CanberraUAV Administrivia Documentation
Release

CanberraUAV Team

Sep 27, 2017

Contents

This is CanberraUAV's public documentation. All written documentation (reports, presentations, etc) are stored here.

These docs can be rendered with sphinx. They can be accessed as web page at https://canberrauav.readthedocs.org/.

The sources are published at http://github.com/CanberraUAV/admin/.

Lessons Learned

Projects, issues or activities that are considered in the past (unlike on-hold). These are recorded for posterity.

They are re-cast as "lessons learned" to encourage post-activity review.

> **Attention:** This documentation system was instigated in early 2013, see the public mailing list archives for earlier material.

Weather Station for CMAC

UPDATE: due to vandallism, now requires repair/replacement

TRL: 7

Description: A remote weather station and camera located at CMAC with a web-based GUI

Developers: Jack, Tridge

Status - Is now (**WAS**) up and running at http://weather.cmac.org.au/

2012 UAV Outback Challenge

CanberraUAV was formed to campaign for the 2012 UAV Outback Challenge, an international amateur UAV search and rescue competition. We won first place and were awarded perfect score for the search component, but suffered a malfunction that prevented us from accomplishing the rescue component.

The 2014 competition was announced on 27/02/2013, we will enter and expect to improve on our 2012 performance.

The above image shows the team members present at the awards ceremony on day 3 of the competition, it doesn't include the members that had to travel home before them, or the wider community that contributed to our efforts.

For more information about the event:

- The official competition web site http://www.uavoutbackchallenge.com.au/

- CanberraUAV mission statement: http://canberrauav.com/about

- OBC Wikipedia article http://en.wikipedia.org/wiki/UAV_Outback_Challenge

- DIYDrones write-up (technical/enthusiast audience) http://diydrones.com/profiles/blogs/canberrauav-outback-challenge-2012-debrief

- Sydney Morning Herald (general public audience) http://www.smh.com.au/technology/technology-news/drone-finds-dummy-bushwalker-in-worldfirst-20121005-273lv.html

- South Burnett Times (general public, Kingaroy local paper) http://southburnett.com.au/news2/2012/10/outback-joe-found-but-not-saved/

Deliverables

The competition requires passing various development and documentation milestones prior to the event. These are the documents we submitted:

- `D1 (word 2010)`,`D1 (PDF)`

- `D2 (word 2010)`,`D2 (PDF)`

- `D3 (word 2010)`,`D3 (PDF)`

Procedures and Reference

We also created the following documents for our own use at the competition (and practice flights):

- `Procedures document (Word 2010)`
- `Items to bring to testing days (Word 2010)`
- `Flight Operations Manual (Word 2010)`

After the Challenge

In addition to Tridge's write-up on DIYDrones, we documented our post-competition review here:

- `Debrief (word 2010)`

2014 UAV Outback Challenge

The 2014 UAV Outback Challenge (OBC) was the 2nd time CanberraUAV had entered the competition.

We came 1st place, successfully dropping a bottle of water to within 2.6m of Joe.

A total of 16 teams made it to Kingaroy, 4 teams being able to drop a water bottle within 100m of Joe (another team dropped the bottle more than 100m from Joe).

For more information about the event:

- The official competition web site http://www.uavoutbackchallenge.com.au/
- CanberraUAV mission statement: http://canberrauav.org.au/about
- OBC Wikipedia article http://en.wikipedia.org/wiki/UAV_Outback_Challenge
- South Burnett Times http://www.southburnetttimes.com.au/news/got-it-first-time-elusive-outback-joe-found/2401560/
- FastCo http://www.fastcoexist.com/3036658/this-drone-just-saved-someone-lost-in-the-australian-wilderness-but-that-som

Hardware/Software used

Airframe: VQ Porter (2.7m wingspan. 12kg takeoff weight) with DLE35 engine

Flight Controller: Pixhawk running APM:Plane 3.1.1

Datalink1: RFD900's with 3dBi patch antennas of the aircraft and 6dBi Yagi antenna of the ground

Datalink2: Ubiquiti Rocket 5.8GHz. 28dBi MIMO antenna on the ground, and a 10dBi MIMO omni antenna in the aircraft.

Camera: PointGrey Chameleon

Image Processing: Odroid XU board running Unbuntu and the cuav imaging software

Ground Station: 3 networked laptops running the MAVProxy GCS software.

Procedures and Reference

We also created the following documents for our own use at the competition (and practice flights):

The rules:

- `Rules V 1.4,`

Deliverables:

- `D1 (word 2010),``D1 (PDF)`
- `D2 (word 2010),``D2 (PDF)`
- `D3 (word 2010),``D3 (PDF)`

Procedures and Checklists:

- `Flight Operations Manual (Word 2010),``Flight Operations Manual (PDF)`

After the Challenge

We completed a post-OBC review here:

- Internal Review

There are also reviews by Stephen and Tridge on DIYDrones:

- Tridge's technical review - http://diydrones.com/profiles/blogs/canberrauav-outback-challenge-2014-debrief
- Stephen's not-so-technical review - http://diydrones.com/profiles/blogs/canberrauav-uav-outback-challenge-review

2016 UAV Challenge

The 2016 UAV Challenge (Medical Express) was the 3rd time CanberraUAV had entered the competition.

We came 1st place, successfully landing 40.6m from Outback Joe and returning safely to the base. Unfortunately the comms relay UAV crashed partway through the mission.

A total of 10 teams made it to Dalby, with 3 teams finding Joe and only CanberraUAV performing a successful landing next to Joe.

For more information about the event:

- The official competition web site https://uavchallenge.org/medical-express/
- CanberraUAV mission statement: http://canberrauav.org.au/about
- OBC Wikipedia article http://en.wikipedia.org/wiki/UAV_Outback_Challenge
- BBC "Click" Documentary http://www.bbc.co.uk/programmes/b0817f4m

Hardware/Software used

Airframe1: VQ Porter (2.7m wingspan. 14kg takeoff weight) with DLE35 engine

Airframe2: Gaui GX9 (2m rotorspan)

Flight Controller: Pixhawk running APM:Plane (Porter) and APM:Copter (GX9)

Datalink1: RFD900's with 3dBi patch antennas of the aircraft and 6dBi Yagi antenna of the ground

Datalink2: 3G modems using the Telstra and Optus networks

Camera: PointGrey Chameleon

Image Processing: Odroid XU board running Linux and the cuav imaging software

Ground Station: 2 networked laptops running the MAVProxy GCS software.

Procedures and Reference

We also created the following documents for our own use at the competition (and practice flights):

The rules:

- `Rules V 1.4,`

Deliverables:

- `D1 (word 2010)`,`D1 (PDF)`
- `D2 (word 2010)`,`D2 (PDF)`
- `D3 (word 2010)`,`D3 (PDF)`

After the Challenge

There is a review by Tridge on the Ardupilot forums:

- Tridge's technical review - http://discuss.ardupilot.org/t/canberrauav-outback-challenge-2016-debrief/12162

2018 UAV Challenge

The 2018 UAV Challenge (Medical Express) was the 4th time CanberraUAV had entered the competition.

Hardware/Software used

TBA

Procedures and Reference

We also created the following documents for our own use at the competition (and practice flights):

The rules:

- TBA

Deliverables:

- `D1 (PDF)`
- TBA
- TBA

After the Challenge

TBA

Presentations

The following is a list of public presentations by CanberraUAV members.

- Emmaus Christian School (June 2017) `Presentation`
- Belconnen SES (March 2013) `Presentation`
- Drone Technology (May 2015) `Presentation`
- Science in ACTion (August 2015) `Presentation`
- Canberra SHED Group (May 2015) `Presentation`
- LinuxConf.au (May 2015) `Presentation`

Workshops

This section contains information and files for the workshops that CanberraUAV runs.

CanberraUAV Workshop 1.0 (Jan 2017)

This workshop covered a detailed look at some of the technologies CanberraUAV used in it's (open-source) UAV's.

The aim of the workshop was to educate people on how to understand, use and extend some of these technologies.

It was aimed at both Windows and Linux users, with no previous experience or knowledge required.

For the practical sessions of the workshop, a laptop is required with the Ardupilot development environment installed (http://ardupilot.org/dev/docs/setting-up-sitl-on-linux.html for Linux or http://ardupilot.org/dev/docs/sitl-native-on-windows.html for Windows).

There were 3 parts to the workshop:

```
CanberraUAV Intro (pdf), CanberraUAV Intro (pptx)

Ardupilot (pdf), Ardupilot (pptx)

Ground Control Station (pdf), Ground Control Station (pptx)

Communications (pdf), Communications (pptx)
```

MHV Quadcopter Workshop 1.0 (March 2013)

Developer: Stephen. With help from Tridge, Jack, Alistair, Andreas and Chris (Wolfe)

The purpose of this workshop was to guide a group of 12 attendees through the process of building, calibrating and flying APM-based quadcopters.

It should be:

- (Relatively) Cheap

- Commonly available spare parts

- Open source or hackable hardware/software where available

- Easy for beginners to build

- Strong/tough enough to withstand beginner pilots

- Able to carry a 200g payload (such as a small camera)

The workshop itself is designed to be:

- Accessible to beginners

- Full documentation of the build process

- Able to be completed in 3 to 4 evenings (not including flight time)

- Educational as to how quadcopters work and how to safely use them

Resources

MHV Quadcopter Workshop Parts List

Note all prices are in $AUD and are from nearby suppliers (to save on shipping) where possible.

Part	Link to Store	Quantity	Approx Cost
Motors	turnigy park 450	4	$60
Propellers	10 * 4.5 slow fly (left, bag of 4)	2	$6
	10 * 4.5 slow fly (right, bag of 4)	2	$6
ESC's	20A (AVR based)	4	$29
RC Transmitter/Receiver	turnigy 9x	1	$53
Autopilot and GPS	APM 2.5 with 3DR uBlox GPS	1	$220
Flight Battery	Zippy 2.45Ah 3S 30C Lipo	1	$15
Battery Alarm	Lipo low voltage alarm	1	$2
Battery Charger	battery charger	1	$13
	power supply	1	$8
Battery Bag	Lipo safety bag	1	$3
Battery <-> Hub connector	XT60 connector (bag of 5)	1	$3
RC Transmitter Battery	nano-tech 2.5Ah 3S 10C Lipo	1	$15
Chassis	flamewheel 450 clone	1	$20
Telemetry Radio	3DR 915MHz telemetry kit	1	$75
Wiring	6 pin female-female cable 15cm (2.54mm spacing, 0.65mm pins)	1	$2
	3 pin female-female cable 10cm (2.54mm spacing, 0.65mm pins)	1	$2
RC Transmitter Backlight (Optional)	white LCD for 9x	1	$5
Sonar (Optional)	MaxSonar MB1200	1	$45
Power Module (Optional)	JDrones power module for APM	1	$25
RC Transmitter to PC Cable	PPM -> USB adapter	1	$5
Motor <-> ESC bullet connectors	3.5mm bullet connectors (bag of 10)	2	$3
Total Cost	(Without optional parts)		$540
Total Cost	(With optional parts)		$615

Shipping will add around 10% to the total cost.

Check-lists

Post-build checklist

This will assist in detecting any parts of the build manual you may have missed

- RC transmitter calibrated and settings correct

- APM RC inputs calibrated

- Telemetry radios have a unique network ID

- ESC's calibrated

- Accelerometers calibrated

- Parameters file loaded

- RC Transmitter bound to receiver

- Propellers and motors the correct way around

- Confirm GPS lock

- Confirm flight modes switch Stabilise -> ALT_HOLD -> Loiter

- Confirm Land mode activates via side switch

- Check roll and pitch values look correct with quadcopter is moved around

- (Without propellers on) confirm all motors spin

- (Whilst quadcopter is tightly held away from face) confirm RTL mode activation when RC Transmitter turned off.

Pre-flight checklist

This will help to avoid any basic errors/crashes.

Before leaving home: * Radio telemetry link working * RC controls working * Battery fully charged * No physical damage to quadcopter

At the field: * Ensure flight is being logged to a nearby laptop * Turn on text-to-speech mode to get audio feedback of mode changes * Be aware of weather conditions. Particularly wind * Bring the quadcopter down if people are in the vicinity * If you think something is going wrong, bring the quadcopter down immediately * Check for damage after a heavy landing * Don't forget to DISARM the quadcopter immediately after landing

Tools and General Materials Required

Depending on your exact setup, this list may vary. This list should cover 90% of people though.

- Wire ties

- Double sided tape (regular and foam)

- Elastic bands

- Normal tape

- Heatshrink (4cm width and 0.6 cm width)

- Soldering iron

- Screwdrivers (Hex and Philips head)

- Pliers

- Sandpaper

- Propeller balancer

- AVR programmer for ESC's and RC Transmitter (optional)

Build Manual

```
Build Manual (word 2010),Build Manual (PDF)
```

Parameters File

```
MHV.parm
```

Photos and Videos

http://www.flickr.com/photos/dburkey/sets/72157632928544691/with/8581032739/

http://youtu.be/C87mYyyV9qQ

Lessons Learned

- Always double check the correct parameters file is loaded.

- Check the quadcopter is calibrated correctly before flight testing.

- Encourage the workshop attendees to use simulator software (such as CRRCSim) to learn the basics of flying.

- Run a beta workshop beforehand with a few friends (particularly if using a custom hardware setup) to ensure all the bits and pieces fit together and are compatible with each other.

- Don't skimp out on the frame. Use a decent, strong frame.

- A ratio of 1 expert to every 3 to 5 attendees will cover most technical issues encountered by the attendees.

- It is very easy for attendees to get left behind in the build process. Schedule 1 or 2 small catch up sessions between the workshop evenings.

- Make sure you have enough screwdrivers, soldering irons and other tools.

- When ordering parts in bulk (such as motors and propellers) make sure the supplier has enough stock to cover your whole order.

- Always check RTL mode works correctly (by holding the quadcopter above your head and enabling RTL) before relying on it during an emergency.

- Fly well away from populated areas in case a quadcopter goes crazy and flies away.

- Check vibration level in Mission Planner.

- Always use telemetry radio logging.

Ideas For Future Workshops

- Anti-vibration foam for APM

- Use Gym for initial flying lessons - It's safer. Maybe Dickson College.

- Prop shrouds for safety.

- Use AR Drone frame and PX4 electronics.

- Use more solid frames from jDrones.

- Use the Turnigy 9xR Transmitter - it already has the firmware and back-light modifications done.

MHV Quadcopter Workshop 2.0 (July 2013)

Developer: Stephen. With help from Tridge

The purpose of this workshop was to guide a group of 9 attendees through the process of building, calibrating and flying APM-based quadcopters.

It should be:

- Cheap, but with a focus on strength
- Commonly available spare parts
- Open source or hackable hardware/software where available
- Easy for beginners to build - minimal soldering
- Strong/tough enough to withstand beginner pilots
- Able to carry a 200g payload (such as a small camera)

The workshop itself is designed to be:

- Accessible to beginners
- Full documentation of the build process
- Able to be completed in 3 to 4 evenings (not including flight time)
- Educational as to how quadcopters work and how to safely use them

Resources

MHV Quadcopter Workshop Parts List

Note all prices are in $AUD and are from nearby suppliers (to save on shipping) where possible. It does not include any tools used in the build.

Recommended tools are:

- USBASP programmer for Atmel MCU's
- Hex (Allen) wrenches
- Soldering iron
- Heat gun for heat shrinking
- Velcro, tape, wire ties

Note all prices below are in $USD.

Part	Link to Store	Quantity	Approx Cost
Motors	D2830-11 1000kv Brushless Motor	4	$39
Propellers	10 * 4.5 slow fly (left, bag of 4)	2	$6
	10 * 4.5 slow fly (right, bag of 4)	2	$6
ESC's	20A Multistar	4	$40
RC Transmitter/Receiver	turnigy 9xr	1	$50
	OrangeRX TX Module	1	$31
	OrangeRX RX Module (S.Bus)	1	$21
Autopilot	Pixhawk	1	$199
GPS and Compass Module	3DR GPS Compass Module	1	$90
Flight Battery	Zippy FlightMax 40C 2650mAh (3S)	1	$20
Battery Alarm	Lipo low voltage alarm	1	$2
Battery Charger	Imax-B6AC	1	$49
Battery Bag	Lipo safety bag	1	$3
Battery <-> ESC connector	Hub wires	1	$3
RC Transmitter Battery	nano-tech 2.5Ah 3S 10C Lipo	1	$15
Chassis	Hobbyking X525 V3	1	$15
	Extra Upper Plate	1	$1
	Standoffs (pack of 20)	1	$1
	Motor Screws	16	$1
Telemetry Radio	3DR 915MHz telemetry kit	1	$75
RC Transmitter to PC Cable	PPM -> USB adapter	1	$5
Total Cost			$674

Shipping will add around 10% to the total cost.

Build Manual

```
Build Manual (Word 2010),Build Manual (PDF)
```

Transmitter

```
ER9x firmware (Atmega128)
```

```
EEPROM settings
```

Eepe software is available from http://code.google.com/p/eepe/. ER9X firmware is available from http://code.google.com/p/er9x/ - note that the Atmega128 build is required for this workshop (ER9X uses the Atmega64 build by default). Check the SVN repository (http://code.google.com/p/er9x/source/browse/#svn%2Ftrunk) for the correct file.

Parameters File

```
APM Parameters
```

Photos and Videos

Other Useful Links

Mailing list (public)

http://www.canberrauav.com/mailman/listinfo/canberrauav

Mailing list (private)

http://www.canberrauav.com/mailman/listinfo/canberrauavprivate

Flickr Photo pool

http://www.flickr.com/groups/canberrauav/

Youtube account

https://www.youtube.com/channel/UCkKf-_mAKedeAHcyh1Ykmsg

Main gmail address

canberraUAV@gmail.com

Website

www.canberrauav.org.au