Requirements Definition

Target Acquired

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Camera Requirements

General Requirement

- **General:** The Aircraft Design Team want a mounted zoom camera that is located near the middle of the vehicle to minimize reduction in structural/flight performance of the aircraft. It should be able to continuously capture video footage of the AOI during the Search phase of motion.

Subjective Requirements

- **HDMI Outputs:** The camera shall have two or more HDMI outputs for transmitting video feed to video transmitters in Ground Control and to open source CV software on coprocessor.
- **Camera Angle:** We should be able to obtain the angle which the camera is at to obtain accurate GPS locations on the ground
- **Resolution:** Must be able to capture video feed of high resolution with flying at the mission altitude (200 ft above ground level)
- **Position:** Camera needs to be placed in the center of the aircraft along with the rest of the hardware to ensure stability of the plane and ensure structural performance

Quantitative Requirements

- **Weight:** The aircraft sees stability issues when it reaches a weight of 16 lbs with the ASE team currently weighing it at 12 lbs. The camera, along with the rest of our system should stay within the designated weight.

Camera Software Requirements

General Requirement:

Subjective Requirements

Quantitative Requirements

Co-Processor Requirements

General requirement

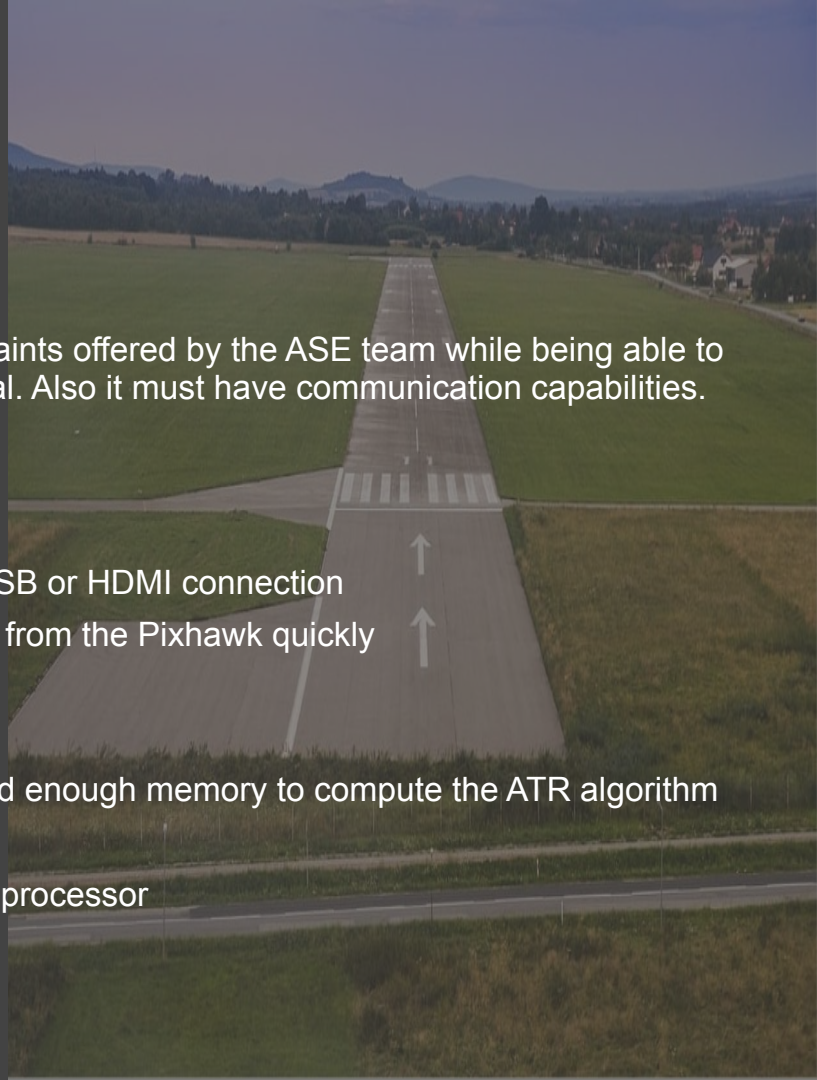
- **Storage:** Co-processor fits the size, weight, and power constraints offered by the ASE team while being able to carry out the ATR algorithm within some maximum time interval. Also it must have communication capabilities.

Input requirements

- **Power**: The co-processor can run on 5 volts
- **Video:** The co-processor can be wired to the camera with a USB or HDMI connection
- **Pixhawk:** The co-processor can send and receive information from the Pixhawk quickly

Output requirements

- **Identification:** Co-processor has a high enough frequency and enough memory to compute the ATR algorithm in a reasonable amount of time.
- **Communication:** ADP team can access results of ATR on co-processor



Automatic Target Recognition Software Requirements

General requirement

- **Storage:** Open Source Computer vision software “fits” on the coprocessor and can operate within the processor’s 4GB memory capacity.

Input requirements

- **Video:** Open source CV software has ability to tap into camera feed through HDMI connection to co-processor
- **GPS:** Software has access to GPS through Pixhawk to grab raw GPS coordinates of aircraft upon target detection

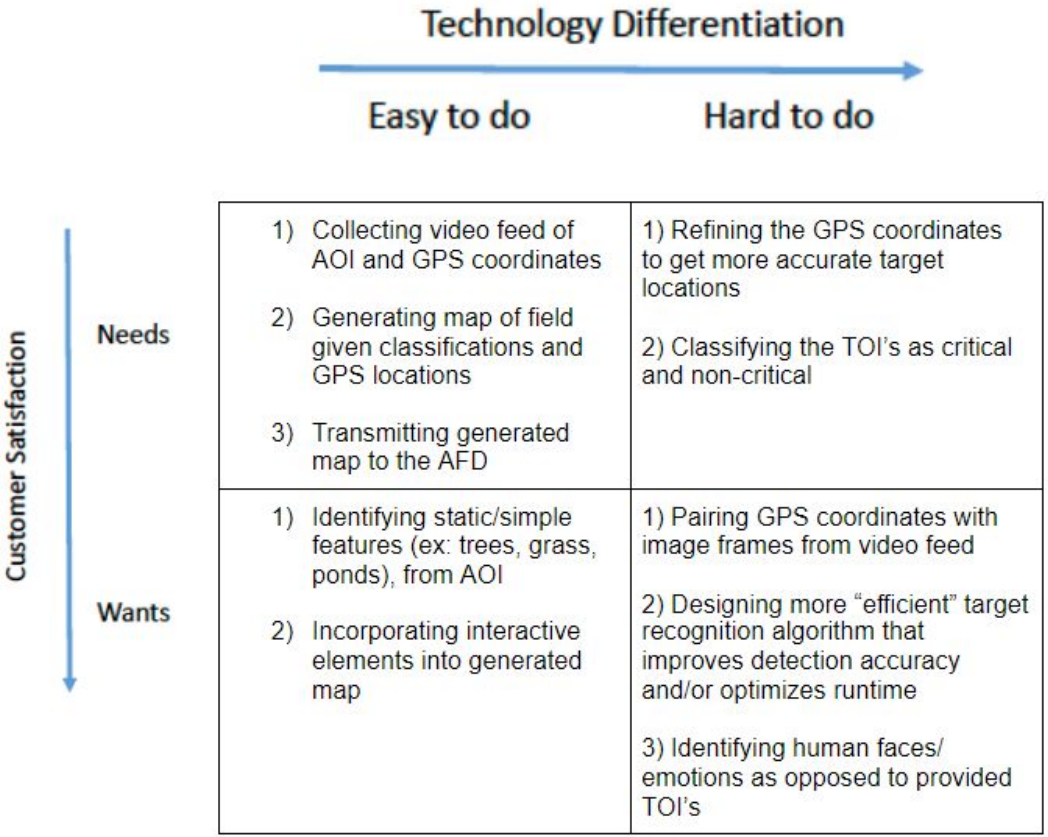
Output requirements

- **Identification:** Open source CV software trained to identify smiley & frowny faces, distinguishing between the two, while aircraft flying over search area.
- **GPS:** Customized software to optimize GPS coordinates & outputs coordinates in format suitable for Payload Drop team, could be but not limited to a text file.
- **Map Generation:** Software outputs spatial map of identified targets’ in the form of but not exclusive to JPEG image; image transferred to the ground station at end of aircraft’s search phase

Product Engineering Specification Request

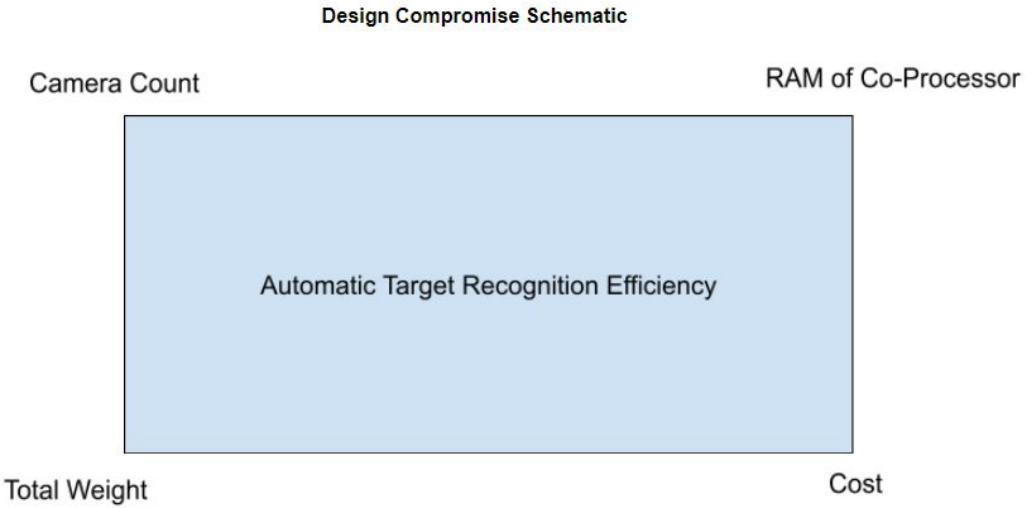
Target Identification Time	**Want:** < 6 min **Need:** < 12 min
Power Supply to Co-processor	5v and 3 amps over usb connection
Object Detection	Up to 5 targets (smiley & frowny) 2m x 2m @ 200 ft altitude
Imaging System Weight	**Want:** Light as possible **Need:** < 4lbs
CV (Image Processing) Software Memory Usage	< 4GB RAM
Search & Mapping Accuracy (GPS locations of TOI)	**Want:** 20ft error radius **Need:** 60ft error radius

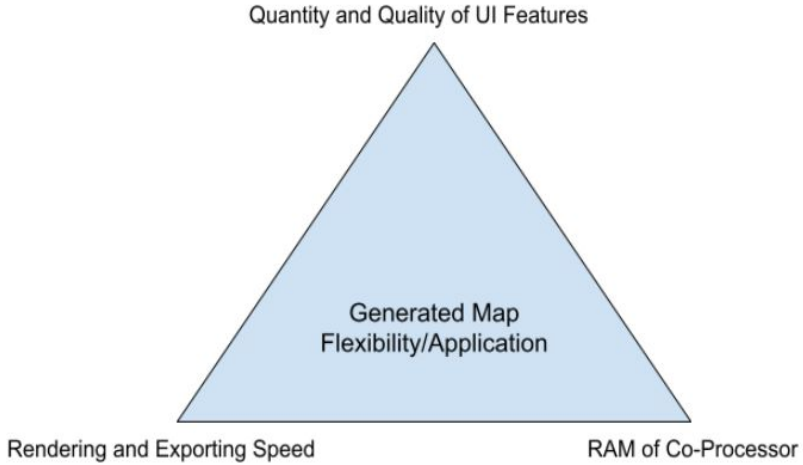
Requirements Decision Matrix



1) Collecting video feed of AOI and GPS coordinates 2) Generating map of field given classifications and GPS locations 3) Transmitting generated map to the AFD	1) Refining the GPS coordinates to get more accurate target locations 2) Classifying the TOI's as critical and non-critical
1) Identifying static/simple features (ex: trees, grass, ponds), from AOI 2) Incorporating interactive elements into generated map	1) Pairing GPS coordinates with image frames from video feed 2) Designing more "efficient" target recognition algorithm that improves detection accuracy and/or optimizes runtime 3) Identifying human faces/ emotions as opposed to provided TOI's

Design Compromise Considerations





Requirements Verification and Validation

COE Imaging Design Team - Request for Requirements Validation/Verification Inbox ×

Justin Campb... Tue, Feb 15, 7:46 PM (14 hours ago)
to rmjacobs28, Preston, rohan.wariyar, Nicholas, ryanarylagan

Hello Riley,

This is Justin Campbell from the COE Imaging Design Team. In preparation for our deliverable tomorrow afternoon on a preliminary requirements review, we have assembled key information on our general, subjective, and quantitative requirements into a google document to present to our points of contact. As the project manager

Preliminary Requirements Proposal - COE ATR and...

of the Aircraft Design (ASE) Team, our team was wondering if you could run through our google document and provide us with high-level feedback (perhaps through comments, or an email response) on requirements that are consistent with your team's requirements/expectations, recommendations for requirements to add, change, or remove entirely. This will help us receive validation/verification heading into the Preliminary Design Phase of our project.

Best Regards,

Riley Jacobs Tue, Feb 15, 9:50 PM (12 hours ago)
to me

Hello!

The slides/dock looked good. The only thing that I would update is the altitude to 200 ft AGL. I sent y'all a message over slack if you want more details. Other than that, looks good to go!

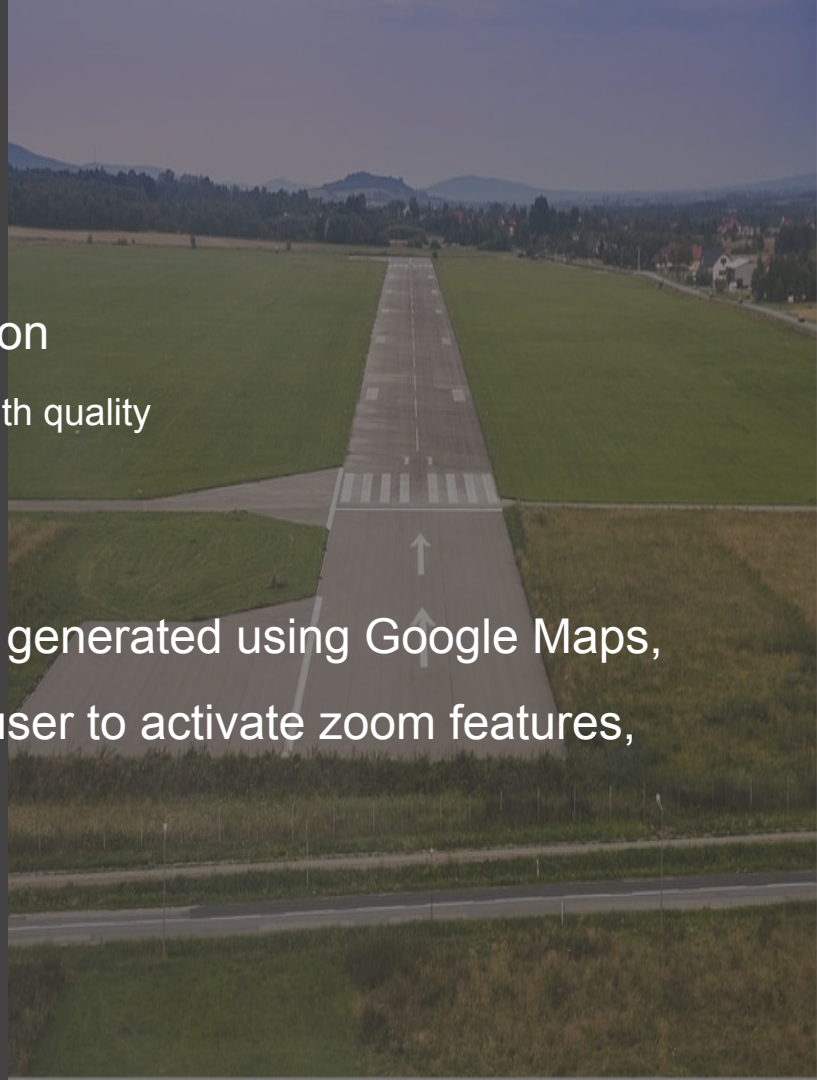
Best,

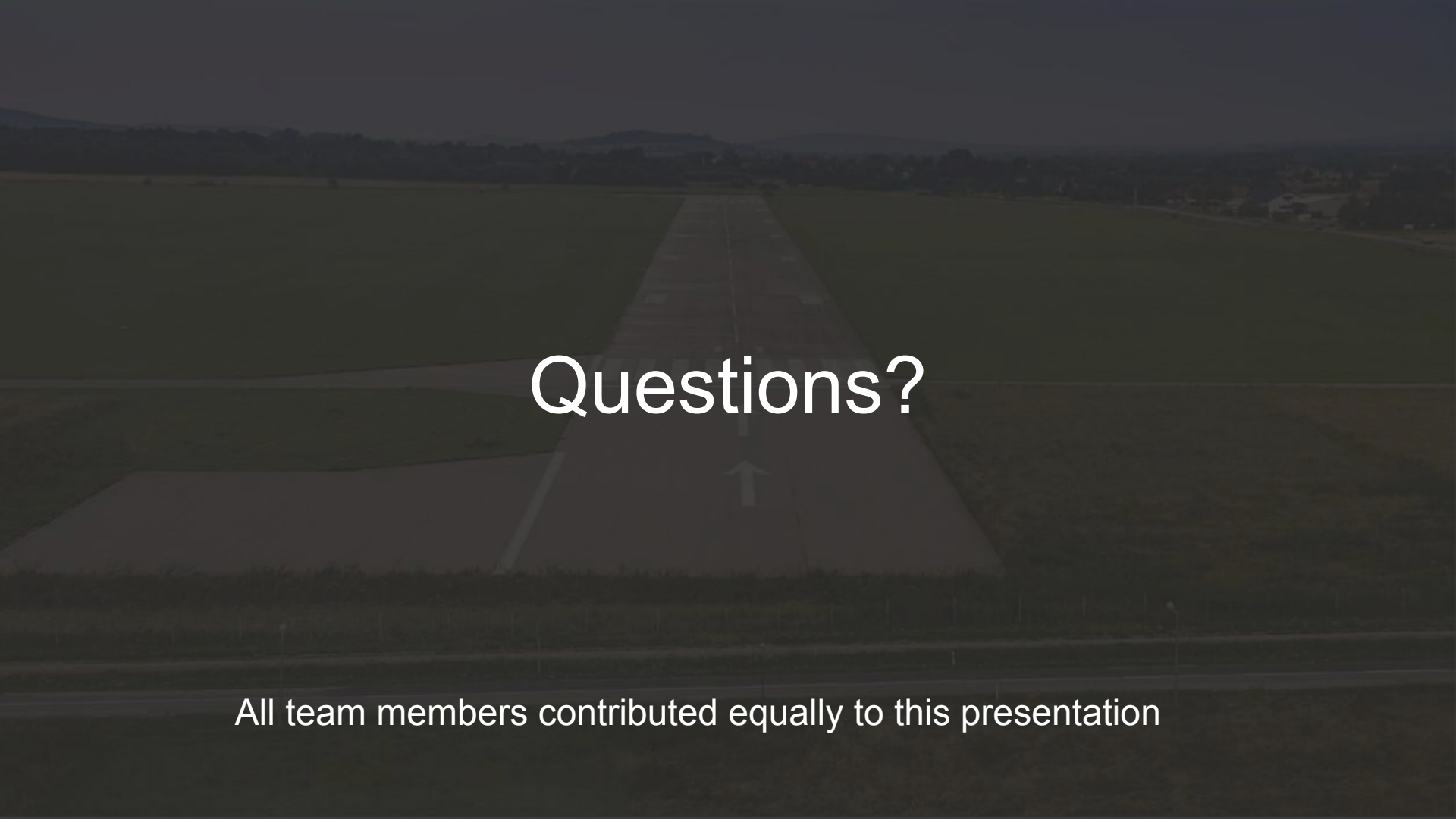
Riley

Requirements Not Nailed Down

- Size of output medium for the map generation
  - Dependent on the output format, size increases with quality

- File Format of generated map (static image generated using Google Maps, dynamic/interactive image that allows end-user to activate zoom features, etc.)





Questions?

All team members contributed equally to this presentation