



Putt from the Sky

Company 4

CEO: Ryan Stolys

CTO-Software: Jayden Cole

CTO-Hardware: Matthew Neddoly

CFO: Jiyeong Jeong

CCO: Oh Chang Kwon



Presentation Agenda

- Project Introduction
- System Description
- Product Analysis
- Project Scheduling
- Finances
- Risk Management
- Reflection
- Conclusion





The Team



CEO
Ryan Stolys



CTO-Software
Jayden Cole



CTO-Hardware
Matthew Nesdoly



CCO
Oh Chang (Samuel)
Kwon



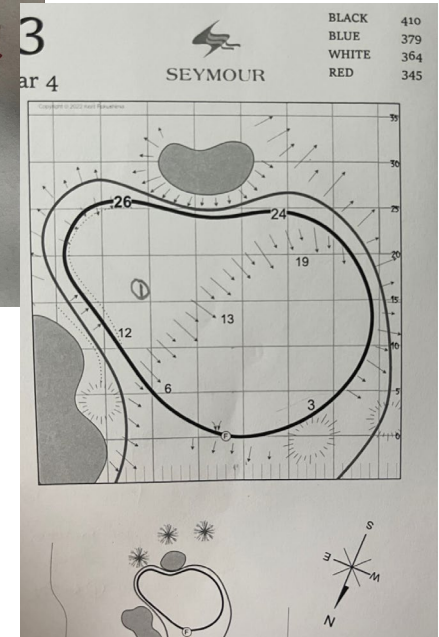
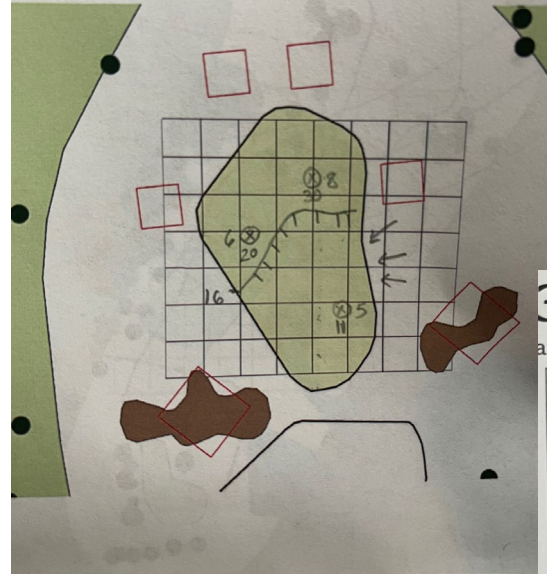
CFO
Jiyeong (Sophie)
Jeong



The Problem



- Yardage books hold information
- Books lack detail to scale
- Personal interest and technical challenge



Our Solution

What?

- Provide accurate yardage books & online 3D viewer

How?

- Drone takes images
- Images create 3D Digital Model
- Convert model to slopes



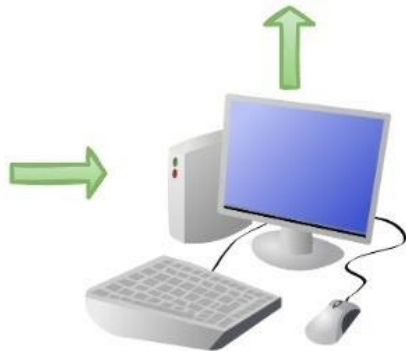
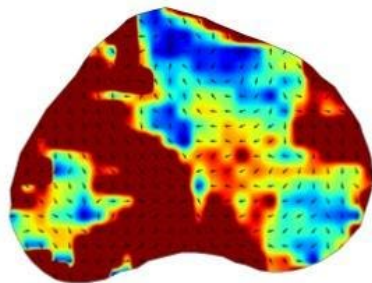
System Overview

Drone Data Collection




GPS Location of Images

Generate Slope Maps

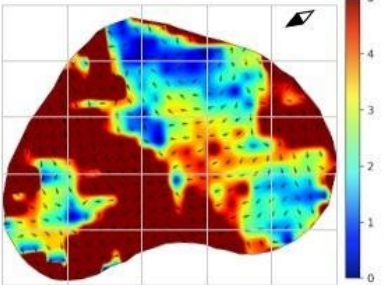


Data Processing

Greens Books for Customers

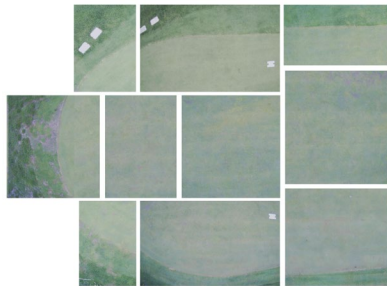
Hole 5  Par: 3 77 YDS

Notes






Generating Green Models



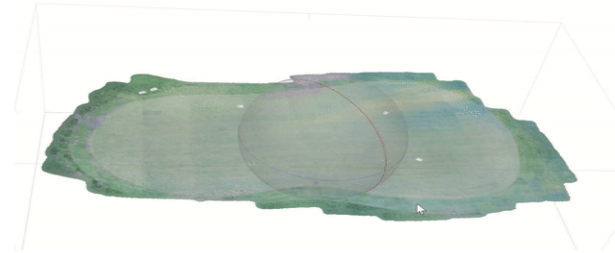
Images

+



GPS Data

Photogrammetry



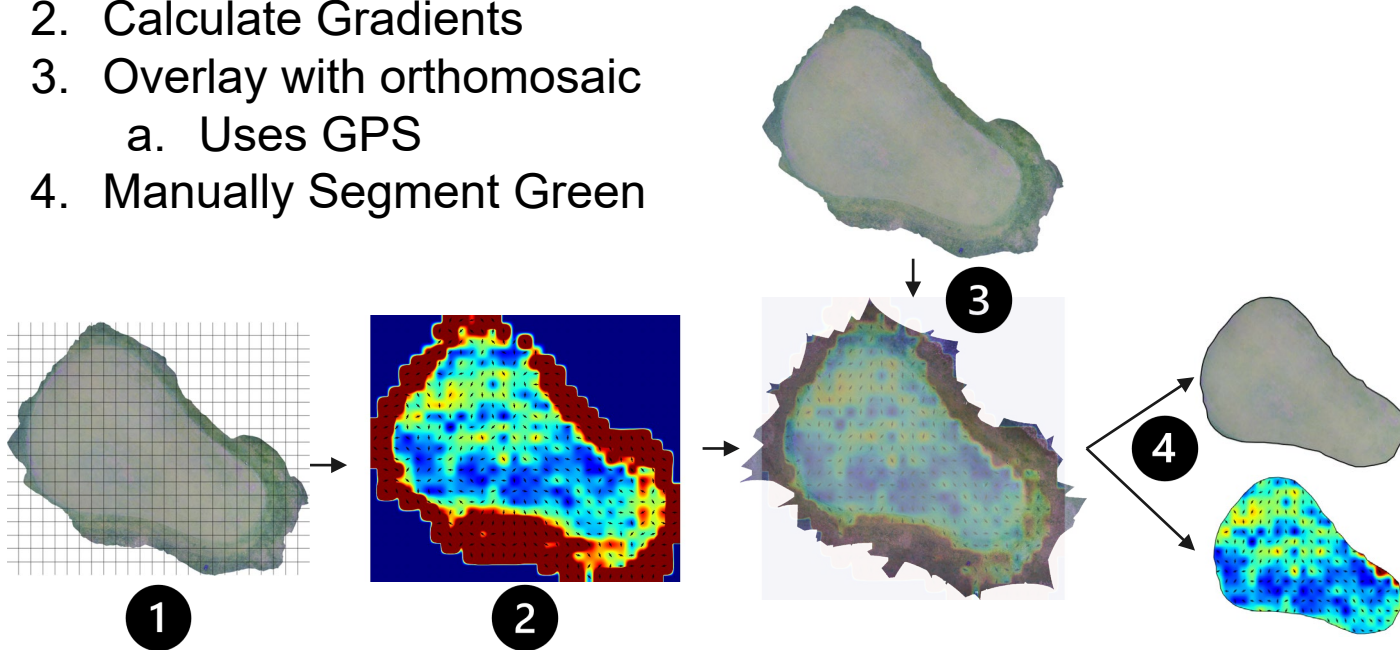
3D Point Cloud & Mesh



Orthomosaic

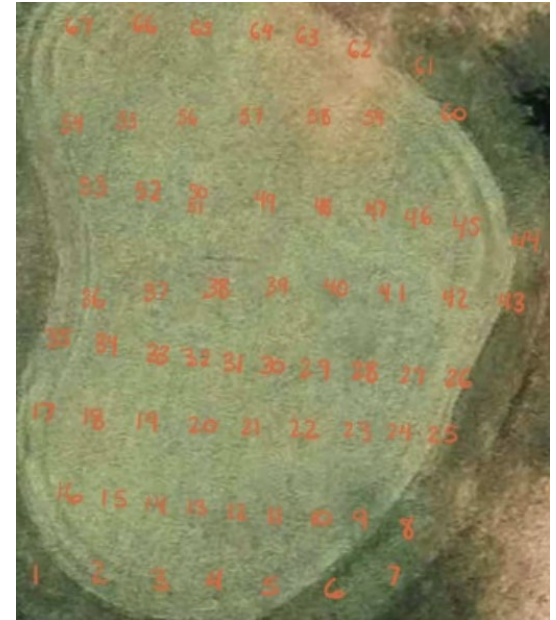
Slope Map Generation

1. Divide 3D Mesh
2. Calculate Gradients
3. Overlay with orthomosaic
 - a. Uses GPS
4. Manually Segment Green



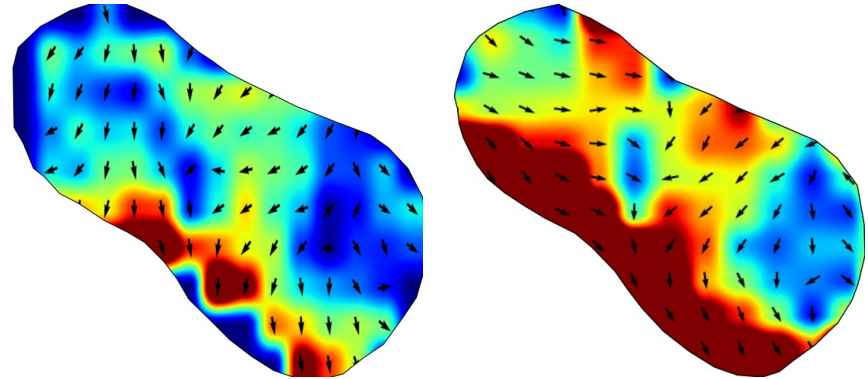
Hardware System

- Data collection with drone
- GPS coordinates acquired manually
- Transitioned from custom drone to commercial drone
- Unable to use Navio
- Estimation is far more accurate





Product Accuracy



GPS Correctness

- Ensure proper scaling of model
- 1.05x bigger
- Slight rotation & translation error

Slope Map Accuracy

- Average slope direction error: 67°
- Average Magnitude error: 2.7%



Sustainability & Product Lifecycle



- Keep for long term use
- Recycle battery
- Donate parts to schools

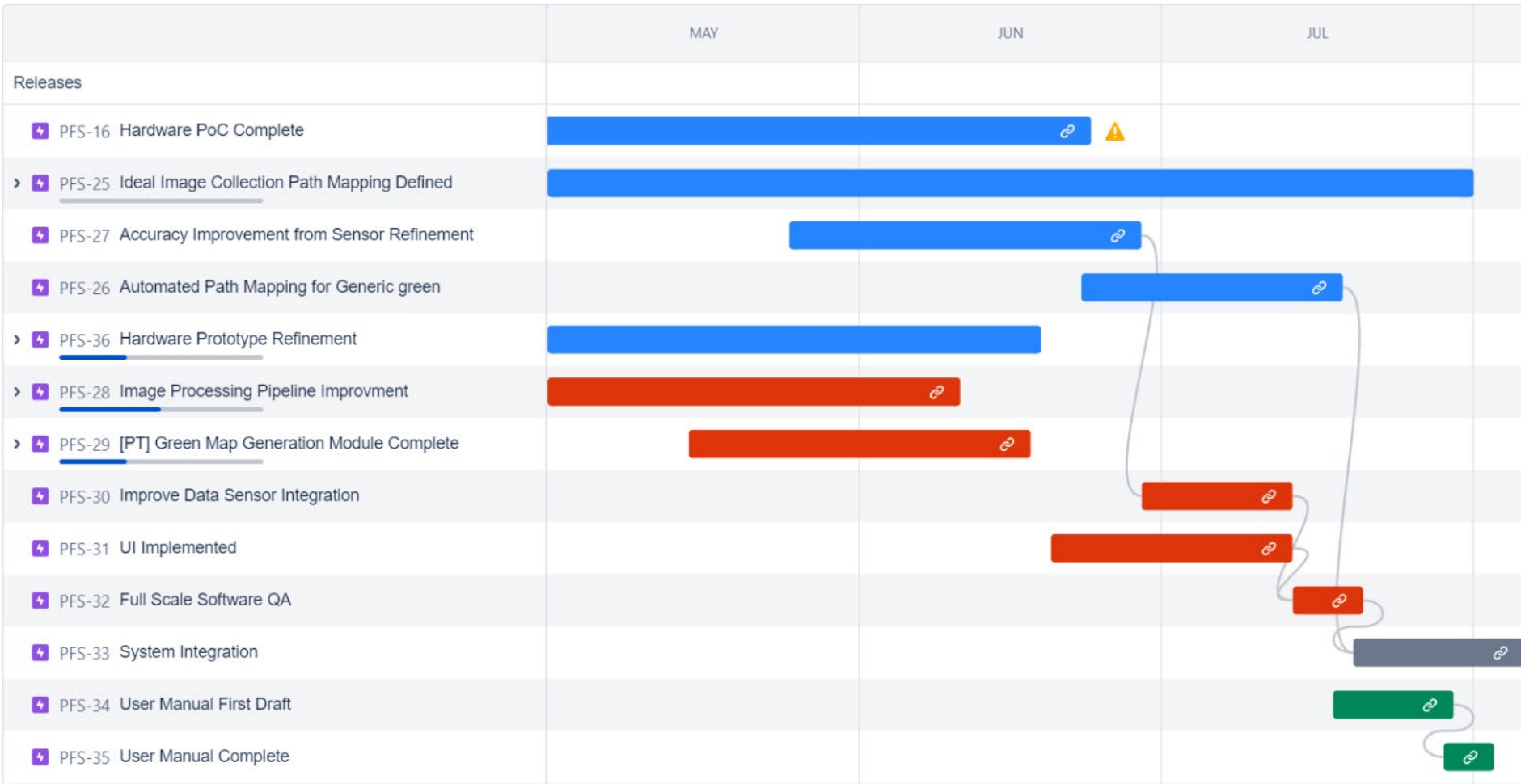
- Fully recyclable
- Long Life Span



- Low CO2 servers to reduce environmental impact



Project Scheduling





Scheduling/Project Adjustments

Adjustments

Data Collection Plan B:

- Commercial Drone
- More time collecting data

Software Pipeline

- Development time added through July

On Time!

UI Implementation:

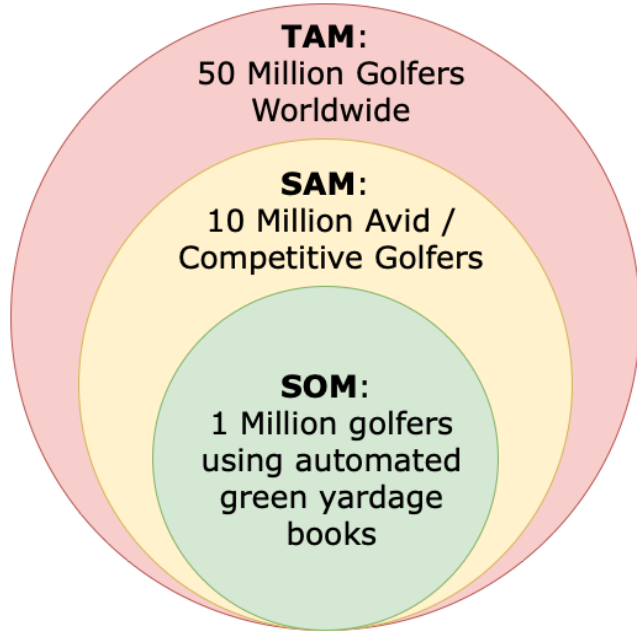
- Began as scheduled in late June and completed on time
- Shifted to User Manual

System Integration

- Completed on time



Market

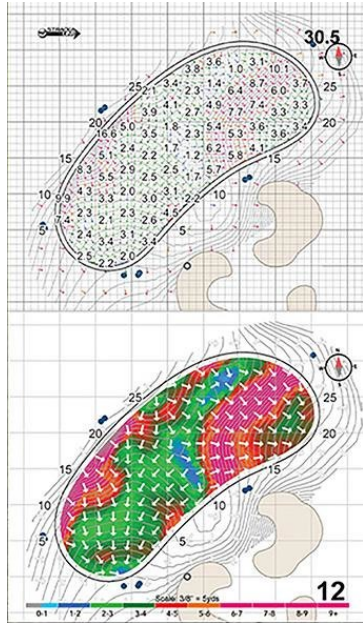


TAM, SAM and SOM for Highly Technologies

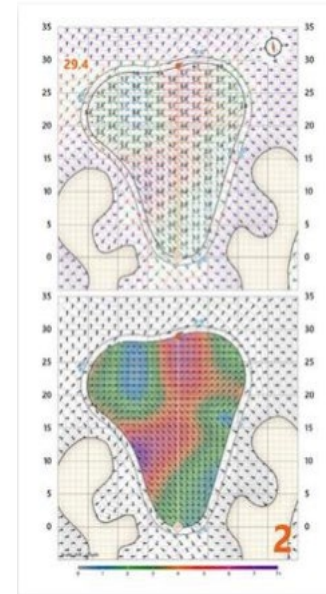
Golfer Persona	Avid Golfer	Competitive/Professional Golfer
Golf Frequency	Plays 20+ rounds per season	Plays 60+ rounds per season
Details	Golf is actively improved throughout their life	Golf is a competitive sport
Customer Likelihood	Likely	Highly Likely



Competition



- Database of over 13000 courses
- Costs \$35 / book, Best Green Book since 2007.
- Has interactive app with 3D green models



- Database of over 30000 courses
- Costs \$50/ book
- Greens books are not primary product



Budget

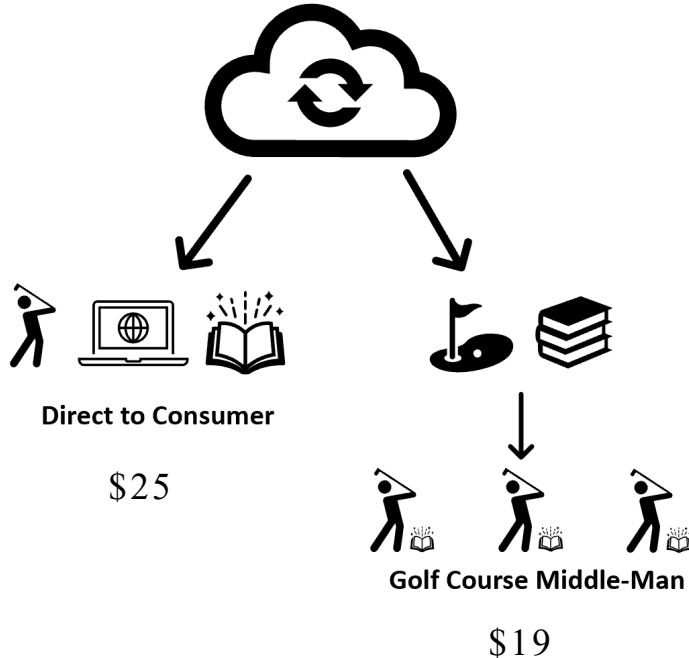


Cost (Fixed or Variable)	Amount
Drone (Fixed)	\$2,500
Travel (Fixed)	\$15,000/ year
Marketing (Fixed)	\$15,000/ year
Software Pipeline (Fixed)	\$3,500/year
Business Equipment (Fixed)	\$3,000
Printing (Fixed and Variable)	\$2,500 + \$3/package
Website Hosting (Fixed and Variable)	\$60 + \$10/ 1k customers
Shipping (Variable)	\$3/ package
Online Payment Provider (Variable)	\$0.3 + \$0.90/package



Price & Financing

2 Pronged Sales Strategy + Pricing



Sales Expectations

- 800,000 golfers in BC for 2023
- 160,000 avid and competitive golfers with 10% adopting yardage and greens books.
- 16000 potential customers
- 57 courses within 20 miles of Vancouver
- If 50 are mapped we expect to sell 2500 Units in 2023
- 1 Unit = Physical Green Book and Website Access

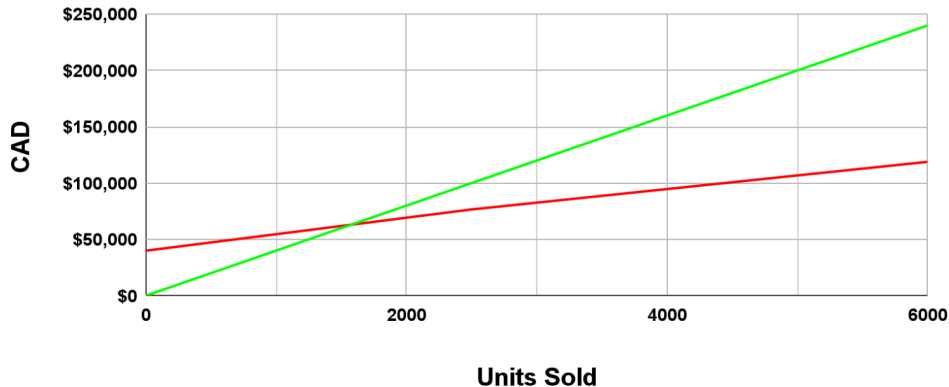


Break Even Point



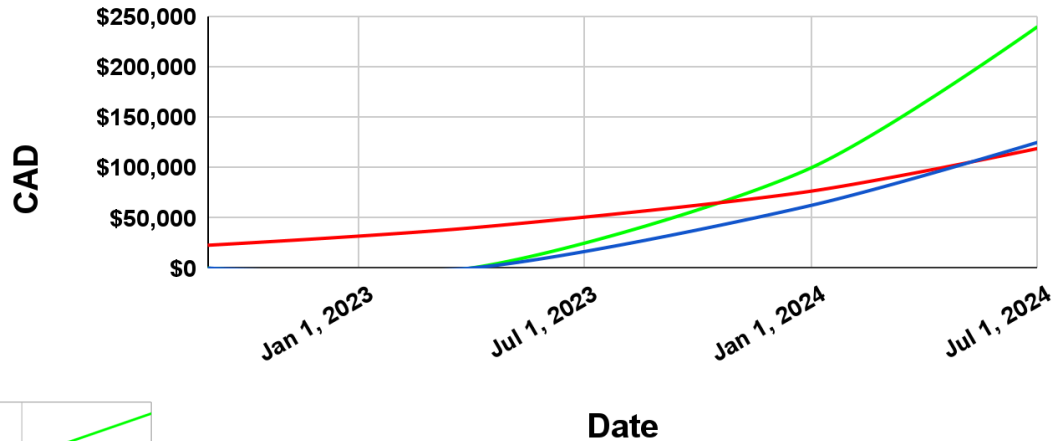
Break Even Point

— Costs — Revenue



Revenue and Cost Over Time

— Revenue — Costs — Revenue with Underperforming Growth



Risk Analysis / Risk Management

Risk	Priority	Solution
Course access denied due to potential drone damage	Low	Use trained operators and provide flight demonstration
Lack of Resources During Growth	Med	Create efficient and automated processes, allocate available resources strategically
Low customer adoption	High	Apply our technology to new market (Land Surveying)



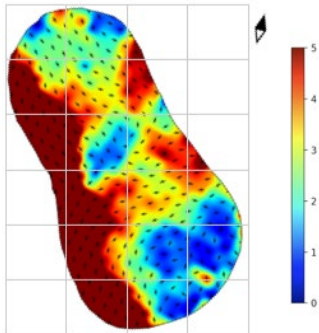
Standard Compliance

- **Standard 921 - Small Remotely Piloted Aircraft in Visual Line-Of-Sight (VLOS) - Canadian Aviation Regulations (CARs)**
 - **IEEE Std 1936.1™-2021, IEEE Standard for Drone Applications Framework - 7.2.3**
- General requirements of the flight platform**



The general requirements listed in 7.2.3 introduce key characteristics of a drone. These include:

- High Reliability: The drone is able to fly the desired path accurately and consistently,
 - Low Demand for Takeoff: The drone is easily started and able to land and takeoff within five seconds, and,
 - Transmission Quality Stability: The signal to the drone is uninterrupted and protected from various sources of interference including cables on the drone.
- **Topographic Maps - Natural Resources Canada**
 - UTM Projections
 - Map Components





Reflection



Feedback

Do Differently

Learnings

MetaShape image processing

Quantify Accuracy

Importance of proving your work and quantifying the results

Resource allocation to achieve desired goals


Start with a commercial drone, focus on automated flight

Utilize TA resources earlier in our project

Commercial Drone

Various Image Techniques (GPS, GCP)



 Future Plans



<http://www.realclear.com/comics/dilbert/2017/02/11/>

Thank You

