Object Following Drone
Test Plan

5/14/16

Revision 1.1

1. **INTRODUCTION**

   This is the Test Plan for Object Following Drone project. This plan will include items and elements that are going to be tested. The system will be tested to meet all the requirement criteria in Requirement Document.

   This Document will cover hardware and software test cases, functionalities and features.

2. **HARDWARE AND EQUIPMENTS**
   - Assembled drone
   - Edison with mini breakout board
   - Laptop
   - Tape Measure
   - Digital Multi-Meter (DMM)

3. **TEST ITEMS AND APPROACH**

   a. Unit/Module Test
   - Power: 14.8V battery, regulators: 5V and 9V
   - Image processing algorithm
   - Automation algorithm

   b. Installation Test
   - Mount the flight controller in the right orientation
   - Mount Edison on the drone
   - Mount regulator on the drone
   - Mount camera on the drone

   c. Environmental Test
   - Operate the drone in a cloudy day
   - Operate the drone in a sunny/clear day

   d. Stress Testing
   - Hover the drone 5ft above the ground until out of battery
   - Hover the drone 10ft above the ground until out of battery

   e. Functional Test
   - Initialize the drone – hovering
   - Walk from 10ft to 15ft mark away from the drone
   - Walk from 10ft to 20ft mark away from the drone
   - Walk from 10ft to 30ft mark away from the drone

4. TEST CASES

a. Unit Test

Test Writer: Hau Truong						
Test Case Name:		Object Following Drone Unit test #1			**Test ID#:**	Unit-T-01
Description:		Check system power, and voltages that are required to power different components on drone.			**Type:**	Black Box White Box
Tester Information						
Name of Tester:					**Date:**	
Hardware Ver:		OFD Rev1			**Time:**	
Setup:		The provided battery for drone is 14.8V rating, but it actually varies from 10V to 16V. Use battery to provide power to the drone. Use DMM to check the input voltage, and output voltages of 5V and 9V regulator.				
Step	**Action**	**Expected Result**	**Pass**	**Fail**	**N/A**	**Comments**
1	Power on the system	Flight Controller LED - ON, ESC LEDs - BLINKING				
2	Check input voltage	DMM shows voltages in range of 10V to 16V				
3	Check 5V regulator voltage	DMM shows voltages in range of 4.6V to 5.4V				
4	Check 9V regulator voltage	DMM shows voltages in range of 8.6V to 9.4V				
Overall test result:						

Test Writer: Hau Truong						
Test Case Name:		Object Following Drone Unit test #2			**Test ID#:**	Unit-T-02
Description:		Use image processing algorithm with a drone's camera to determine distance and velocity from camera to an object.			**Type:**	Black Box White Box
Tester Information						
Name of Tester:					**Date:**	
Hardware Ver:		N/A			**Time:**	
Setup:		Use tape measure to mark the distance from camera: 5ft away, 10ft away, 15ft away, 20ft away and 30ft on an open field. Have an object or a person stand at distance and use image processing algorithm to measure the distance from camera to object/person. Then, have a person walk away from camera and use image processing algorithm to measure the velocity				
Step	**Action**	**Expected Result**	**Pass**	**Fail**	**N/A**	**Comments**
1	Have a person/object at 5ft away from camera	Image processing algorithm outputs a distance of 5ft ± 10%				
2	Have a person/object at 10ft away from camera	Image processing algorithm outputs a distance of 10ft ± 10%				
3	Have a person/object at 15ft away from camera	Image processing algorithm outputs a distance of 15ft ± 10%				
4	Have a person/object at 20ft away from camera	Image processing algorithm outputs a distance of 20ft ± 10%				
5	Have a person/object at 30ft away from camera	Image processing algorithm outputs a distance of 30ft ± 10%				
6	Have a person/object move from 5ft to 15ft away from camera at walking speed	Image processing algorithm outputs a velocity of 1.1m/s ± 10%				
7	Have a person/object move from 5ft to 20ft away from camera at walking speed	Image processing algorithm outputs a velocity of 1.1m/s ± 10%				
8	Have a person/object move from 5ft to 30ft away from camera at walking speed	Image processing algorithm outputs a velocity of 1.1m/s ± 10%				
Overall test result:						

Test Writer: Hau Truong						
Test Case Name:		Object Following Drone Unit test #3			**Test ID#:**	Unit-T-03
Description:		Use automation algorithm, Edison with mini-breakout board to communicate and control the drone.			**Type:**	Black Box White Box
Tester Information						
Name of Tester:					**Date:**	
Hardware Ver:		OFD Rev1			**Time:**	
Setup:		Use tape measure to mark the distance from camera: 10ft away, 15ft away, 20ft away, 50ft away and 100ft away on an open field. The drone is assembled with Edison connected. Set the drone at 0ft mark facing direction of distance marks. Use laptop/computer to connect with Edison on the drone via wifi/Bluetooth.				
Step	**Action**	**Expected Result**	**Pass**	**Fail**	**N/A**	**Comments**
1	Send arm command	Arm LED (Blue color) is ON				
2	Send hover/throttle command with 7ft altitude	Drone hover 7ft ± 10% above the ground.				
3	Send move command to 10ft mark and back to starting position	Drone move to 10ft mark ± 10% and back to starting position				
4	Send move command to 20ft mark and back to starting position	Drone move to 20ft mark ± 10% and back to starting position				
5	Send move command to 50ft mark and back to starting position	Drone move to 50ft mark ± 10% and back to starting position				
6	Send move command to 100ft mark and back to starting position	Drone move to 100ft mark ± 10% and back to starting position				
Overall test result:						

b. Installation Test

Test Writer: Hau Truong						
Test Case Name:		Object Following Drone Installation Test #1			**Test ID#:**	INSTALL-T-01
Description:		Assemble drone kits, flight controller, Edison and make all of the connections (power, motors, TX/RX). Use Multiwii software and documentation to verify results			**Type:**	Black Box White Box
Tester Information						
Name of Tester:					**Date:**	
Hardware Ver:		OFD Rev1			**Time:**	
Setup:		Parts needed: Drone frame kit, Drone battery, flight controller, Edison and female to female wire jumpers. Software needed: Multiwii configuration.				
Step	**Action**	**Expected Result**	**Pass**	**Fail**	**N/A**	**Comments**
1	Mount flight controller on the drone body with the front of flight controller and front of drone facing the same direction.	Micro USB port side is the head of the drone. Multiwii configuration responds proportionally to drone when being tilted left and right, front and back.				
2	Mount Edison, 9V regulator and battery.	Edison is accessible and close to flight controller for wiring. Battery is close to input power connector.				
3	Connect power to drone	Flight Controller LED lights up				
4	Make appropriate connection from ECSs to flight controller.	Each LED ON when connected. D3 – Front Left D9 – Back Right D10 – Front Right D11 – Back Left				
5	Make connection TX/RX from Edison to Flight Controller	TX and RX are connected as labelled on the Flight controller and Edison				
6	Make connection from 9V regulator output to Edison.	Mini-breakout board LED lights up.				
7	Disconnect power from drone	All LEDs are off.				
8	Mount propeller in right orientation.	D3 and D9 – Clockwise Orientation D10 and D11 – Counterclockwise Orientation.				
Overall test result:						

c. Environmental Test

Test Writer: Hau Truong						
Test Case Name:		Object Following Drone Environmental Test #1			**Test ID#:**	E-T-01
Description:		Check functionalities of systems under different conditions.			**Type:**	Black Box White Box
Tester Information						
Name of Tester:					**Date:**	
Hardware Ver:		OFD Rev1			**Time:**	
Setup:		Setup Unit in open field.				
Step	**Action**	**Expected Result**	**Pass**	**Fail**	**N/A**	**Comments**
1	Operate Unit in clear sky/sunny day	Unit functional as normal and follow the object				
2	Operate Unit in cloudy day	Unit functional as normal and follow the object				
Overall test result:						

d. Stress Test

Test Writer: Hau Truong						
Test Case Name:		Object Following Stress Test #1			**Test ID#:**	S-T-01
Description:		Check overall system power and how long the battery lasts			**Type:**	Black Box White Box
Tester Information						
Name of Tester:					**Date:**	
Hardware Ver:		OFD Rev1			**Time:**	
Setup:		Setup Unit in open field.				
Step	**Action**	**Expected Result**	**Pass**	**Fail**	**N/A**	**Comments**
1	Initialize Unit	Unit is ready to fly				
2	Command Unit to hover 5ft above the ground	Unit hover 5ft above the ground				
3	Run for 20 minutes	Unit still hover 5ft above the ground.				
Overall test result:						

e. Functional Test

Test Writer: Hau Truong						
Test Case Name:		Object Following Drone Test #1			**Test ID#:**	FUNC-T-01
Description:		Check the expected outputs (following an object) corresponding to the inputs (upload image)			**Type:**	Black Box White Box
Tester Information						
Name of Tester:					**Date:**	
Hardware Ver:		OFD Rev1			**Time:**	
Setup:		Setup a drone in an open field with camera facing direction of object moving. Communication between laptop and drone. Tape measure is used to measure distance from drone to object.				
Step	**Action**	**Expected Result**	**Pass**	**Fail**	**N/A**	**Comments**
1	Initialize drone	Drone hover at object/person height				
2	Initialize target	Target LED - ON				
3	Object/person moves 10ft away from drone on a straight line	Tape measure shows distance from drone to object is 10ft ± 10%				
4	Object/person moves 20ft away from drone on a straight line	Tape measure shows distance from drone to object is 20ft ± 10%				
5	Object/person moves 50ft away from drone on a straight line	Tape measure shows distance from drone to object is 50ft ± 10%				
6	Object/person moves 100ft away from drone on a straight line	Tape measure shows distance from drone to object is 100ft ± 10%				Reinitialize (step 1 and 2) might be needed if the field is not big enough.
Overall test result:						