 0, disarmed: 0 us, min: 1000 us, max: 1000 us)
channel 8: 0 us (default rate: 50 Hz failsafe: 0, disarmed: 0 us, min: 1000 us, max: 1000 us)
channel group 0: channels 1 2
channel group 1: channels 5 6 7 8
channel group 2: channels 3 4
```

```
nsh> fmu start
nsh> fmu status
INFO [fmu] Max update rate: 50 Hz
INFO [fmu] PWM Mode: no pwm
fmu: cycle: 45 events, 1070us elapsed, 23.78us avg, min 1us max 990us 147.310us rms
control latency: 0 events, 0us elapsed, 0.00us avg, min 0us max 0us 0.000us rms
INFO [mixer_module] Switched to rate_ctrl work queue: 0
INFO [mixer_module] Mixer loaded: no
INFO [mixer_module] Driver instance: 1
INFO [mixer_module] Channel Configuration:
INFO [mixer_module] Channel 0: value: 0, failsafe: 0, disarmed: 0, min: 1000, max: 2000
```

```

INFO [mixer_module] Channel 1: value: 0, failsafe: 0, disarmed: 0, min: 1000, max: 2000
INFO [mixer_module] Channel 2: value: 0, failsafe: 0, disarmed: 0, min: 1000, max: 2000
INFO [mixer_module] Channel 3: value: 0, failsafe: 0, disarmed: 0, min: 1000, max: 2000
INFO [mixer_module] Channel 4: value: 0, failsafe: 0, disarmed: 0, min: 1000, max: 2000
INFO [mixer_module] Channel 5: value: 0, failsafe: 0, disarmed: 0, min: 1000, max: 2000
nsh> px4io status
WARN [px4io] loaded
protocol 4 hardware 2 bootloader 3 buffer 64B crc 0x4756503d
8 controls 8 actuators 18 R/C inputs 2 analog inputs 0 relays
760 bytes free
status 0x2765 OUTPUTS_ARMED SAFETY_SAFE RC_OK SBUS FMU_OK MIXER_OK ARM_SYNC INIT_OK
alarms 0x0030 FMU_LOST RC_LOST
vservo 74 mV vservo scale 10000
vrssi 1328
actuators -10000 -10000 0 0 8245 6755 0 0
servos 900 900 900 900 0 0 0 0
reversed outputs: [_____] trims: r: 0.0000 p: 0.0000 y: 0.0000
18 raw R/C inputs 1495 1495 982 1493 982 982 982 982 995 995 995 995 1495 1495 1495 1495
R/C flags: 0x0018 MAPPING_OK
mapped R/C inputs 0x000f 0:0 1:0 2:0 3:0
ADC inputs 33 1938
features 0x0008 RSSI_ADC
arming 0x0861 FMU_DISARMED FMU_NOT_PREARMED IO_ARM_OK INAIR_RESTART_OK ALWAYS_PWM_ENA
rates 0x000f default 50 alt 400 sbus 72
debuglevel 0
controls 0: 146 322 3885 0 0 0 0 0
controls 1: -10000 991 0 0 0 0 0 0
controls 2: 0 0 0 0 0 0 0 0
controls 3: 0 0 0 0 0 0 0 0
input 0 min 1000 center 1500 max 2000 deadzone 10 assigned 0 options 0x0001 ENABLED
input 1 min 1000 center 1500 max 2000 deadzone 10 assigned 1 options 0x0001 ENABLED
input 2 min 982 center 982 max 2005 deadzone 10 assigned 3 options 0x0001 ENABLED
input 3 min 982 center 1492 max 2005 deadzone 10 assigned 2 options 0x0001 ENABLED
input 4 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 5 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 6 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 7 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 8 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 9 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 10 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 11 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 12 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 13 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 14 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 15 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 16 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 17 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
failsafe 900 900 0 0 1500 1500 0 0
disarmed values 900 900 900 900 0 0 0 0
IMU heater off

```

```

nsh> mixer load /dev/pwm_output0 /etc/mixers/vtol_tailsitter_duo.main.mix
nsh> mixer load /dev/pwm_output0 /etc/mixers/blade130.main.mix
nsh> px4io status

```

```

WARN [px4io] loaded
protocol 4 hardware 2 bootloader 3 buffer 64B crc 0x4756503d
8 controls 8 actuators 18 R/C inputs 2 analog inputs 0 relays
904 bytes free
status 0x2765 OUTPUTS_ARMED SAFETY_SAFE RC_OK SBUS FMU_OK MIXER_OK ARM_SYNC INIT_OK
alarms 0x0030 FMU_LOST RC_LOST
vservo 74 mV vservo scale 10000
vrssi 1297
actuators -10000 816 56 312 3850 0 0 0
servos 900 900 900 900 0 0 0 0
reversed outputs: [_____] trims: r: 0.0000 p: 0.0000 y: 0.0000
18 raw R/C inputs 1495 1495 982 1493 982 982 982 982 995 995 995 995 1495 1495 1495 14
R/C flags: 0x0018 MAPPING_OK
mapped R/C inputs 0x000f 0:0 1:0 2:0 3:0
ADC inputs 34 1577
features 0x0008 RSSI_ADC
arming 0x0861 FMU_DISARMED FMU_NOT_PREARMED IO_ARM_OK INAIR_RESTART_OK ALWAYS_PWM_ENAE
rates 0x000f default 50 alt 400 sbus 72
debuglevel 0
controls 0: 136 333 3853 0 0 0 0 0
controls 1: -10000 978 0 0 0 0 0 0
controls 2: 0 0 0 0 0 0 0 0
controls 3: 0 0 0 0 0 0 0 0
input 0 min 1000 center 1500 max 2000 deadzone 10 assigned 0 options 0x0001 ENABLED
input 1 min 1000 center 1500 max 2000 deadzone 10 assigned 1 options 0x0001 ENABLED
input 2 min 982 center 982 max 2005 deadzone 10 assigned 3 options 0x0001 ENABLED
input 3 min 982 center 1492 max 2005 deadzone 10 assigned 2 options 0x0001 ENABLED
input 4 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 5 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 6 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 7 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 8 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 9 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 10 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 11 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 12 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 13 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 14 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 15 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 16 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 17 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
failsafe 900 1530 1530 1530 1500 0 0 0
disarmed values 900 900 900 900 0 0 0 0
IMU heater off

```

Attempted a few other commands - Nothing too interesting

Reloaded VTOL Tailsitter Duo Mixer

Attempted Arming - Would not arm

Arm and Generate Servo Outputs with QGroundcontrol

Attempted to Arm - Pre-flight fail. Compass Inconsistent. Preflight Checks failed.

Performed Mag Cal and Rebooted

Attempted to Arm - Avionics Power is Low (4.8V). Arming with USB is not safe.

Disabled USB and Power Arming checks and Rebooted
Attempted to Arm - Arming Denied Press Safety Switch first - Pressed Safety Switch
Attempted to Arm - Success
Move Throttle Stick - PWM value changes in servo1_raw and servo2_raw
Move Roll Stick - PWM value changes in servo1_raw and servo2_raw (opposite) as well as servo5_raw and servo6_raw
Move Pitch Stick - PWM changes in servo5_raw and servo6_raw
Move Yaw Stick - PWM changes in servo5_raw and servo6_raw
Conclusion: Mixing is working and making sense
Disarmed

Attempt Heli Mixing Without Changing Vehicle Type

Loaded blade130 mixer through Mavlink Console
Attempted to Arm - Success
Move Throttle Stick - PWM value changes in servo 1-4 (2-4 most similarly) - Makes sense for collective with throttle
Move Roll Stick - PWM value changes in servos 3 and 4 - makes sense for 2 servos moving to roll the swash plate
Move Pitch Stick - PWM value changes in servos 2 through 4 - makes sense for 3 servos moving to pitch the swash plate
Move the Yaw Stick - PWM value changes in servo 5 - makes sense for tail rotor response
Conclusion: Mixing is working and making sense

Modify Blade130 mixer to have 2 helicopter mixers and load onto SD Card (no re-compile)

Created a new mix file called "dual_heli_test.main.mix" and loaded it on the SD Card
Booted up Cube with no issues
Attempted to Arm - Success after pressing safety switch
Servo mixing matches VTOL Tailsitter Duo mixing - must have re-loaded after reboot. Makes sense
Disarmed
New "Custom" Mixer loaded through Mavlink Console - No errors shown
Armed
Two helicopter mixers appear to be functional
Move Throttle Stick - PWM value changes in all servos (1-8)
Move Roll Stick - PWM values change in the last 2 servos of the swash setup (3&4, 7&8)
Move Yaw Stick - Minimal PWM response
Move Pitch Stick - PWM movement in all swash servos
Conclusion: Mixing is working and making sense
Disarmed

Conclusion:

- There is not a fundamental limitation for the Cube to process and output two helicopter mixers
- I was not able to replicate some of the bizarre failure modes I was seeing in the past

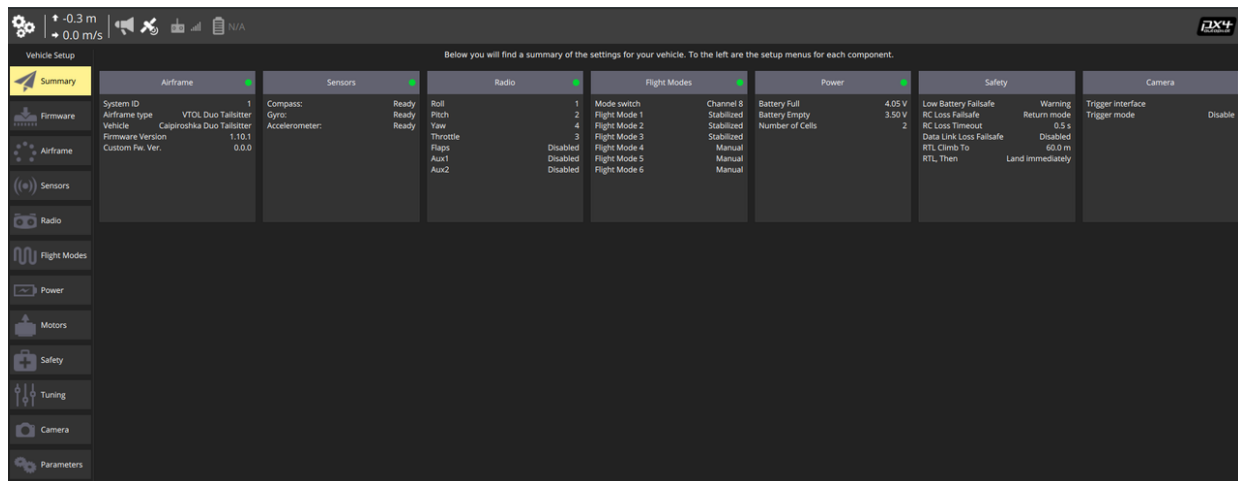
Pixhawk 2.1 (Cube) Experiment #2 5/27

Hardware Setup

- Cube #1
- Here2 GPS Connected
- TBS Crossfire Micro Connected
- SD Card from Previous Debugging (Dedicated to Debugging)

Software Setup

- PX4 Firmware cloned from Repo
 - Checked out tag v1.10.1
 - built using `make px4_fmu-v3_default`
 - loaded via QGroundcontrol
- Left all parameters as-is



Arm and Generate Servo Outputs with QGroundcontrol

Attempted to Arm - Success after pressing the safety switch
Verified servo outputs looked correct for Duo Talisiter
Disarmed

Test Previous Dual Helicopter Test Mixer with Console

Loaded dual_heli_test.main.mix from SD card on the console - success
Armed
Verified servo outputs looked correct for two helicopter mixers stacked together
Disarmed

Conclusions:

- Firmware built from source is capable of running the mixer file with two stacked helicopter mixers
- Question: Where did we branch our PX4 code from? Was it a stable release?

Pixhawk 2.1 (Cube) Experiment #3 5/27

Hardware Setup

- Cube #1
- Here2 GPS Connected
- TBS Crossfire Micro Connected
- SD Card from Previous Debugging (Dedicated to Debugging)

Software Setup

- PX4 Firmware cloned from Repo
 - Checked out tag v1.10.1
 - Modified to show mixer debug output with printf
 - built using make px4_fmu-v3_default
 - loaded via QGroundcontrol
- Left all parameters as-is

Arm and Generate Servo Outputs with QGroundcontrol

Attempted to Arm - Success after pressing the safety switch
Verified servo outputs looked correct for Duo Tailsitter
Disarmed

Test Previous Dual Helicopter Test Mixer with Console

Loaded dual_heli_test.main.mix from SD card on the console - success
Armed
Verified servo outputs looked correct for two helicopter mixers stacked together
Disarmed
Powered Down

Test New Dual Helicopter Test Mixer with Console

Create new mixer dual_heli_test2.main.mix that sets the number of servos to 6 (hoping to see a debug message)
Loaded dual_heli_test2.main.mix from SD card on the console - no error or expected debug message
Armed
Servos are flatlined
Closing QGroundcontrol and switching to mavlink_shell

```
nsh> px4io status
WARN [px4io] loaded
protocol 4 hardware 2 bootloader 3 buffer 64B crc 0xe0e5af71
8 controls 8 actuators 18 R/C inputs 2 analog inputs 0 relays
1160 bytes free
status 0x3765 OUTPUTS_ARMED SAFETY_OFF RC_OK SBUS FMU_OK MIXER_OK ARM_SYNC INIT_OK
alarms 0x0010 FMU_LOST
vservo 50 mV vservo scale 10000
vrssi 1346
actuators 0 0 0 0 0 0 0 0
servos 0 0 0 0 0 0 0
reversed outputs: [_____] trims: r: 0.0000 p: 0.0000 y: 0.0000
18 raw R/C inputs 1495 1497 1487 1495 982 982 982 982 995 995 995 995 1495 1495 1495 1
R/C flags: 0x0018 MAPPING_OK
mapped R/C inputs 0x000f 0:0 1:0 2:0 3:4886
ADC inputs 24 1894
features 0x0008 RSSI_ADC
arming 0x0867 FMU_ARMED FMU_PREARMED IO_ARM_OK INAIR_RESTART_OK ALWAYS_PWM_ENABLE
rates 0x000f default 50 alt 400 sbus 72
debuglevel 0
controls 0: 110 479 -895 4905 0 0 0 0
```



```
controls 1: 575 919 0 0 0 0 0 0
controls 2: 0 0 0 0 0 0 0 0
controls 3: 0 0 0 4886 0 0 0 0
input 0 min 1000 center 1500 max 2000 deadzone 10 assigned 0 options 0x0001 ENABLED
input 1 min 1000 center 1500 max 2000 deadzone 10 assigned 1 options 0x0001 ENABLED
input 2 min 982 center 982 max 2005 deadzone 10 assigned 3 options 0x0001 ENABLED
input 3 min 982 center 1492 max 2005 deadzone 10 assigned 2 options 0x0001 ENABLED
input 4 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 5 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 6 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 7 min 982 center 1493 max 2005 deadzone 10 assigned 255 options 0x0000
input 8 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 9 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 10 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 11 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 12 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 13 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 14 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 15 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 16 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
input 17 min 1000 center 1500 max 2000 deadzone 0 assigned 255 options 0x0000
failsafe 0 0 0 0 0 0 0 0
disarmed values 900 900 900 900 0 0 0 0
IMU heater off
```

```
nsh> fmu status
INFO [fmu] not running
nsh> pwm info
device: /dev/pwm_output0
channel 1: 0 us (alternative rate: 400 Hz failsafe: 0, disarmed: 900 us, min: 1080 us,
channel 2: 0 us (alternative rate: 400 Hz failsafe: 0, disarmed: 900 us, min: 1080 us,
channel 3: 0 us (alternative rate: 400 Hz failsafe: 0, disarmed: 900 us, min: 1000 us,
channel 4: 0 us (alternative rate: 400 Hz failsafe: 0, disarmed: 900 us, min: 1000 us,
channel 5: 0 us (default rate: 50 Hz failsafe: 0, disarmed: 0 us, min: 1000 us, max: 2
channel 6: 0 us (default rate: 50 Hz failsafe: 0, disarmed: 0 us, min: 1000 us, max: 2
channel 7: 0 us (default rate: 50 Hz failsafe: 0, disarmed: 0 us, min: 1000 us, max: 2
channel 8: 0 us (default rate: 50 Hz failsafe: 0, disarmed: 0 us, min: 1000 us, max: 2
channel group 0: channels 1 2
channel group 1: channels 5 6 7 8
channel group 2: channels 3 4
```

Disarmed
Powered Down
Opened up QGroundcontrol
Last log too big to download
Power-cycled and pulled log from SD Card
Nothing conclusive in logged debug messages

Test New Dual Helicopter Test Mixer using Aux Mixer

Create new mixer dual_heli_test2.aux.mix that sets the number of servos to 6 (hoping to see a debug message)
Loaded dual_heli_test2.aux.mix from SD card on the console - error loading to pwm_output1

```
nsh> mixer load /dev/pwm_output1 /fs/microsd/etc/mixers/dual_heli_test2.aux.mix
ERROR [mixer] cant open /dev/pwm_output1

ERROR [mixer] failed to load mixer
```

Conclusions:

- Purposely violating one of the error-checks in the helicopter mixer did not cause the expected behavior
- While the mix file did not load successfully, it did not cause MIXER_FAIL as I have seen in previous attempts
- The idea of trying to load the mix file on the Aux output was presented in one of the forum posts, but there must be an additional step to actually make that work

Pixhawk 2.1 (Cube) Experiment #4 5/27

Hardware Setup

- Cube #1
- Here2 GPS Connected
- TBS Crossfire Micro Connected
- SD Card from Previous Debugging (Dedicated to Debugging)

Software Setup

- PX4 Firmware cloned from Repo
 - Checked out tag v1.10.1
 - Modified to show mixer debug output with debug interface
 - Did not build
 - Modified based on this post: <https://discuss.px4.io/t/debug-function/16331>
 - Did not build
 - Retried building with printf debug
 - built using `make px4_fmu-v3_default`
 - loaded via QGroundcontrol
- Left all parameters as-is

Try to read messages off the CONS pins

Connected FTDI

Installed Screen

Closed QGroundcontrol (may have been leading to port opening issues)

Connected to ttyUSB0 at 57600 Baud, but nothing streamed across the serial port

Alternated switching pins on the CONS side and the FTDI side to make sure it wasn't a Tx/Rx issue - No changes

Giving up on the system console for now

Pixhawk 2.1 (Cube) Experiment #5 5/27

Hardware Setup

- Cube #1
- Here2 GPS Connected
- TBS Crossfire Micro Connected
- SD Card from Previous Debugging (Dedicated to Debugging)

Software Setup

- PX4 Firmware cloned from Repo
 - Checked out tag v1.10.1
 - Modified mixer to accept up to 6 servo inputs and process them with the same traditional heli logic
 - Modified the error check in the helicopter mixer
 - Modified the array size for servos in mixer.h
 - built using `make px4_fmu-v3_default`
 - loaded via QGroundcontrol
- Left all parameters as-is

Arm and Generate Servo Outputs with QGroundcontrol

Attempted to Arm - Success after pressing the safety switch
 Verified servo outputs looked correct for Duo Tailsitter
 Disarmed

Test New Dual Helicopter Test Mixer with Console

Create new mixer `dual_heli_test2.main.mix` that sets the number of servos to 6
 Loaded `dual_heli_test2.main.mix` from SD card on the console - errors

```
NuttShell (NSH)
nsh> mixer load /dev/pwm_output0 /fs/microsd/etc/mixers/dual_heli_test2.main.mix
INFO [px4io] [IO] mixer upload fail
ERROR [mixer] failed to load mixers from /fs/microsd/etc/mixers/dual_heli_test2.main.mix
ERROR [mixer] failed to load mixer
nsh>
```

Qgroundcontrol also announced that manual control was lost
 Closed Qgroundcontrol and switched to `mavlink_shell`
`px4io` status command returned VERY slowly (something I have observed before)

```
nsh> px4io status
WARN [px4io] loaded
protocol 2147483648 hardware 2147483648 bootloader 2147483648 buffer 2147483648B crc 0
2147483648 controls 2147483648 actuators 2147483648 R/C inputs 2147483648 analog input
2147483648 bytes free
status 0x0000 SAFETY_SAFE RC_FAIL FMU_FAIL MIXER_FAIL ARM_NO_SYNC INIT_FAIL
alarms 0x0000
vservo 2147483648 mV vservo scale 2147483648
vrssi 2147483648
actuators 0 0 0 0 0 0 0 0
servos 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648 21
reversed outputs: [_____] trims: r: 0.0000 p: 0.0000 y: 0.0000
0 raw R/C inputs
```

```

R/C flags: 0x0000
mapped R/C inputs 0x0000
ADC inputs
features 0x0000
arming 0x0000 FMU_DISARMED FMU_NOT_PREARMED IO_ARM_DENIED
rates 0x80000000 default 2147483648 alt 2147483648 sbus 2147483648
debuglevel 2147483648
controls 0: 0 0 0 0 0 0 0 0
controls 1: 0 0 0 0 0 0 0 0
controls 2: 0 0 0 0 0 0 0 0
controls 3: 0 0 0 0 0 0 0 0
input 0 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 1 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 2 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 3 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 4 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 5 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 6 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 7 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 8 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 9 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 10 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 11 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 12 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 13 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 14 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 15 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 16 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
input 17 min 2147483648 center 2147483648 max 2147483648 deadzone 2147483648 assigned 2
failsafe 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648
disarmed values 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648 2147483648
IMU heater off

```

Everything seemed to fail
Powered down

Verify Reset - Arm and Generate Servo Outputs with QGroundcontrol

Attempted to Arm - Success after pressing the safety switch
Verified servo outputs looked correct for Duo Tailsitter
Disarmed

Conclusions:

- One simple change to a structure messed up a lot of stuff
- The hardware should recover after power-cycling as long as it has a reasonable mix file to use for loading

Pixhawk 2.1 (Cube) Experiment #6 5/27

Hardware Setup

- Cube #1

- Here2 GPS Connected
- TBS Crossfire Micro Connected
- SD Card from Previous Debugging (Dedicated to Debugging)

Software Setup

- PX4 Firmware cloned from Repo
 - Checked out tag v1.10.1
 - Modified mixer to accept up to 6 servo inputs and process them with the same traditional heli logic
 - Modified the error check in the helicopter mixer
 - Modified the array size for servos in mixer.h
 - turned off the debug printf statements
 - built using make px4_fmu-v3_default
 - loaded via QGroundcontrol
- Left all parameters as-is

Arm and Generate Servo Outputs with QGroundcontrol

Attempted to Arm - Success after pressing the safety switch
 Verified servo outputs looked correct for Duo Tailsitter
 Disarmed

Test Previous Dual Helicopter Test Mixer with Console

Loaded dual_heli_test.main.mix from SD card on the console - success with no errors
 Armed
 Verified servo outputs looked correct for two helicopter mixers stacked together
 Disarmed
 Powered Down

Test New Dual Helicopter Test Mixer with Console

Loaded dual_heli_test2.main.mix from SD card on the console - Errors

- Manual control lost
- Failed to load the mix file
- Can't reload a different mix file
- px4io stop/start cycle does not unlock the system
- Reboot command doesn't fix it- it needs a full power cycle

Conclusions:

- Calling the Helicopter mixer with the code changes I made does not inherently cause problems
 - Setting the servo array size to 6 instead of 4 seems just fine
- Actually trying to load 6 servos does cause a problem