FAMU/FSU College of Engineering

Department of Electrical and Computer Engineering
Sponsor: Northrop Grumman

<u>Targets</u>

Team # 302 – Design/Prototype a Multi-Platform Broadband Communication Payload for a Search and Rescue Operation

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Targets by Function/Need

Detection of Emergency Signal:

Metric: Signal should be detected, at minimum, –20 dBm.

Method of Derivation: RF signal detectors can be found on RF-Lambda.com with the lowest detection power being the listed metric.

Method of Validation: RF detectors all have a power detection rating. To test, signal power of outbound signal would have to be measured and then the receiver should be moved away until signal power is no longer detected.

Support of FPGA Code

Metric: Upon boot, code should be operational.

Method of Derivation: If the code is functional, it should boot 100% of the time without fault.

Method of Validation: Booting the FPGA with code loaded onto it.

Independent Battery Source

Metric: Should have at least 50 minutes of battery life.

Method of Derivation: Total battery life of the drone is 50 minutes. Payload should be able to sustain functionality throughout flight time.

Method of Validation: The payload should be connected to the battery and left running while timed.

Internal Storage (Memory)

Metric: Storage space should be at least 256MB.

Method of Derivation: Micro SD cards are affordable and lightweight. Most micro-SDs are also well over 256MB of storage. This is the bear minimum.

Method of Validation: Storage does not need to be validated as it is finite.

Modularity

Metric: Components should be able to be changed within 30 seconds.

Method of Derivation: If proper modularity is achieved, parts should be able to be unplugged and reconnected very quickly.

Method of Validation: Components should be changed and timed during the process.

Location Detection via GPS

Metric: Location of the drone should be accurate to 10m.

Method of Derivation: Most FPGA compatible GPS modules have accuracy out to around 10m.

Method of Validation: GPS should be turned on and the location displayed compared against actual location.

Storage of Data

Metric: Data should be written to txt files stored on memory

Method of Derivation: All data must be stored somewhere. Therefore, all data must be written to the storage.

Method of Validation: Data output should be observed with resultant file being able to be accessed.

Weight

Metric: Payload should not weigh more than 5 kg.

Method of Derivation: This comes directly from the sponsor.

Method of Validation: All constituent parts should be weighed separately first and then weighed assembled.

Cost

Metric: Payload components should not total more than $20k.

Method of Derivation: Directly from the sponsor.

Method of Validation: All financial records are bookkept and will be on hand.

Water-resistant

Metric: Payload should be able to sustain 50 minutes of flight near sea level.

Method of Derivation: Directly from the sponsor.

Method of Validation: Waterproofing will be tested by misting the housing for 10 minutes and observing the interior of said housing.

High-Heritage Parts

Metric: Manufacturer of parts should have at least 10 years of experience developing parts in aerospace field.

Method of Derivation: The definition of high heritage is proven capability in the field. Therefore, a reasonable amount of time for a manufacturer to have proven that is 20 years.

Method of Validation: Manufacturer history should be checked thoroughly before any part is selected and purchased.

Discussion of Measurements and Critical Targets

For many of the targets, there will won't be any tools needed to the validation. Instead, the validation will automatically be checked by selecting a product that meets the target. I.e., finding an SD card that can store minimum 256MB or a signal receiver with minimum -20dBm. For other targets such as flight time or payload weight, the appropriate tool to measure whether the target has been met will be used. For example, a stopwatch or scale. A laptop will be used for targets such as detection of emergency signal, support of FPGA code, and storage of data.

There are several critical targets which, if not met, will cause immediate failure of the project. Those are: detection of emergency signal, support of FPGA code, weight, storage of data, and location detection using GPS. These targets must be met or ideally exceeded to ensure success of the project. Refer to the above for the metrics of each.

Target Summary

Most of the targets are derived from the functions of the payload while three other targets are not derived from the functions. The targets related to the functions are detection of emergency signal, support of FPGA code, independent power source, internal storage, modularity, location detection via GPS, storage of data, and weight. The three targets not associated with functions are cost, waterproof, and high-heritage parts. The targets were all derived by what the team expects each function from the function tree should be able to perform and meet the customer needs. The path of measuring the targets were determined per situation and can be adjusted if needed. Overall, all targets are intended to help assess if the design will meet the needs given by the customer and requirements to successfully perform the emergency scenario.

Number	Target
1	Emergency signal detection (at minimum 20dB)
2	Support of FPGA code (can support algorithm given by Northrop Grumman)
3	Independent battery source (Payload will have a battery life that will outlast the drone, approximately 1 hr+)
4	Internal storage memory (Has at least 256 MB of space)
5	Modularity (Should be able to easily mount and dismount)
6	Location Detection via GPS (Aim to have an accuracy within 10m)
7	Storage of Data (Should be able to write data to txt files)
8	Weight (Payload should not weigh more than 5 kg)
9	Cost (Payload components should not total more than $20k)
10	Water-resistant (Payload should be able to sustain 50 minutes of flight near sea level)
11	High Heritage Parts (All parts will have high heritage which will be proven by manufacture)

Appendix

Metric No.	Need	Metric	Importance (1 = Most Important)	Units	Marginal Value	Ideal Value
1	1	Signal should be detected, at minimum, –20 dBm.	1	dBm	-20dBm	N/A
2	6	Upon boot, code should be operational.	1	N/A	N/A	N/A
3	3	Should have at least 50 minutes of battery life.	2	min	10 min	30 min
4	1	Storage space should be at least 256MB.	3	GB	256GB	1GB
5	7	Components should be able to be changed within 30 seconds.	3	sec	30 sec	20 sec
6	1	Location of the drone should be accurate to 10m	2	m	10m	6m
7	1	Data should be written to txt files stored on memory	3	N/A	N/A	N/A
8	4	Payload should not weigh more than 5 kg	1	kg	5kg	3kg
9	1	Payload components should not total more than $20k	1	Dollars	$20k	$15k
10	7	Payload should be able to sustain 10 minutes of flight near sea level	2	min	10min	30min
11	5	Manufacturer of parts should have at least 10 years of experience developing parts in aerospace field.	2	yrs	10yrs	20yrs

Reference

https://rflambda.com/search_powerdetector.jsp?gclid=Cj0KCQjwnP-ZBhDiARIsAH3FSRdejaLxnwrkcdHv5dTtISvRcp-i5oG3FY0pBuAK37XVI82hxmybhDAaAjZaEALw_wcB