Component	Functional Purpose	Failure Mode*	Failure Effect	Failure Cause	Current Situation				Assigned Action	Improved Situation			
					S	L	D	RPN		S	L	D	RPN
RC Reciver	Communicate Manual Commands from the RC Transmittor to F4	Hardware Failure*	Mission Failure Aircraft Loiters	Poorly Connected Electrical Joint	8	1	7	56		8	1	7	56
		Transmits incorrect data	Crash	Internal Code	9	1	10	90	Extensive testing prior to use**	9	1	10	90
		Loss of Connection	Mission Failure Aircraft Loiters	Interference	8	4	9	288	FFCL*** range test	8	4	3	96
RC Transmittor	Communicate Commands from the RC Pilot to the RC Reciver	Hardware Failure	Mission Failure Aircraft Loiters	Poorly Connected Electrical Joint	8	2	7	112	FFCL	8	2	3	48
		Transmits incorrect data	Crash	Settings Incorrect	9	2	6	108	FFCL	9	1	4	36
		Loss of Connection	Mission Failure Aircraft Loiters	Settings Incorrect	8	6	8	384	FFCL	8	4	3	96
				Interference	8	4	9	288	FFCL, and laboratory debugging	8	6	3	144
				Transmittor Battery Dead	8	6	3	144	FFCL	8	4	2	64
WIFI antenna	Allow communitation with grounstation over ROS network	Hardware Failure	Mission Failure Manual Landing	Poorly Connected Electrical Joint	6	1	7	42		6	1	7	42
		Loss of Connection	Mission Failure Manual Landing	Antenna Incorrectly Pointed	6	7	3	126	Assign someone to point antenna	6	3	3	54
Odroid	Run ROS, generate high level commands, process images, & estimate state	Hardware failure	Mission Failure Manual Landing	Poorly Connected Electrical Joint	6	2	7	84		6	2	7	84
			Crash	Poorly Connected Electrical Joint	9	1	7	63	Extensive testing prior to use	9	1	3	27
F4 Flight Computer & Mount	Turn high level (Odroid & RC) commands into low level servo commands	Software Failure	Crash	Internal Code	9	3	6	162	Extensive testing prior to use	9	3	3	81
		Hardware Failure	Crash	Poorly Connected Electrical Joint	9	3	7	189	Extensive testing prior to use	9	3	3	81
Airspeed Sensor	Measure Va	Software Failure	Flight Less Smooth	Internal Code	4	1	10	40		4	1	10	40
		Inaccurate Readings	Flight Less Smooth	Plugged Pito Tube	4	4	5	80		4	4	5	80
				High Angle of Attack	4	4	2	32		4	4	2	32
				Incorrect Mounting	4	2	2	16		4	2	2	16
		Hardware Failure	Flight Less Smooth	Poorly Connected Electrical Joint	4	1	7	28		4	1	7	28
Inertial Sense	Measure acceleration, barometter data, and magnetic heading	Software Failure	Crash	Internal Code	9	1	10	90	Extensive testing prior to use	9	1	3	27
		Inaccurate Readings	Crash	Interference	9	3	8	216	Extensive testing prior to use	9	3	3	81
		Hardware Failure	Crash	Poorly Connected Electrical Joint	9	1	7	63	Extensive testing prior to use	9	1	3	27
GPS	Measure global position	Software Failure	Crash	Internal Code	9	3	10	270	Extensive testing prior to use	9	3	3	81
		Inaccurate Readings	Crash	Interference	9	4	5	180	FFCL	9	2	4	72
		Hardware Failure	Mission Failure Manual Landing	Poorly Connected Electrical Joint	6	1	7	42		6	1	7	42
Battery	Provide current to all systems in the air	Loss of Power	Crash	Battery Not Charged Correctly	9	5	3	135	FFCL	9	5	2	90
				Chemical Misshap	10	2	3	60	Assign battery saftey officer	10	1	2	20
				Battery Degridation	9	1	1	9	FFCL	9	1	1	9
ESCs	BEC and convert digital logic PWM to high voltage/current motor inputs	Hardware Failure	Crash	Poorly Connected Electrical Joint	9	1	7	63	Extensive testing prior to use	9	1	3	27
Motors	Rotate Props	Overheat	Fire and Crash	Overstressing the Motors	10	3	5	150	Add warning to FFCL	10	2	5	100
		Does Not Transmit Tourque	Mission Failure Glide to Safe Landing	Props Unsecured	7	8	3	168	FFCL	7	5	2	70
		Rotates the Wrong Way	Mission Does Not Start	Wires Connected Backwards	6	3	2	36	FFCL	6	1	2	12
		Hardware Failure	Mission Failure Glide to Safe Landing	Poorly Connected Electrical Joint	7	1	7	49		7	1	7	49
Props	Provide Thrust	Does Not Provide Thrust	Mission Failure Glide to Safe Landing	Chipped/broken prop	7	5	3	105		7	5	3	105
Wiring	Transmit power and signals	Provides Electricty to Incorrect Location	Crash	Wires Connected to Incorrect Ports	9	7	8	504	FFCL	9	3	3	81
		Does Not Transmit Electricity	Crash	Electrical Short Circuit	9	3	8	216	Shrink wrap all exposed wires	9	1	8	72
			Crash	Electrical Open Circuit	9	8	5	360	FFCL	9	8	1	72
Servos	Move control surfaces	Linkage Breaks	Crash	Poorly Assembled	9	2	7	126	Extensive testing prior to use	9	2	5	90
				Large Controll Inputs at High Velocity	9	1	3	27	Train saftey pilot	9	1	3	27
		Mechanical Limits Exceeded	Crash	Aerobatic Flight Saturates Controller	9	5	8	360	Train saftey pilot	9	1	4	36
				Poorly Assembled	9	6	4	216	Extensive testing prior to use	9	2	4	72
		Software Failure	Crash	Internal Code	9	1	10	90	Extensive testing prior to use	9	1	3	27
		Hardware Failure	Crash	Poorly Connected Electrical Joint	9	1	7	63	Extensive testing prior to use	9	1	3	27
		Internal Mechanics Broken	Crash	Overuse	9	2	5	90		9	2	5	90
		Servo Burns Out	Crash	Overuse	9	2	5	90		9	2	5	90
UGV System	Deliver water bottle to both ground locations	See UGV Documentation for UGV FMEA											
Imaging System	Capture, interperate, and report ground targets	See Imaging Documentation for Imaging FMEA											
Control Software	Pilot aircraft autonomusly	See Control Documentation for Control FMEA											
Communication Software	Allow communication of all components	See Communication Documentation for Communication FMEA											
Airframe Body	Contain components, provide lift, provide stability, & respond to control inputs	Flight Characteristics Change	Crash	Icing	9	2	1	18	Only fly in good weather	9	1	1	9
				Components Move	9	5	5	225	Strap down all components	9	3	3	81
		Parts Break Off	Crash	Flight Envelop Exceeded	9	2	3	54	Train saftey pilot	9	2	2	36
				Poor Manufacturing	9	6	7	378	Extensive testing prior to use	9	6	2	108
				Part poorly attached	9	2	7	126	FFCL	9	2	3	54
				Unidentified Flying Object (UFO) Impact	9	1	3	27	Train saftey pilot	9	1	3	27
Ground stations	Transmit high level commands between operators and WIFI router	Battery Dies	Mission Failure Manual Landing	Charger Not Connected	6	1	1	6		6	1	1	6
		Hardware Failure	Mission Failure Manual Landing	Poorly Connected Electrical Joint	6	1	7	42		6	1	7	42
		Software Failure	Crash	Bug in Code	9	7	10	630	Extensive testing prior to use	9	4	3	108
WIFI Router	Trasmit data over ROS network between groundstations to light beam	Loss of Connection	Mission Failure Manual Landing	Interference	6	2	7	84		6	2	7	84
		Hardware Failure	Mission Failure Manual Landing	Poorly Connected Electrical Joint	6	1	7	42		6	1	7	42
		Software Failure	Mission Failure Manual Landing	Internal Code	6	1	10	60		6	1	10	60
WIFI Light Beam	Transmit data over ROS network between WIFI router and the WIFI antenna on the aircraft	Loss of Connection	Mission Failure Manual Landing	Interference	6	8	7	336	Laboratory debugging	6	5	7	210
		Hardware Failure	Mission Failure Manual Landing	Poorly Connected Electrical Joint	6	1	7	42		6	1	7	42
		Software Failure	Mission Failure Manual Landing	Internal Code	6	1	10	60		6	1	10	60
Ground Power Source	Provide current to all ground systems	Not Brought with Us	Mission Does Not Start	Poor Planning	4	8	4	128	FFCL	4	4	4	64
		Mechanical Failure	Mission Failure Manual Landing	Poor Manufacturing	6	1	7	42		6	1	7	42
Human Operators	Give high level commands & ensure saftey of flight	Sick	Mission Does Not Start	Bacteria or Viruses	5	4	3	60		5	4	3	60
		Can Not Attend	Mission Does Not Start	Other Plans	5	1	1	5		5	1	1	5
		Sends Incorrect Commands	Crash	Poor Judgement	9	2	9	162	Extensive practice	9	1	9	81
			Crash	Poor Understanding of System	9	2	5	90	Extensive practice	9	1	5	45

* In this analysis "Hardware Failure" refers only to electrical hardware (e.g. USB port breaks or soldering fails)

** FFCL is the Field Flight Checklist to which we will add items to test and do before flight

*** Extensive testing before use refers to extensive flight tests before the competition.
We currently perform flight tests a couple times a week.

S: Severity of failure effect

L: Likelihood of failure occurring

D: Dectability of cause before failure occurs

RPN: Risk Priority number (S*L*D)