Minnesota Space Grant Consortium (MnSGC)

2020-2021 Exploration-Flying Quadcopter Challenge

Preliminary Design Review

Team Name

[Insert a Meaningful Photo or Figure (like a logo)]

Written by: (*full names of all students*)

Advisor:

Institution:

Report Date: January 22, 2021

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1. **Introduction to Project and Team Members**

Introduce the overall project describing in general terms what you are trying to accomplish. Also introduce your team members and include a team photo (or montage) with individuals identified, either directly on the photo(s) or in a caption. Team roles will be described in the organizational chart later, but a brief description about who will be working on what parts of the project might be helpful here as well.

1. **Blue Heron Drone Flying, Soldering, and Microcontroller Programming: Technical Skill Set**

Report, using text, diagrams, and/or photos (note: every photo, diagram, graph, etc. here or elsewhere needs a unique number and a caption), on (A) progress learning to fly the Blue Heron (including determining the maximum load you are comfortable having it lift – this value will influence your overall plans), (B) progress on team members completing the learn-to-solder activity, and (C) progress on at least basic microcontroller programming. Give preliminary coverage (provide more details in section 4.0) to your microcontroller choice (Teensy 3.5 or other?) and the sensors you will fly. In particular, did the team test and/or adopt sensors other than those provided? Will you fly a live radio telemetry system or implement some other means of learning about the sensor values which the drone is in flight? Describe any custom part(s) your team is designing for this project: e.g. modified solder-breadboard(s), custom printed circuit board(s) (pcbs), sample return arm, etc.

1. **Organization of (Remote) Team Work**

Discuss the organization of team work, especially as modified by COVID-19 restrictions which may have led to limitations on in-person meetings and on sharing hardware. Talk about the creative/alternative ways the team has managed to continue making progress on the project. Items you may want to include in this section might include:

- All-team meetings and training sessions (possibly remote)

- Sharing of hardware and team’s process for sensor testing and selection

- Options for continuing to improve drone flying capabilities

- Plans/progress on collecting footage for the team’s two videos (due later)

1. **Progress and Plans for Accomplishing Challenge Goals**

This section gives more details about progress/plans for selection, programming, testing, and integration of flight electronics and other matters. Include comments about designs considered but not adopted, why specific design decisions were made, material(s) used, price, how custom parts (if any) were fabricated, component weights, final weight (might have to be estimated at this stage), and dimensions. Include diagrams and/or photos, especially of custom item(s) designed.

Items to be considered are:

- Discussion the sensor suite the team is planning to carry with the Blue Heron drone to measure both ambient and unusual physical characteristics of the exploration area. Describe all sensors planned, especially any sensors in addition to the ones supplied. Explain how you plan to mount the electronics to the drone. Above or below the body? On the legs? etc. Talk about how things attach/detach if they will need to be swapped out.

- Talk about the camera mount and potential live video telemetry. Discuss what camera(s) is(are) being considered and how you plan to switch between out-view, down-view, etc. Will this be done manually (between flights) or using a servo mechanism while in flight?

- Discuss ideas for taking close-up images. Will this use the same camera that is being used for general exploration and mapping? Ideas, if any, about how to mount, focus, and steady the camera, maximize/optimize resolution, and image specific targets on both horizontal and vertical surfaces.

- Comment on plans for generating maps (including size/elevation of object in the exploration area, with real units.

- Discuss progress/plans for programming microcontroller(s) to log (at least) and possibly transmit sensor data while in flight (or perhaps use indicator LEDs).

- Talk about accomplishing “sample return” (e.g. collecting at least 1 cubic cm of fluid and/or granular samples from the exploration area).

- Discussion of specific team member roles (pilot, home base videographer, person monitoring live video feed (if any), person monitoring data telemetry feed (if any), people who will swap out hardware, et.

- Decisions about the order in which hardware will be flown (i.e. the data will be collected), assuming parts may need to be switched out during the fly-off. Perhaps “General video (for making maps) first, then sensor suite, then sample collection hardware, then…”

1. **Organizational Chart** (and perhaps Description of Roles)

Create an organizational chart (an “Org chart” – look up examples on the internet to see what this might look like) stating team roles and listing who is fulfilling each. Describe here (or else in the Introduction) who is involved in each part of the project and explain (briefly) what each part entails.

1. **Budget and Parts List**

List all provided and purchased parts (perhaps in an Excel spreadsheet – insert directly, or as a screenshot). Include vendor, cost, and other details that may be relevant (especially weight). Describe or list (separately) your planned future purchases, as many as are known.

1. **Schedule**

This will include past as well as future dates, sort of like a journal. Detail how the fall semester went (what you got done, how long it took, who worked on what, etc.). Lay out a timeline for the upcoming semester and what you plan to accomplish and by when. Look up “Gantt Chart” to see one way in which such a schedule might be laid out. In addition to listing just deadlines and tasks, assign names of team members to specific tasks (i.e. at least name who will be in charge of organizing each major part – programming, sample return, bench testing, soldering/installation, documentation/photography, fly-off operations, etc.). Spread the load!

1. **References**

Cite web links or other references you have used. This might include links to instructional videos, additional Teensy (or other microcontroller(s)) teaching materials, data sheets for sensors and other electronics, etc. Number the references here and mention them, by number (and in the order in which they are listed), in the main text. Include a direct link to the challenge website in this list.

1. **Appendices**

This section is for supporting documents. There may not be many yet, but you will need more in future reports. This report should at least include the list of challenges announced at the kick-off – call that Appendix A. Supporting documents will eventually include flight code for the Teensy (or other microcontroller(s)) used for logging sensor data and/or for controlling servo(s), supporting calculations (like weight sums used to help decide whether to fly all equipment at the same time or to swap things out), etc.