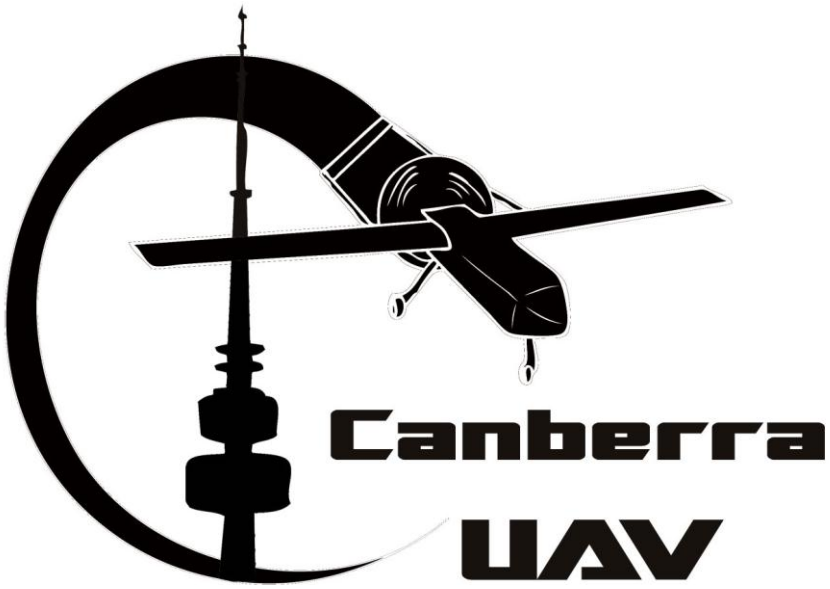
Deliverable 3 – Autonomous Flight Record

2012 UAV Outback Challenge – Search and Rescue Challenge



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1 Table of Contents

2 Flight Logs

2.1 Flight Log Book

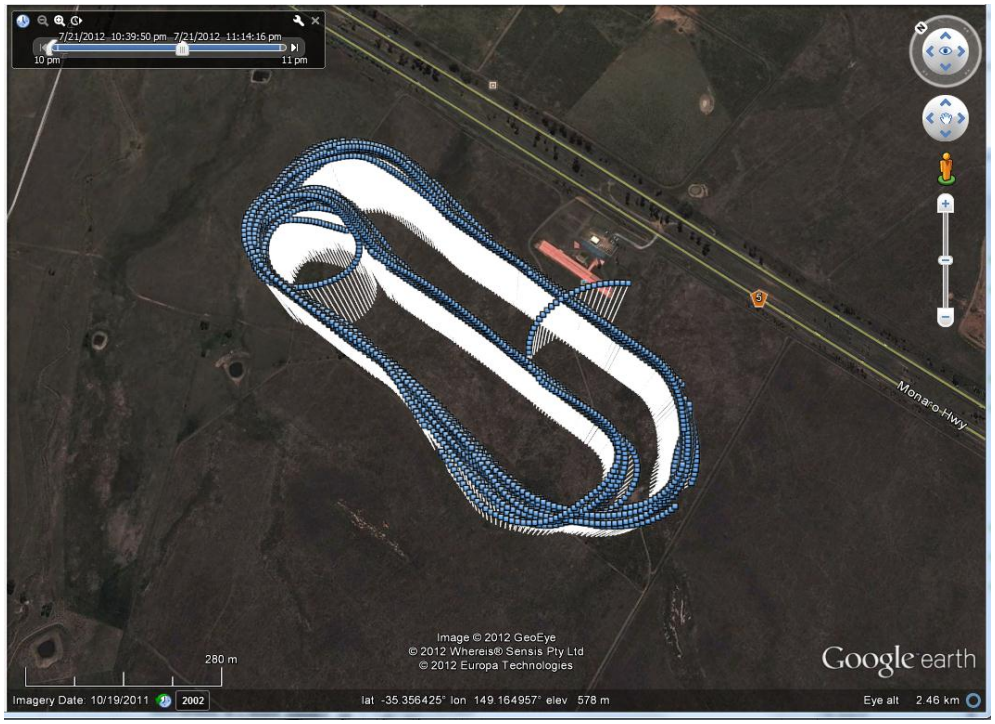
The following is an extract from our flight log book.

Date	Aircraft	Start Time	Flight Time	AUTO time	Flight Comments	Bottle Drop?	Camera capturing?
06/01/12	Mugin	1030	4:52	0:00	Recording flight characteristics in order to tune autopilot.	Not fitted	Not fitted
05/02/12	Mugin	1039	8:14	0:00	Tuning of the autopilot's stabilisation parameters.	Not fitted	Not fitted
22/04/12	Mugin	1114	10:00	0:00	Testing telemetry streams and bottle drop mechanism. Also capturing video for Deliverable 2	Bottle released. Parachute did not open	Not fitted
01/07/12	Mugin	1105	38:18	35:40	Failsafe module (V1) test OK. Rough landing – slight nosewheel damage needs fixing. Dead stick landing – Suspect engine tuning problem. Excellent waypoint tracking.	Not fitted	Not running
07/07/12	Mugin	1114	44:18	41:03	Onboard computer crashed during flight. Motor stopped during flight. Dead stick landing. Some damage to nosecone	Not fitted	16700 images captured. Joe successfully found by shirt colour
07/07/12	Mugin	1342	36:47	34:51	Motor stopped during flight. Dead stick landing.	Not fitted	23320 images captured. Joe found by shirt colour
15/07/12	Mugin	1301	36:05	34:40	Very high winds. Mugin coped exceptionally well. 5.8 GHz radio link unreliable, possibly due to depleted avionics battery.	Not fitted	9069 images captured. Joe found by shirt colour
15/07/12	Mugin	1433	19:00	12:07	Testing fuel system – only filled tank to 1/3 to determine fuel cut-out problem. Engine cut-out. Dead stick landing. HSV image filter tested.	Not fitted	No images captured
21/07/12	Mugin	1239	68:49	62:11	New header tank fitted. Airspeed sensor more accurate. Main wheel strut showing signs of delamination.	Unsuccessful. Bottle did not release	Camera connection problem. 29357 images captured. Joe recognised successfully

Date	Aircraft	Start Time	Flight Time	AUTO time	Flight Comments	Bottle Drop?	Camera capturing?
29/07/12	Mugin	1340	54:48	45:29	Replaced bung on header tank. Possible elevator issue causing difficulty maintaining consistent altitude. Image scoring functioning well	Successful	25752 images captured. Joe successfully found
04/08/12	Mugin	1155	63:55	58:12	Very high wind – gusting over 25 knots with significant cross component. Auto flight successfully coped with wind. Tested new blue filtering algorithm on image detection.	Successful	26341 images captured. Joe successfully found
Total			**6:25:06**	**5:19:06**			

2.2 GPS Telemetry

A KML log of the first 35 minutes of the flight from 21/07/12 is shown below:



The full file is available from https://docs.google.com/open?id=0BxJBg_6KSZ5zTmo4NE5Xdm1YUmM. The file is in kmz format and is able to be opened in Google Earth.

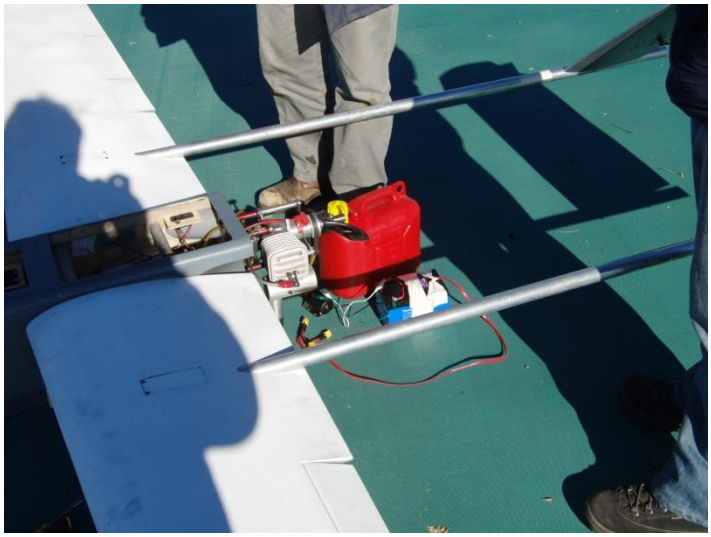
2.3 Video

A video showing the aircraft during autonomous flight and the operational ground station is available at http://youtu.be/8Ofaq-7kO3Y.

2.4 Static Images

The following are a set of static images showing the ground station, aircraft and team members during flight operations from a number of flights over the last 3 months.

	Pre-flight checks

	Pre-flight checks
	Fuelling the UAV before flight
	Starting the engine

	Taxiing to the runway for take-off
	Starting the takeoff run
	Takeoff

	The Ground Station during flight.
	The Ground Station during flight.

	During automated flight
	Removing the UAV from the runway after landing

3 RF Transmitters

3.1 2.4 GHz RC Link

This link is used for manual RC control of the UAV's throttle and flight control surfaces.

Specification	Value
Model	FrSky DJT 2.4 GHZ
Transmission Frequency	2400 – 2483.5 MHz
Transmitter Power	60 mW (17 dBm)
Transmitter antenna gain	< 5 dBi
Calculated EIRP	< 23 dBm
Covering licence	Radiocommunications (Low Interference Potential Devices) Class Licence 2000. Part 45A, 53, 54 "C-tick" No. N14939

3.2 900 MHz Telemetry Link

This is a low bandwidth link for transmitting telemetry from the UAV to Ground Station. Commands can be sent from the Ground Station to UAV when necessary. They have been calibrated and tested for LIPD-2000 (Part 52) compliance by RFDesigns RF lab in Brisbane.

Specification	Value
Model	RFD900 Telemetry Radio
Transmission Frequency	915 – 928 MHz, 50 Channel Hopping
Transmitter Power	27 dBm
Transmitter antenna gain	3 dBi
Calculated EIRP	30 dBm
Covering licence	Radiocommunications (Low Interference Potential Devices) Class Licence 2000. Part 52

3.3 5.8 GHz Image and Telemetry Link

This is a high bandwidth link for transmitting images from the UAV's on-board cameras to the Ground Station. As a backup, the telemetry and command datastream also uses this link.

Specification	Value
Model	Ubiquiti Bullet M5HP
Transmission Frequency	5750 MHz
Transmitter Power	25 dBm (UAV) 16 dBm (Ground)
Transmitter antenna gain	5 dBi (UAV) 20 dBi (Ground)
Calculated EIRP	30 dBm (UAV) 36 dBi (Ground)
Covering licence	Radiocommunications (Low Interference Potential Devices) Class Licence 2000. Part 45B, 55 "C-tick" No. N14691

4 Aircraft Specifications and Performance

The Aircraft platform used by Canberra UAV is a Mugin (donated by CyberTechnology P/L). It has the following specifications:

Specification	Value
Maximum Airspeed	100 kts (180 Km/h)
Cruise Airspeed	50 kts (90 Km/h)
Endurance at maximum airspeed	Estimated 30 minutes
Endurance at cruise airspeed	80 minutes
Maximum take off weight	22 Kg
Competition take off weight	18 Kg
Wingspan	3 m
Airframe length	2.5 m
Identifying marks	“08WA” on side of fuselage
Aircraft planform and configuration	Twin boom V-tail pusher aircraft