Copee Co.

Cerberus and Hound Drones

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Mission Statement

The mission of Copee Drones is to provide security and safety to people worldwide to enable everyone to feel safer in their homes or outdoors. The company's customer-oriented mission is stated in our corporate promise:

- Offer a diverse drone, from simple to high-end, at competitively low prices.
- Provide excellent customer service through friendly and knowledgeable customer support specialist.
- Provide sufficient replacements, repairs, and refunds for any dissatisfied customers

Objective

Copee Drones primary objective is to be a competitive player in the drone manufacturing and security market. Currently, the majority of sales traffic comes from Nightingale Security and Boeing. As research on the drone market has suggested, drones as a whole are going to explode into the market. Being that we already have a solid base in manufacturing drones, and security becoming a larger issue for people of this day and age, now would be the time to invest into the security drone market. This expansion into the new market will enable Copee to realize substantial sales growth over the next five years so that it can achieve specific financial objectives:

- Increase potential client base from thousands to millions by increasing exposure from basic consumer drones to the security market
- Increase sales revenue, margins and profitability
- Break even by the end of year one, and increase profitability every year for the next four years

Company Information

Copee Drones started at UCSC in 2010 when a group of seven students met to come up with a project idea. Starting with basic consumer drones sold over the Internet, Copee developed it's customer base and built themselves as a company. After five years Copee was able to acquire partnerships allowing their drones to compete with some of the largest manufacturers in the drone industry.

The newly developed headquarters, as well as the manufacturing plant and e-commerce division employ a total of 216 employees.

Growth Highlights

Over the past five years, Copee Drones has grown from a small start-up to a large scale drone manufacturer with an average increase in revenue of 28% each year. In 2016, Copee grossed $520M from online sales alone, in addition to acquiring partnerships with Intel and other large companies to equipe our drones with the highest quality specifications.

Products

Copee provides a wide range of drones, from a high-end cinemagraphic drone, to a Do-It-Yourself kit, as well as customizable and upgradeable parts. Overall Copee Drones meets the following drone consumer needs:

- Racing drones
- Cinemagraphic drones
- Casual user drones
- Small form-factor drones
- Customization

Content and Connections

The purpose of this report is to provide information for the management, development, and commercialization of our new product platform, The Customizable Drone, all in a clear, concise, and structured format. Figure (I) (see next page) shows each component of the report and also how different components are related to each other

Management

Firm-Level Strategy: Our map of the industry-market landscape showed us a small amount of competitors in the commercial-use drone space. The hobbyist drone space, however, has many successful Chinese companies, including DJI, which is the industry leader. A representation of the industry-market landscape for the technology/product, the overall competitive strategy, technology strategy, and market strategy

Business Goals: Our business goals and objectives

- Influenced by the Functional Maps and Product Architecture/Product Strategy

Developmental Goals: Our overall development goals which are aligned with our business goals, competitive strategy, technology strategy, and market strategy

Functional Maps: Time-based evolutionary maps for engineering, manufacturing, and marketing

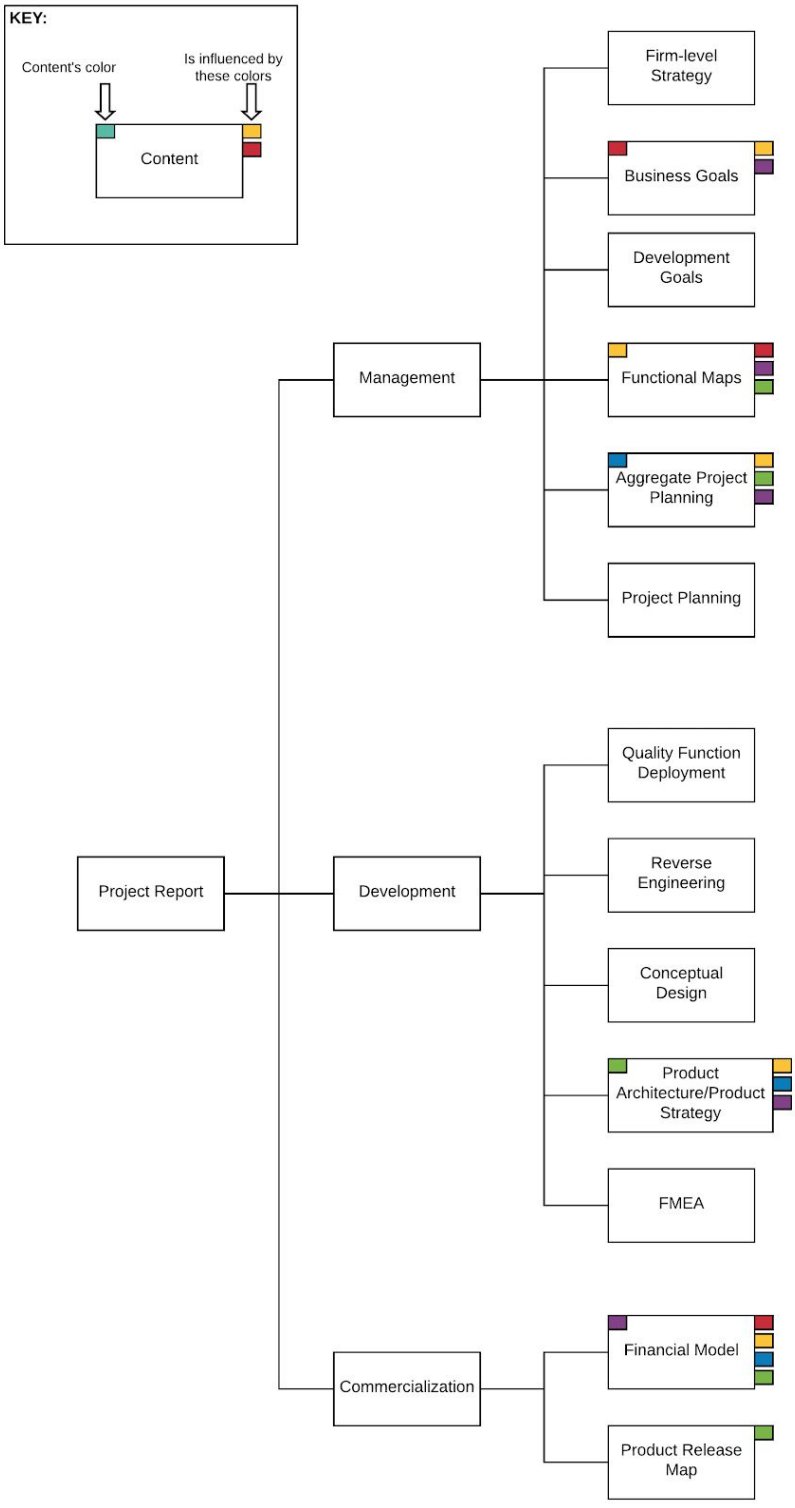
- Influenced by Business Goals, Financial Model, and Product Architecture/Product Strategy

Aggregate Project Plan: Probabilistic decision analysis to develop an initial mix of products to be developed. Risk analysis to select products for further development

- Influenced by Functional Maps and Financial Model

Project Planning: Establish a cross-functional team for each technology/product development project. Project plan developed using the Activity matrix, GANTT, PERT, and CPM charts

Figure (I):


KEY:
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Content
Project Report
Management
Development
Commercialization
Firm-level Strategy
Business Goals
Development Goals
Functional Maps
Aggregate Project Planning
Project Planning
Quality Function Deployment
Reverse Engineering
Conceptual Design
Product Architecture/Product Strategy
FMEA
Financial Model
Product Release Map

Development

Quality Function Deployment: A comprehensive House of Quality (HOQ) correlating customer needs and technical specifications

Reverse Engineering: Dissection of existing products which are similar to the proposed new product using Function Analysis Systems Technique (FAST)

Conceptual Design: A process to create a feasible concept. This includes a Function Structure (FS), morphological matrix (MM), multiple design concepts, and a utility function to rank and select 1-2 feasible concepts

Product Architecture/Product Strategy: The technology platform and product platform. Within the platform, different product lines to serve different target markets

- Influenced by Functional Maps, Aggregate Project Plan, and Financial Model

FMEA: Failure modes for each subsystem of the product with an effects analysis calculating the Risk Priority Number and steps to improve any systems with an RPN above 10

Commercialization

Financial Model: A base-case Net Present Value (NPV) financial model to determine expected profits from the product development products. In addition, sensitivity analyses for each appropriate cash flow

- Influenced by Business Goals, Functional Maps, Aggregate Project Plan, and Product Architecture/Product Strategy

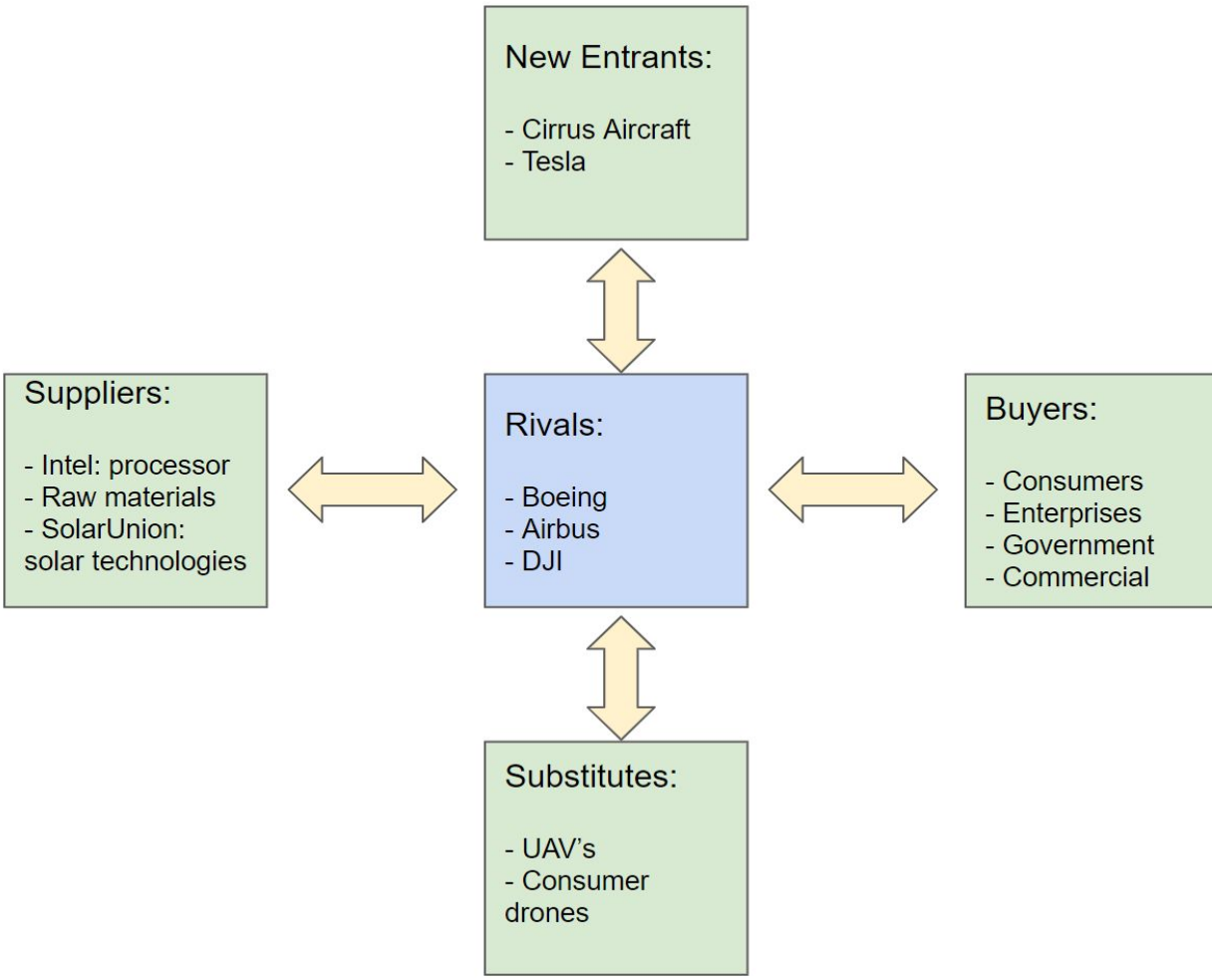
Product Release Map: A time-based diagram to map product releases

- Influenced by Product Architecture/Product Strategy

Section 1: Management

1.1 Firm Level Strategy

Our firm-level strategy began with researching Boeing and the rest of the Drone industry and marketplace. The largest competitor for us was DJI, who own the market share for small-scale drones. Other small companies like Yuneeq and Airbus develop drones with commercial uses in mind. We moved onto analyzing the entire company to get an idea of how other firms were handling business, and whether it would be worthwhile (profitable) to enter this market landscape.



Porter five-forces industry map

Forces	Analysis	Force power
F1: Competitors	Certain areas of the drone industry have intense competition, the military sphere is dominated by those who focus on weapons or are government branches/defense contractors. Outside of military applications, there is plenty of variety in drone usage we can focus on in order to grab a foothold and fulfill a particular niche.	Medium
F2: New Entrants	New technological innovations allow for additional niches to be fulfilled by new drone technology. Relatively low start up costs and access to technology. These include Yuneeq, Nightingale, and other companies that specialize in a particular kind of drone.	High
F3: Substitution Threat	There is the threat of the possibility of people going back to what drone technology may have replaced. For S&R purpose, this includes substituting our product with a full-scale, manually-piloted helicopter.	Medium
F4: Supplier Power	Most of our competitors are based in China and have access to China's vast, high-quantity industrial market. These companies source their own equipment from Chinese companies, meaning there are fewer drone part suppliers in America and in China that aren't exclusively beholden to our competitors.	Medium
F5: Buyer Power	Market is structured in a way that drone suppliers create products that are made for a budget or highly priced for enthusiasts. There are also various focuses one could create a drone for such as for surveillance or for recreation. Thus bargaining power is reduced	Low

Overall, the industry has a medium attractiveness. There are not too many competitors, but there are other forces, including the threat of new entrants due to the attractiveness of the market. We do expect to be able to make significant profits from entering this market.

Competitive Strategy:

The competitive strategy is to use utilitarian drones to target a wider audience than hobby photographers. Most current drone companies hit only small sections of the market -- this includes "utility" drone providers like Yuneec whose drones are effective for Search and Rescue, but ineffective for most other purposes. We can develop a drone that appeals to more consumers, which will cut our development and manufacturing costs and drive better profit margins.

Technology Strategy:

The technology strategy is to come up with a way to meet our competitive strategy. This means developing a drone that hits more parts of the market - ideally, a customizable drone. The drone would be able to attach various cameras, equipment, and optics for a variety of missions. Our idea includes automating and streamlining the drone deployment process, which means our company will develop docking stations for drones to recharge outdoors, shielded from the elements.

Our core technological advantages:

- An attachment mount/Clip to allow for quick and secure attachment of customizable parts, including HD cameras, infrared cameras, supplies, lights, and more.
- Advanced state of the art docking station and smart AI for drones built specifically for the purposes of security and search and rescue.

Product/Market Strategy:

What differentiates our products from our competitors is our products are reliable, and they provide the highest level of security, quality of service, and product customization to the customers

Copee serves Enterprises, Commercial, and Consumers alike. We recognize the possibility of contracting with US natural park services at both the federal and state level once our customizable have special search and rescue capabilities.

1.2 Business Goals

Our goal is to hit a competitive double-digit revenue growth yearly. This will appeal to our investors and employees who want stock options. The release of the new drone platform will drive this revenue growth.
The company with the biggest market share is DJI, with a whopping 70% of the consumer

market. Our goal is to grab a similar share of the commercial drone market, while gaining ground in the consumer market as well. The commercial drone market is forecasted to be $16bn in 2030. Our goal is to hit at least $1bn, or 6% of that market.

- Year 1:
    - Annual Sales Revenue: $500M
    - Growth: 10.2%
    - Profit: $50M
    - Profit Margin: (Profit/Sales revenue)x100 = (50/500)x100 = 10%
- Year 5:
    - Annual Sales Revenue: $732M (10% growth/year)
    - Growth: 10.7%
    - Profit: $73.2M
    - Profit Margin: (Profit/Sales revenue)x100 = (73.2M/723M)x100 = 10%
- Year 10:
    - Annual Sales Revenue: $1B
    - Growth: 10.3%
    - Profit: $100M
    - Profit Margin: (Profit/Sales revenue)x100 = (100M/1B)x100 = 10%

1.3 Developmental Goals

The overall developmental goals are to create products in markets that are ripe for profits. By targeting a growing field (commercial drones) with a competitive strategy (drones with wider applications) we should be able to grow this product line significantly.

Create innovative new products

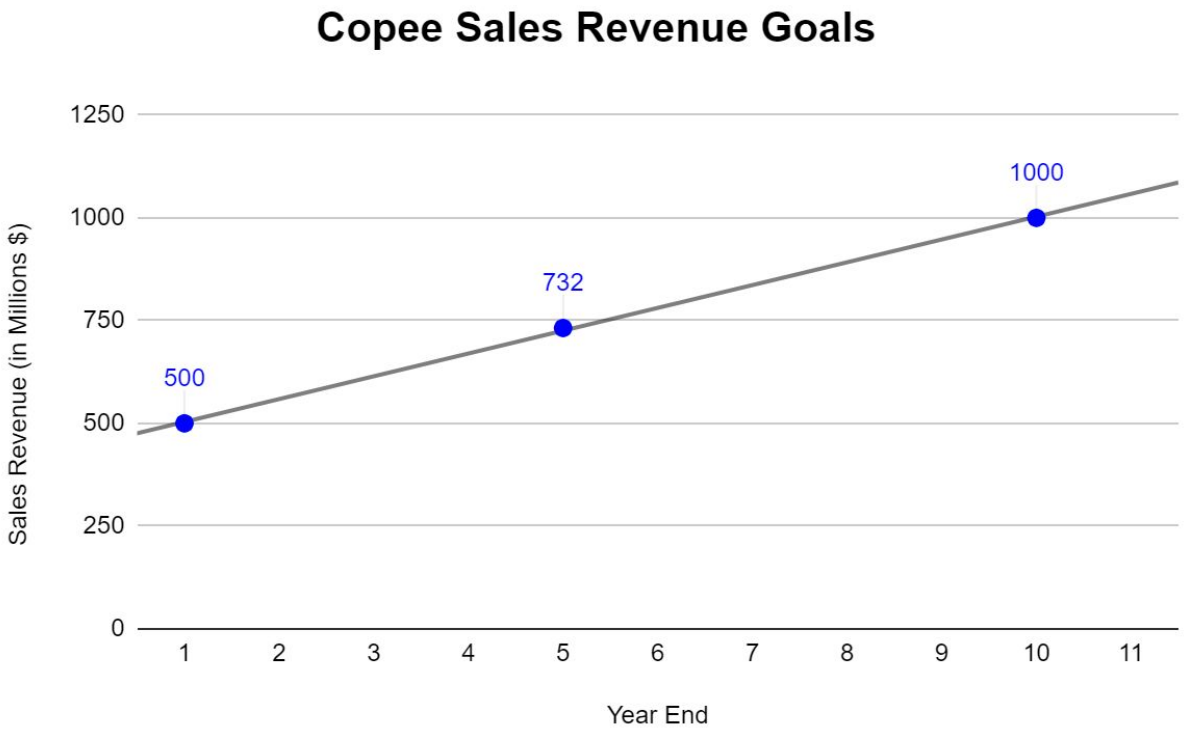
- *Charging Dock*: A dock allowing the drone to land and charge itself. This will be done through solar energy as to promote environmental awareness will also create a worry free environment for the customer.
- *Smart AI*: An AI that can learn and capture its surroundings. Allowing the drone to learn what the "normal" surroundings should be and act accordingly should there be a disturbance.

Be the best-in-show company for the industry

- *Premium Customer Service*: A superior customer service allowing customers to receive help should something occur allowing for the minimal amount of time for the product to be non operation.

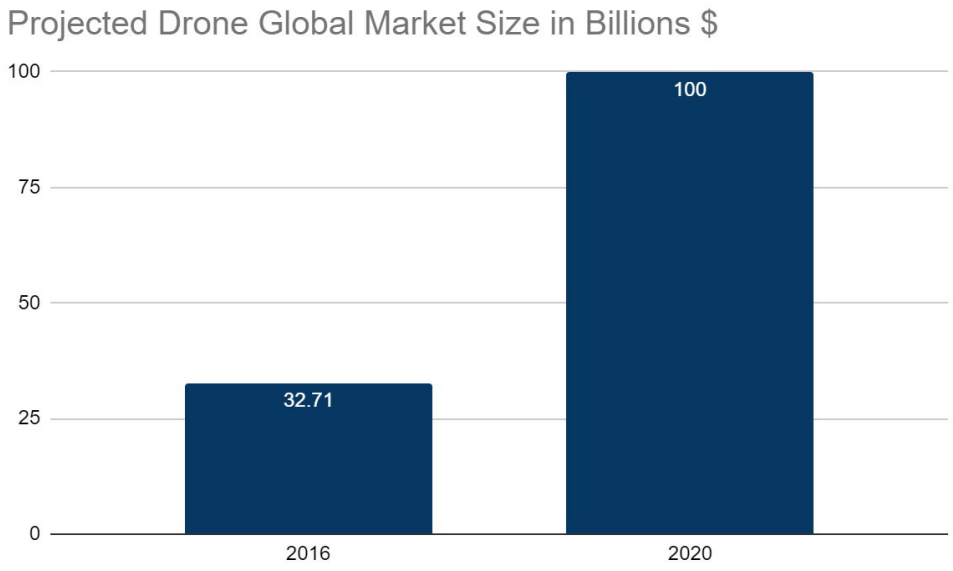
- *Target Price*: lots of variation as there is a lot of customization to each customers drone based on needs. Base price for Drone: $5k

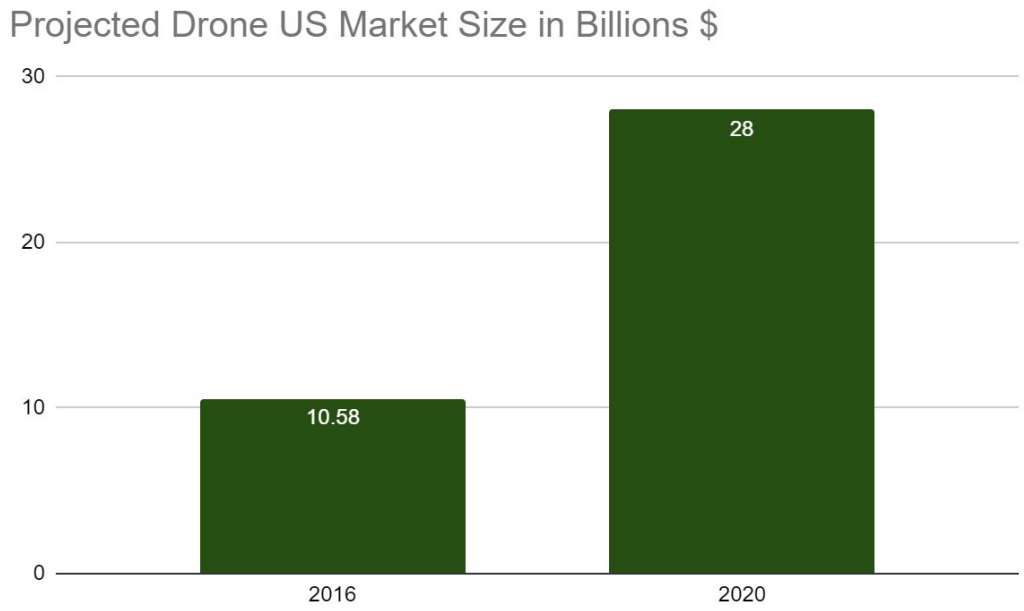
1.4 Functional Maps



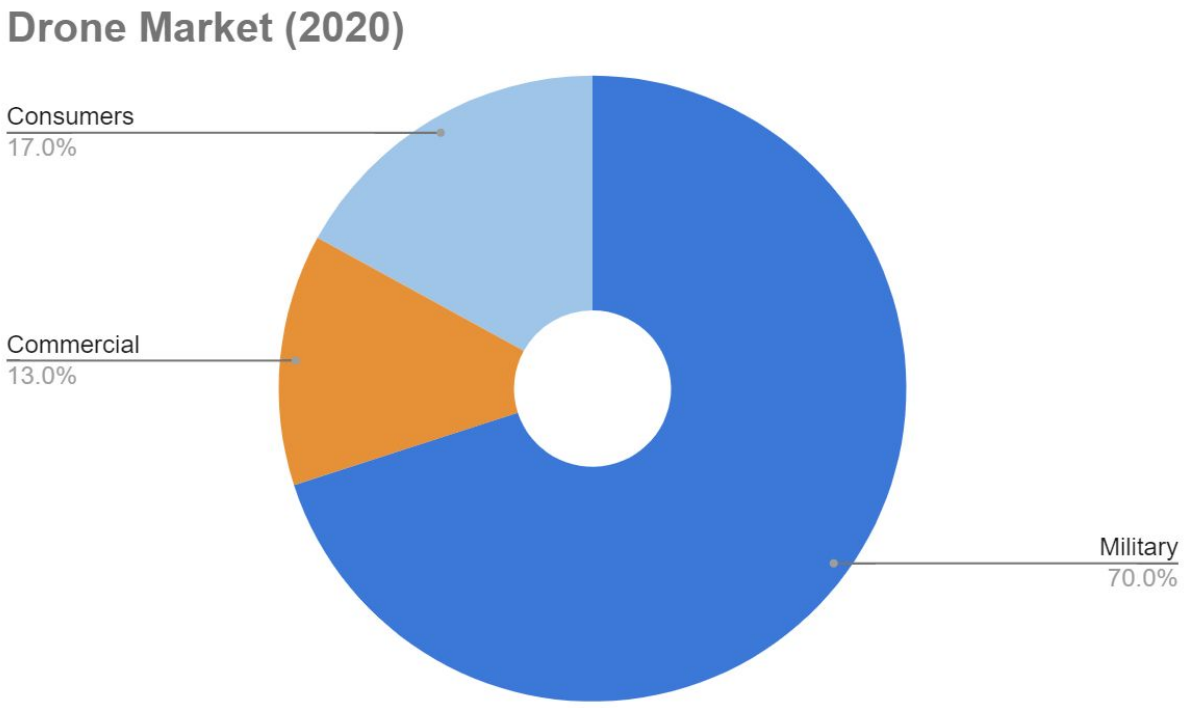
Sales Revenue Goals:

- End of year 1: $500 million
- End of year 5: $732 million
- End of year 10: $1 billion





- The Global Drone Market is expected to triple in size by 2024, and the North American market is expected to grow almost twice in size
- This provides an exciting opportunity to develop a new line of products to increase Copee's market share



Revenue Map
Total Market Size $100 billion (2020)

Market Share (%)	Market share (billions $)					
70%	4.06	**Military**	$10B	$40B	$20B	-
17%	0.986	**Commercial**	$4B	$6B	$2B	$1
13%	0.754	**Consumer**	$10B	$4B	$2.5B	$0.5
			Custom Drones	**Surveillance**	**Mapping**	**Cinematography**

Source for financial data:
https://www.goldmansachs.com/insights/technology-driving-innovation/drones/

1.5 Aggregate Project Plan

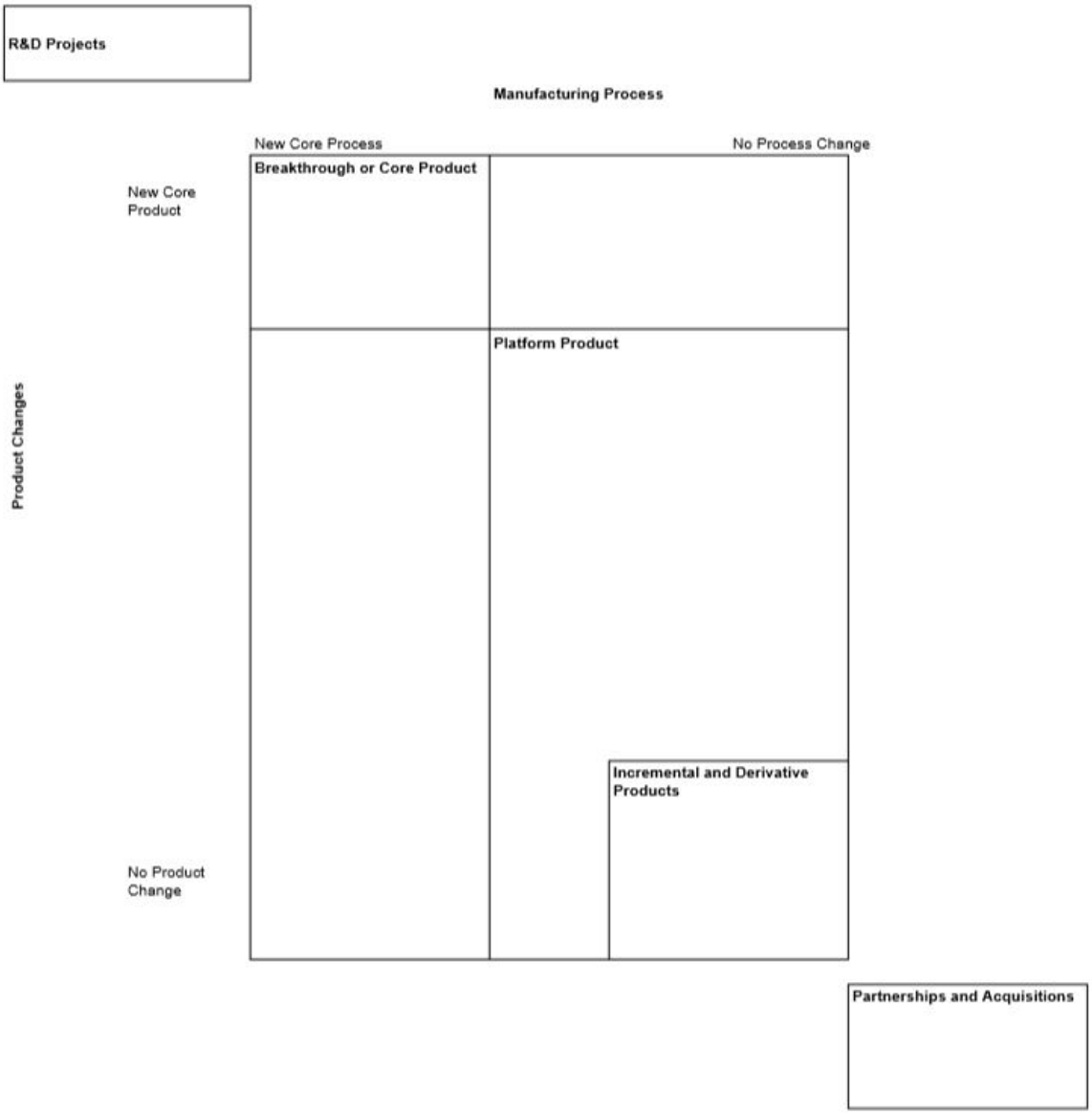
Several projects were viable for our company. The problem of "letting people see from above" fit in to other areas than just search and rescue. For example, the security drone market is growing every year. We also tried another idea, the concept of customizable drones, where the user could choose what attachments he wants to put on his drone. This allows people to use the drone for multiple purposes, and secures contracts.

Each project had its merit. The search and rescue drone would be great for large contract deals. The US government is known for overspending, which could make us a hefty profit. However, that project depends on securing contracts, and the limited scale of national and state parks (only 8,600 total) meant low unit sales volume overall.

The security drone would have provided for a wider market. Enterprises and private individuals would see the value of having a security guard in the air at all times. The downside was the existence of a competitor (Nightingale) and the risk of potential legislation. Privacy legislations are becoming more common, and it isn't unforeseen that a "Drone Privacy Act" could put limits on what customers could do with our drones.

By utilizing an aggregate project plan, we were able to breakdown our project into research and advance development, breakthrough products, platform products, incremental products, and our partnered products. This also allowed us to create a decision analysis on what to develop further given our budget constraint.

The Potential Projects Landscape



	Cost	Prob1	Cost	Prob2	Expected Profit	Ci	Vi
P1 (S&R)	$10M	0.95	$1M	0.4	$30M	$11M	$0.45M
P2 (security)	$10M	0.95	$5M	0.65	$60M	$15M	$17.8M
P3 (customizable)	$15M	0.95	$5M	0.9	$90M	$20M	$57.2M

a1	a2	a3	CT	VT
0	0	0	0	0
0	0	1	20	57.2
0	1	0	15	17.8
0	1	1	35	75
1	0	0	11	0.45
1	0	1	31	57.65
1	1	0	26	18.25
1	1	1	46	75.45

CB = $30M

solution to table lookup
within budget, but not hightest payoff
exceeds capital budget

A1: search and rescue. A2: security. A3: customizable

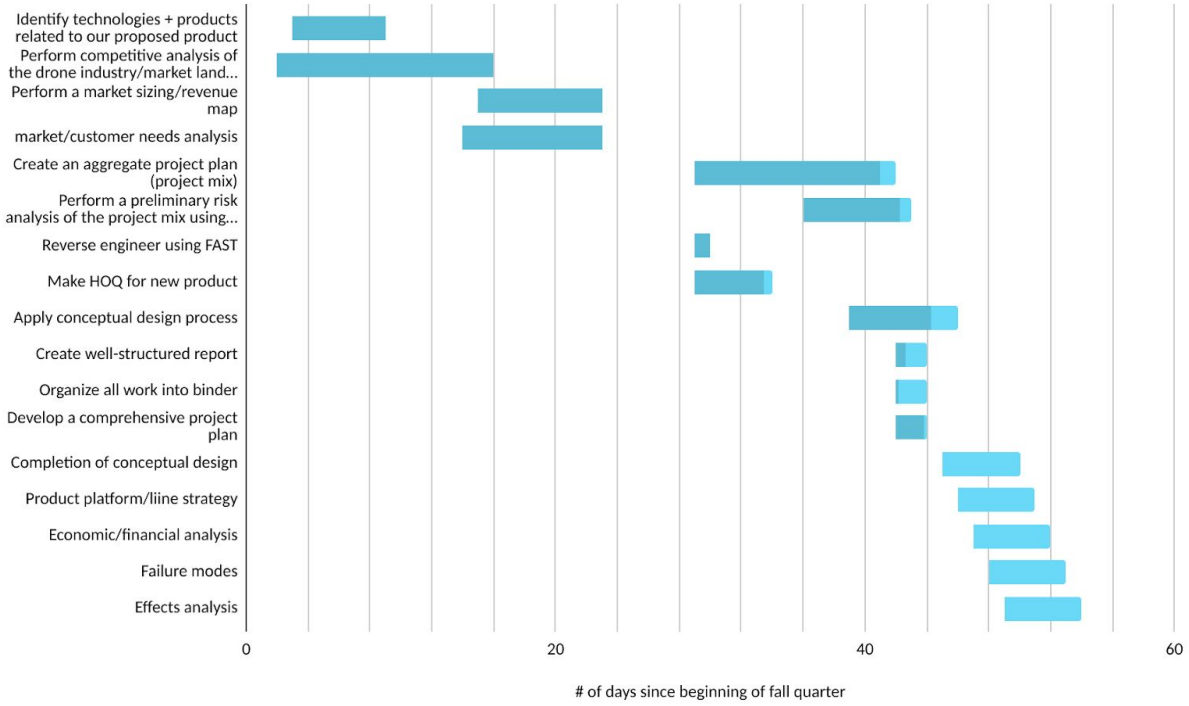
1.6 Project Planning

Our team utilized GANTT, PERT, and CPM charts to budget our time and efforts in the most efficient manner possible. Before any chart to be accurately created we need to construct an activity matrix.

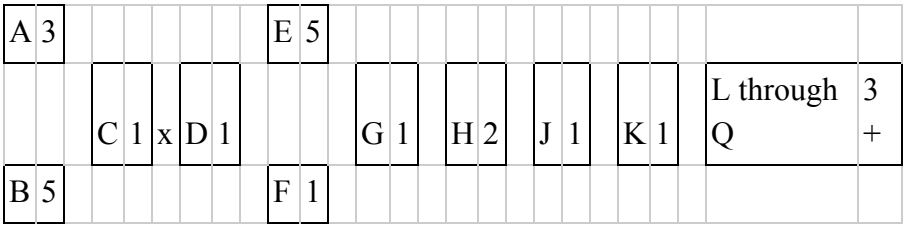
Sub Tasks		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
ID related techs	A	A	x															
Competitive analysis	B	x	B															
Revenue	C		x	C														
Customer needs analysis	D	x	x		D													
Agg Project Plan	E	x	x			E	x											
Risk analysis	F	x	x	x	x	x	F											
FAST	G	x						G										
HOQ	H	x			x			x	H									
Design concepts	I	x			x			x	x	I								
Make report	J	x	x	x	x	x	x	x	x	x	J							
Binder	K	x	x	x	x	x	x	x	x	x	x	K						
Project plan	L												L					
Complete conceptual design	M									x				M				
Platform/line strategy	N		x		x	x	x		x	x				x	N			
Economic analysis	O		x	x		x	x			x				x	x	O		

Failure modes	P							x	x	x				x	x		P	
Effects analysis	Q							x	x	x				x	x		x	Q

After the completion of the activity matrix we were easily able to create a GANTT chart. Which gives us a time schedule to complete each step of the project.



Following GANTT we constructed a PERT chart which is a flow chart that uses the schedule and time estimates that were made in the GANT chart.



Lastly we needed to create a CRM diagram which is the smallest possible form that project tasks can be described. It shows the order in which projects have to be started, with concurrent tasks being simplified to whichever task needs more time.

B → C → D → E → G → H → I → J → K → M → N → O → (P...Q)

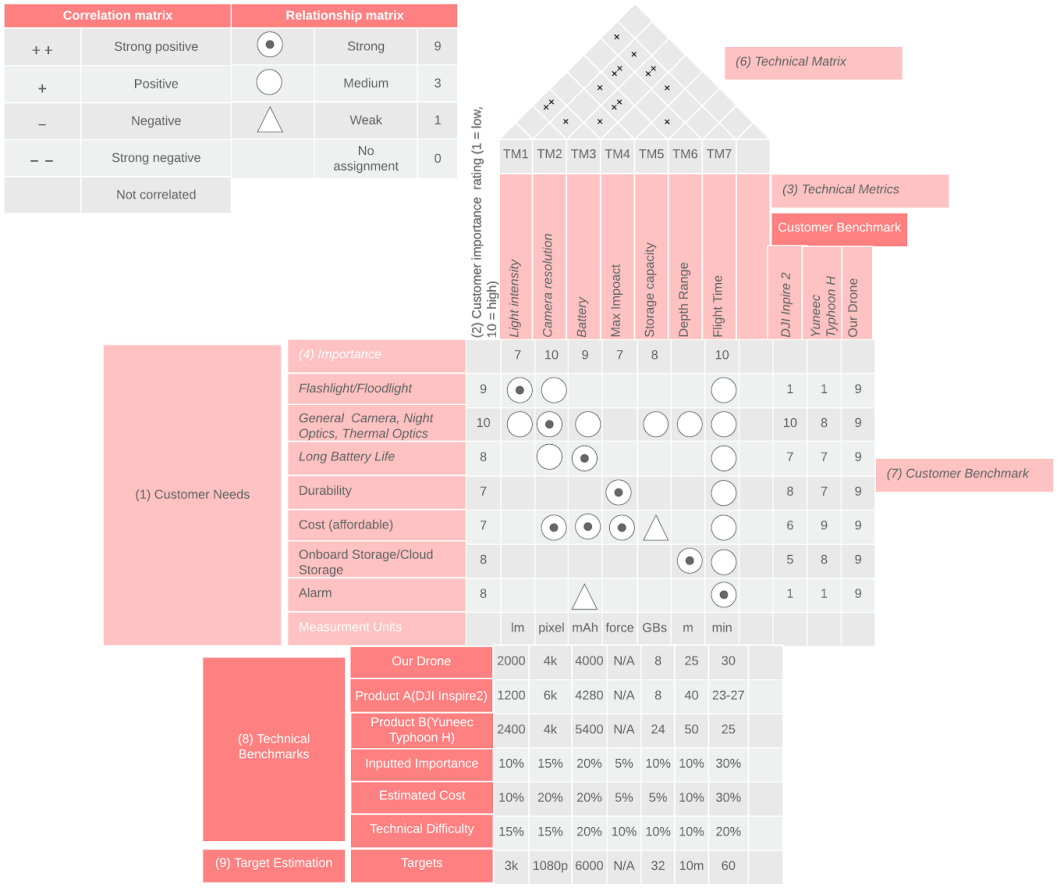
1.7 Conclusion

Through extensive project planning and research our team was able to successfully analyze the market in which allowed us to see and take into account our competing forces. Create our developmental goals and business goals which will lay the road map for what we wish to achieve as a company. Create time based functional maps giving us the capability to demonstrate our product plan over a set time period. Visualize which mix of projects will bring in the most revenue as it is important for us to maximize our resources without going over budget. And create a time schedule to efficiently complete each phase in an efficient manner.

Section 2: Development

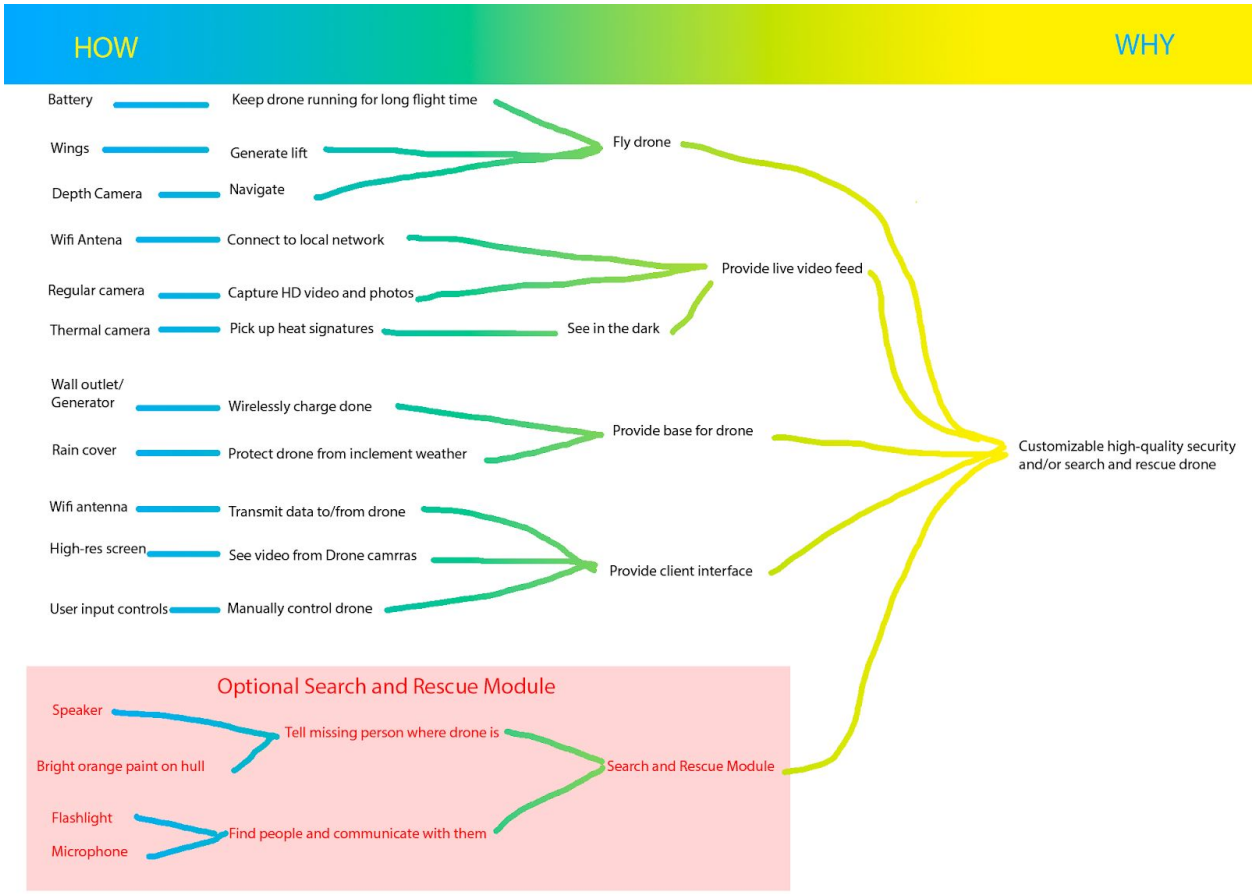
2.1 Quality Function Development

We need to know what important points to touch on before we develop a product. This means finding out what the customers need, and how we can objectively and effectively measure our product's ability to satisfy those needs. Our company developed a House of Quality in order to properly map out the needs of our customers and technical requirements for product development.



Through studying the relation of customer needs and the technical metrics we can quantify our ability to build a better overall product. We aim to surpass our competitors in the eyes of our consumers by doing a better job of meeting customer needs with the technology we have.

Section 2.2 Reverse Engineering



Using a FAST style diagram in order to dissect our product (from “How” to “Why”) we’re able to reduce our product into a structured list of various technology/physical features of our drone in order to order to perform functions that would all come together to create our high quality security/S&R drone.

In regards to our search and rescue functionality and keeping with our goal of drone customizability, we included a FAST-style section on an optional S&R module that consumers can utilize.

2.3 Conceptual Design

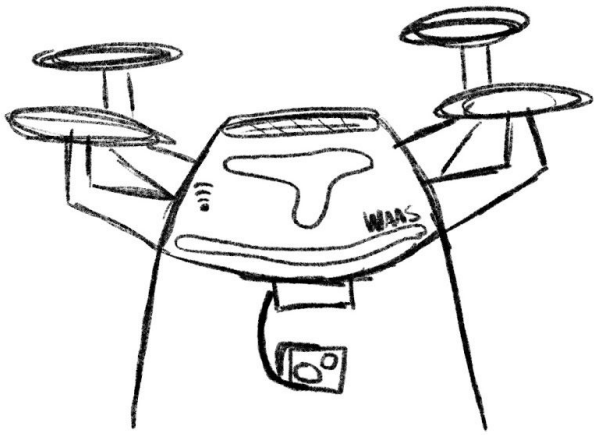
Our team went through many different design concepts and alternative ways to complete a similar task (such as different modes of power, movement, and materials). We started this process by creating a function structure. This process implements a House of Quality and a FAST diagram, allowing us to establish customer needs, engineering metrics, and a better understanding of competing products as well as our own. From this we created a morphological matrix to generate several different concepts.

Solution principles → Sub-functions ↓	**SP 1**	**SP 2**	**SP 3**	**SP 4**	**SP 5**
Provide power	Electric	Solar	Nuclear	Gasoline	Hydro-Electric
Provide movement w.r.t. air	Propeller	Turbine	Pneumatic	Wings	Balloon
Onboard storage for video	Micro SD	HDD	SSD	Flash Storage	Internal Storage
Cloud storage for video	Amazon Drive	Google Drive	iCloud	Dropbox	OneDrive
Sense location	GLONASS	GPS	Galileo	BeiDou	WAAS
Sense objects for collision	Vision (from camera)	Infrared	Sonar	Thermal	LIDAR (Light Detection And Ranging)
Sense object in unideal conditions	Vision (from camera)	Infrared	Sonar	Thermal	LIDAR (Light Detection And Ranging)
Receive and Send data	WiFi	Bluetooth	Cellular	Radio	Satellite
Transmit Power	Gear Box	Hydraulic	Pneumatic		

After generating several concepts, we needed to run a utility function allowing us to create the most feasible concept. This was done through assignment of appropriate weights for the selection criteria.

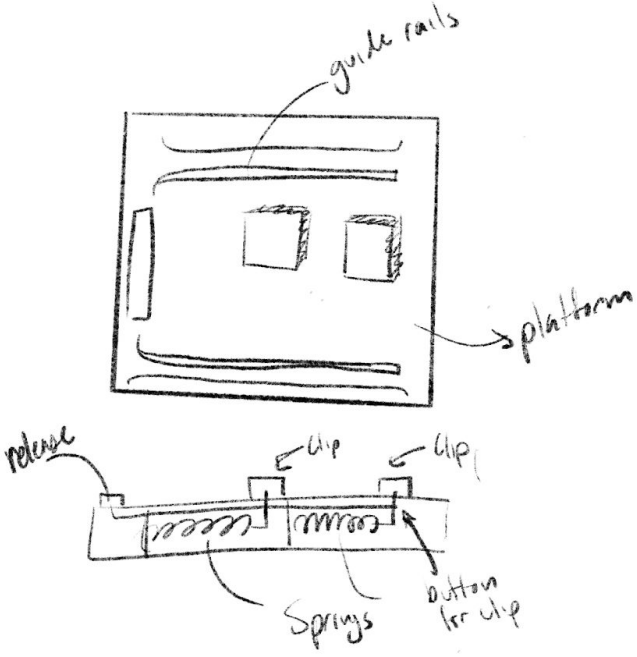
		Concept 1		**Concept 2**		**Concept 3**		**Concept 4**		**Concept 5**	
Selection Criteria	**Absolute Weight**	**Rating**	**Utility**	**Rating**	**Utility**	**Rating**	**Utility**	**Rating**	**Utility**	**Rating**	**Utility**
S1	0.064	4	0.256	3	0.192	2	0.128	2	0.128	1	0.064
S2	0.096	4	0.384	3	0.288	1	0.096	4	0.384	2	0.192
S3	0.08	4	0.32	1	0.08	5	0.4	5	0.4	4	0.32
S4	0.16	1	0.16	4	0.64	2	0.32	2	0.32	2	0.32
S5	0.09	5	0.45	4	0.36	3	0.27	4	0.36	4	0.36
S6	0.03	4	0.12	2	0.06	5	0.15	3	0.09	1	0.03
S7	0.054	4	0.216	3	0.162	1	0.054	3	0.162	5	0.27
S8	0.126	4	0.504	3	0.378	4	0.504	3	0.378	2	0.252
S9	0.09	3	0.27	3	0.27	1	0.09	3	0.27	4	0.36
S10	0.15	3	0.45	3	0.45	1	0.15	3	0.45	4	0.6
S11	0.06	3	0.18	3	0.18	1	0.06	3	0.18	4	0.24
S12			0		0		0		0		0
S13			0		0		0		0		0
Σ	1		**3.31**		3.06		2.222		3.122		3.008

Based on the utility function, we concluded that concept 1 was the best design we came up with. The concept consists of solar powering, propellers for movement, a micro SD card for on board memory, Google drive for cloud storage, WAAS as a GPS navigation tool, sonar and infrared for detection of objects and people, and cellular reception for transfer and communication data between the user and the drone. Below is a very rough concept of the drone, it does not reflect the actual appearance of the final product.



2.4 Product Architecture/Product Strategy:

After achieving a feasible concept, we decided to move forward with a technology platform and product platform. For the product platform our team decided to create a device that would allow us to customize each drone to the customer needs and allow the client to upgrade their drones in the future.

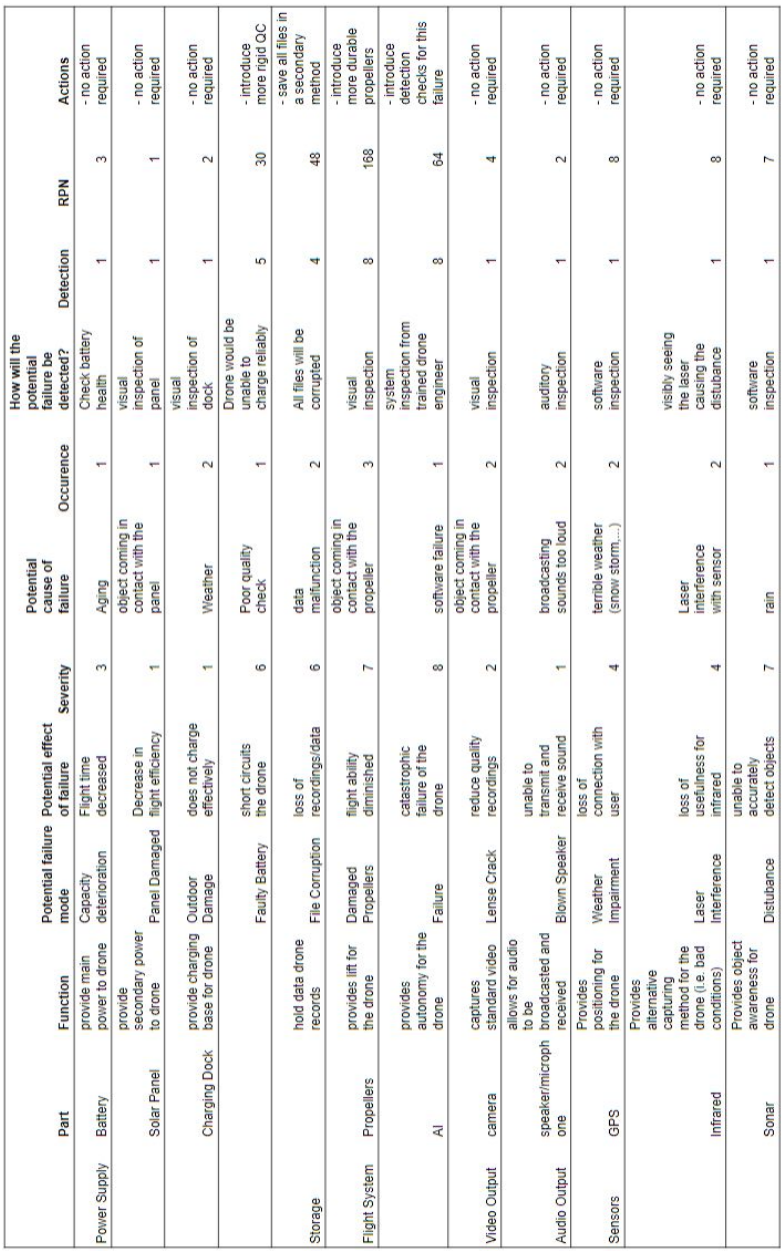


Next we tackled the product lines to hit the market. After several group meetings we decided on a “consumer” line (the Hound) and a “professional” line (the Cerberus) so we could accomplish our goals to achieve a wide audience with our product.

Product Line 1: Hound-scale drones					
	2019	2020	2021	2022	2023
High-range drone (3 hours)					
Charging dock					
High-performance drone(2 hours)					
Mid-performance midrange (2 hours)					
Entry-level drone (1 hour)					
Upgradability					
Product Line 2: Cerberus-scale drones					
	2022	2023	2024	2025	2026
High-range drone (4.5 hours)					
Charging dock					
High-performance midrange (3 hours)					
Mid-performance midrange (3 hours)					
Entry-level drone (2 hours)					
Upgradability					

2.5 Failure Modes and Effects Analysis:

Risk factors inherent in the operation of a drone product like ours have been taken into account through the Risk Priority Number (RPN) process.



Part	Function	Potential failure mode	Potential effect of failure	Severity	Potential cause of failure	Occurence	How will the potential failure be detected?	Detection	RPN	Actions
Power Supply Battery	provide main power to drone	Capacity deterioration	Flight time decreased	3	Aging	1	Check battery health	1	3	- no action required
Solar Panel	provide secondary power to drone	Panel Damaged	Decrease in flight efficiency	1	object coming in contact with the panel	1	visual inspection of panel	1	1	- no action required
Charging Dock	provide charging base for drone	Outdoor Damage	does not charge effectively	1	Weather	2	visual inspection of dock	1	2	- no action required
Storage	hold data drone records	Faulty Battery File Corruption	short circuits the drone loss of recordings/data	6 6	Poor quality check data malfunction	1 2	Drone would be unable to charge reliably All files will be corrupted	5 4	30 48	- introduce more rigid QC - save all files in a secondary method
Flight System Propellers	provides lift for the drone	Damaged Propellers	flight ability diminished	7	object coming in contact with the propeller	3	visual inspection	8	168	- introduce more durable propellers
AI	provides autonomy for the drone	Failure	catastrophic failure of the drone	8	software failure	1	system inspection from trained drone engineer	8	64	- introduce detection checks for this failure
Video Output camera	captures standard video	Lense Crack	reduce quality recordings	2	object coming in contact with the propeller	2	visual inspection	1	4	- no action required
Audio Output speaker/microphone	allows for audio to be broadcasted and received	Blown Speaker	unable to transmit and receive sound	1	broadcasting sounds too loud	2	auditory inspection	1	2	- no action required
Sensors GPS	Provides positioning for the drone	Weather Impairment	loss of connection with user	4	terrible weather (snow storm...)	2	software inspection	1	8	- no action required
Infrared	Provides alternative capturing method for the drone (i.e. bad conditions)	Laser Interference	loss of usefulness for infrared	4	Laser interference with sensor	2	visibly seeing the laser causing the distubance	1	8	- no action required
Sonar	Provides object awareness for drone	Distubance	unable to accurately detect objects	7	rain	1	software inspection	1	7	- no action required

Our team has taken into account a multitude of scenarios and assessed them accordingly to how severe,frequent, and how easily detectable the problems that the drone would encounter would be in order to create the best plan possible for tackling it.

2.6 Conclusion

By following a structured process for each step of product development, we touched on the two necessary questions to design and develop an effective product. This section of our report answers two questions: *HOW*? And *WHY*? The House of Quality asks both questions, setting up *WHY* do customers buy this product and *HOW* can we measure success. The *FAST* diagram is a heavy lean towards the *HOW*? We ask, how does each part work, and how do the parts fit together? The function structure turns our focus back to the *WHY*. We don't care about what each part of the drone is; we only care what it does in the big picture, and why it is there to begin with. We can use the answers to this *WHY* question to establish the last *HOW* - the concept development phase. Once we have the concepts, we can objectively find the best one, and then finish our process with a product design that will fit all our customers' needs effectively.

Section 3: Commercialization

3.1 Financial Model

Our team had to create a financial model to determine the profitability of our product (NPV, ROI%, revenue) as well as our expected sales volume and expectations for the next four years. This was predominantly created to show the company who will decide to fund the project or not an easy way to visualize our ambitions. Below is the financial model for our Cerberus line(the more expensive of two product lines), input parameters, base case, and sensitivity analysis.

Sales and Production Volume: This number was estimated based off of the most popular drone shipments in the United States. 25 million consumer drones were sold in 2018. For one product, entering the marketplace, we expect to sell about 15,000, representing about 10% of our company's total sales.

Development cost: Based off of AeroVironment and Boeing's public financial data. And earnings reports.

Unit Price: based off of current pricing for similar drones, modified to reflect our drone's added technology and higher quality.

Cerberus Input Parameters

Sales & Production Volume (units/year)	15,000
Development Cost (total $)	30,000,000
Unit Price ($/ unit)	10,000
Unit Production Costs ($/unit)	5,000
Ramp-up cost (total $)	4,000,000
Marketing & suppost cost ($/year)	2,000,000
Annual Discount Factor (%)	10

BaseCase

	Year 1				Year 2				Year 3			
period	1	2	3	4	5	6	7	8	9	10	11	12
($ valus in thousands)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Development Cost	-7500	-7500	-7500	-7500								
Rampu-up Cost				-2000	-2000							
Marketing & suppost cost					-500	-500	-500	-500	-500	-500	-500	-500
Production cost						-18750	-18750	-18750	-18750	-18750	-18750	-18750
Production volue						3750	3750	3750	3750	3750	3750	3750
Unit production cost						-5	-5	-5	-5	-5	-5	-5
Sales revenue						37500	37500	37500	37500	37500	37500	37500
Sales volume						3750	3750	3750	3750	3750	3750	3750
Unit price						10	10	10	10	10	10	10
Period Cash Flow	-7500	-7500	-7500	-9500	-2500	18250	18250	18250	18250	18250	18250	18250
PV year 1, r=10%	-7500	-7317	-7139	-8822	-2265	16130	15737	15353	14979	14613	14257	13909
Project NPV, $	124262											

Year 4				
13	14	15	16	
Q1	Q2	Q3	Q4	
-500	-500	-500	-500	-500
-18750	-18750	-18750	-18750	-18750
3750	3750	3750	3750	3750
-5	-5	-5	-5	-5
37500	37500	37500	37500	37500
3750	3750	3750	3750	3750
10	10	10	10	10
18250	18250	18250	18250	18250
13570	13239	12916	12601	

Sensitivity Testing

We acknowledge that the budget could quickly accelerate. Early in the quarter, our research showed that the US military's aviation technology programs can cost upwards of $1.5tn. Our biggest concern with sensitivity is a runaway development cost.

Cerberus -10% Development Cost (Sensitivity Analysis)

BaseCase

	Year 1				Year 2				Year 3			
period	1	2	3	4	5	6	7	8	9	10	11	12
($ valus in thousands)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Development Cost	-7	-7	-7	-7								
Rampu-up Cost				-2000	-2000							
Marketing & suppost cost					-500	-500	-500	-500	-500	-500	-500	-500
Production cost						-14625	-14625	-14625	-14625	-14625	-14625	-14625
Production volue						3250	3250	3250	3250	3250	3250	3250
Unit production cost						-5	-5	-5	-5	-5	-5	-5
Sales revenue						29250	29250	29250	29250	29250	29250	29250
Sales volume						3250	3250	3250	3250	3250	3250	3250
Unit price						9	9	9	9	9	9	9
Period Cash Flow	-7	-7	-7	-2007	-2500	14125	14125	14125	14125	14125	14125	14125
PV year 1, r=10%	-7	-7	-6	-1863	-2265	12484	12180	11883	11593	11310	11034	10765
Project NPV, $	117601											

Year 4				
13	14	15	16	
Q1	Q2	Q3	Q4	
-500	-500	-500	-500	-500
-14625	-14625	-14625	-14625	-14625
3250	3250	3250	3250	3250
-5	-5	-5	-5	-5
29250	29250	29250	29250	29250
3250	3250	3250	3250	3250
9	9	9	9	9
14125	14125	14125	14125	14125
10503	10247	9997	9753	

Cerberus Development Cost +10%(Sensitivity Analysis)

BaseCase

	Year 1				Year 2				Year 3			
period	1	2	3	4	5	6	7	8	9	10	11	12
($ valus in thousands)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Development Cost	-8250	-8250	-8250	-8250								
Rampu-up Cost				-2000	-2000							
Marketing & suppost cost					-500	-500	-500	-500	-500	-500	-500	-500
Production cost						-23375	-23375	-23375	-23375	-23375	-23375	-23375
Production volue						4250	4250	4250	4250	4250	4250	4250
Unit production cost						-6	-6	-6	-6	-6	-6	-6
Sales revenue						46750	46750	46750	46750	46750	46750	46750
Sales volume						4250	4250	4250	4250	4250	4250	4250
Unit price						11	11	11	11	11	11	11
Period Cash Flow	-8250	-8250	-8250	-10250	-2500	22875	22875	22875	22875	22875	22875	22875
PV year 1, r=10%	-8250	-8049	-7852	-9518	-2265	20218	19725	19244	18775	18317	17870	17434
Project NPV, $	161235											

Year 4				
13	14	15	16	
Q1	Q2	Q3	Q4	
-500	-500	-500	-500	-500
-23375	-23375	-23375	-23375	-23375
4250	4250	4250	4250	4250
-6	-6	-6	-6	-6
46750	46750	46750	46750	46750
4250	4250	4250	4250	4250
11	11	11	11	11
22875	22875	22875	22875	22875
17009	16594	16189	15794	

Reflecting this analysis, we see a large disparity in NPV - a swing of approximately 20 million dollars. Our company must be sure to manage and mitigate any risks affecting development costs.

Following the Cerberus line, we also made a more consumer friendly line which consists of the Hound. The financial model below is correlated to this product.

hound input parameters

Sales & Production Volume (units/year)	20,000
Development Cost (total $)	20,000,000
Unit Price ($/ unit)	5,000
Unit Production Costs ($/unit)	3,000
Ramp-up cost (total $)	2,000,000
Marketing & suppost cost ($/year)	3,000,000
Annual Discount Factor (%)	10

BaseCase

	Year 1				Year 2				Year 3			
period	1	2	3	4	5	6	7	8	9	10	11	12
($ valus in thousands)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Development Cost	-5000	-5000	-5000	-5000								
Rampu-up Cost				-1000	-1000							
Marketing & suppost cost					-750	-750	-750	-750	-750	-750	-750	-750
Production cost						-15000	-15000	-15000	-15000	-15000	-15000	-15000
Production volue						5000	5000	5000	5000	5000	5000	5000
Unit production cost						-3	-3	-3	-3	-3	-3	-3
Sales revenue						25000	25000	25000	25000	25000	25000	25000
Sales volume						5000	5000	5000	5000	5000	5000	5000
Unit price						5	5	5	5	5	5	5
Period Cash Flow	-5000	-5000	-5000	-6000	-1750	9250	9250	9250	9250	9250	9250	9250
PV year 1, r=10%	-5000	-4878	-4759	-5572	-1585	8176	7976	7782	7592	7407	7226	7050
Project NPV, $	57935											

Year 4				
13	14	15	16	
Q1	Q2	Q3	Q4	
-750	-750	-750	-750	-750
-15000	-15000	-15000	-15000	-15000
5000	5000	5000	5000	5000
-3	-3	-3	-3	-3
25000	25000	25000	25000	25000
5000	5000	5000	5000	5000
5	5	5	5	5
9250	9250	9250	9250	9250
6878	6710	6546	6387	

Hound Development Cost -10% (Sensitivity Analysis)

BaseCase

	Year 1				Year 2				Year 3							
period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
($ valus in thousands)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Development Cost	-4500	-4500	-4500	-4500												
Rampu-up Cost				-1000	-1000											
Marketing & suppost cost					-750	-750	-750	-750	-750	-750	-750	-750	-750	-750	-750	-750
Production cost						-11250	-11250	-11250	-11250	-11250	-11250	-11250	-11250	-11250	-11250	-11250
Production volue						4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
Unit production cost						-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
Sales revenue						20250	20250	20250	20250	20250	20250	20250	20250	20250	20250	20250
Sales volume						4500	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
Unit price						5	5	5	5	5	5	5	5	5	5	5
Period Cash Flow	-4500	-4500	-4500	-5500	-1750	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250	8250
PV year 1, r=10%	-4500	-4390	-4283	-5107	-1585	7292	7114	6940	6771	6606	6445	6288	6134	5985	5839	5696
Project NPV, $	51244															

Hound Development Cost +10%(Sensitivity Analysis)

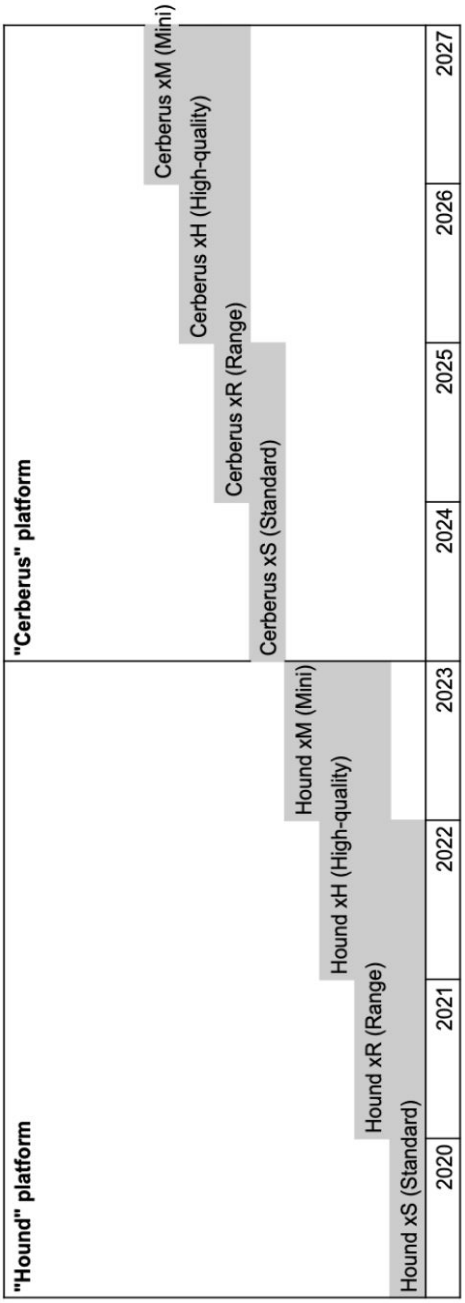
BaseCase

	Year 1				Year 2				Year 3			
period	1	2	3	4	5	6	7	8	9	10	11	12
($ valus in thousands)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Development Cost	-5500	-5500	-5500	-5500								
Rampu-up Cost				-1000	-1000							
Marketing & suppost cost					-750	-750	-750	-750	-750	-750	-750	-750
Production cost						-18150	-18150	-18150	-18150	-18150	-18150	-18150
Production volue						5500	5500	5500	5500	5500	5500	5500
Unit production cost						-3	-3	-3	-3	-3	-3	-3
Sales revenue						30250	30250	30250	30250	30250	30250	30250
Sales volume						5500	5500	5500	5500	5500	5500	5500
Unit price						6	6	6	6	6	6	6
Period Cash Flow	-5500	-5500	-5500	-6500	-1750	11350	11350	11350	11350	11350	11350	11350
PV year 1, r=10%	-5500	-5366	-5235	-6036	-1585	10032	9787	9548	9315	9088	8867	8650
Project NPV, $	74108											

Year 4				
13	14	15	16	
Q1	Q2	Q3	Q4	
-750	-750	-750	-750	-750
-18150	-18150	-18150	-18150	-18150
5500	5500	5500	5500	5500
-3	-3	-3	-3	-3
30250	30250	30250	30250	30250
5500	5500	5500	5500	5500
6	6	6	6	6
11350	11350	11350	11350	11350
8439	8234	8033	7837	

After analyzing the results from the sensitivity analysis, it is clear that given the input parameters both hound and cerberus product lines are profitable and should be pursued. However, it is also clear that there are clear trade-offs between and increase/decrease in production cost, production time, development cost, and unit production cost. In both cases, we found that at +-10% there to be an increase in npv. However the range of increase was far larger in the Cerberus production line. This is most likely due to the fact that Cerberus development cost and ramp-up costs are higher while having a lower expected unit produced per year. This in connection with the higher unit cost led to the results of a high range of increase of npv. On the counterpoint the hound doesn't see as large of a change mostly in part due to lower development cost, ramp up cost, unit production cost, and unit price. While there is still an increase of NPV for the hound product line the range of increase, as well as the range between +10% or -10% are much smaller with respect to cerberus.

3.2 Product Release Map



For our products we needed to create an appropriate road map to phase out older models at appropriate times while also not releasing a new model too soon. Our team decided to release a new model of each product line each year (allowing us to gain a larger customer base), while phasing out models after they have reached a 3-5 year life cycle (as technology changes quickly over time).

3.3 Conclusion

Given our financial model, we can conclude that the project is profitable. We can see with the Cerberus line we would expect an NPV of $124mm. Similarly with the Hound line we have an expected NPV of $57mm. In addition, given our product release map, there is a clear structure as to how we will release each model to gain more market share while also expanding our customer base.

Our biggest competitors ended up helping us for this project -- we could use their openly published quarterly financial data to discern our own goals and benchmarks.

Development Cost will be a significant factor when assuming the risks of our project. In our project, this translates to a variation of $22mm in NPV. This should be manageable for a private company. However, the world of aircraft development costs is not one to underestimate. For example, the U.S. military is infamous for overspending on new aircraft development. Indeed, our 10% sensitivity analysis pales in comparison to the real-life Lockheed Martin F-35's 3,900% increase in development costs.

Overall Conclusion and Guidelines

After the thorough research our team conducted (the drone market, conceptual design, feasibility analysis, financial model, etc.) we have concluded our project would be very profitable, the Hound having an NPV of $57M and the Cerberus having an NPV of $124M. Our next step should we want to continue this project, would be to find investors (i.e. a large company) who would fund the project. Should this occur we can take our project to the prototyping phase and build real world drone concepts to test and work out the kinks to bring the best product possible to market.