NASA’s MN Space Grant Consortium

2019 – 2020 Intercollegiate Quadcopter Challenge

Preliminary Design Review

Team Name

[Insert a Team-Photo-With-Hardware (at least) and a Team Logo (optional)]

Written by: (full names of all students)

Advisor:

Institution:

Report Date: January 27, 2020

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

Introduce the overall project with a general description of what you are trying to accomplish and why you are doing it. Also introduce team members with either a whole-team photo, with individuals identified, or individual team member photos. Team roles will be described in the organizational chart (“Org chart”) later, but a brief description about who will be working on what parts of the project might be helpful here.

1. **Blue Heron Drone and Flame Wheel F450 Kit: Build/Fly/Tune Progress**

Report using both text and photos (note: every photo, diagram, and graph needs a unique number and a caption – labels are optional, but will often be useful too) your progress on learning to fly the commercial Blue Heron drone and on the overall build/fly/tune of the Flame Wheel F450 kit (which should be very far along by the time you submit this report). Comment about how build went, especially what was particularly challenging/educational and what deviations, if any, you made from the basic build. Describe custom part(s), if any, you added to the F450 drone itself apart from items for the challenge (which you should describe in the next section). For example, if you made a custom piece for your gps module to mount on then include CAD diagram(s) and photos here for documentation. For any such custom part include comments about why the part was needed/useful and how the design was chosen, the material(s) used, the price, how the part was fabricated (does not have to be using 3D printing or laser cutting) and the final weight and dimensions.

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

Items you may want to include in this section:

- Discuss plans for making your team videos (and progress, if any).

- Explicitly talk about how team members are improving their CAD skills and their microprogramming skills. Those are two educational goals of this program so be sure at least some team members (preferably all team members) improve their skills in these areas.

- Give ideas about how you will continue improving your flying capabilities. We encourage every team member to learn to do at least some basic drone flying, possibly just with the Blue Heron drone. We strongly recommend you have more than one person (and possibly every team member) also gain experience flying the Flame Wheel F450 quadcopter. In this subsection talk about your experiences tuning the Flame Wheel F450. Remember that as you add accessories to it you might need to continue to tune it.

- Share some details about your plans for adding a camera (or more than one) to your drone for challenge flying. Include at least one labeled sketch (unless you already have a CAD for a final design, in which case include that instead). Explain your plans for attaching the camera(s), which might include fabricating camera mount(s). Discuss what specific camera(s) you are considering, and how you plan to collect both out-view and down-view footage (you will definitely want both) – either manually or using a servo mechanism or just by using multiple cameras. Will the same camera(s) be used for general exploration and for making maps? Include ideas about how to focus and steady the camera(s), how to maximize/optimize resolution, and how to image items on horizontal and vertical surfaces.

- Summarize your team’s progress in hardware selection (or design + fabrication) and also in programming/testing for the exploration challenge: Mention plans for taking images of specific targets in the exploration area, plans for generating maps (including elevation, with real units), plans for a microcontroller-logged sensor suite to measure physical parameters of the exploration area (and to look for anomalies like hot/cold spots or hidden magnets), plans for accomplishing sample return (e.g. collecting a 1 cubic centimeter of a fluid sample from the exploration area), etc.

1. **Plans for Challenge Flight Day Operations**

This section describes plans for operations and roles during the challenge flight day. Some items to consider are (a) how flight equipment might be switched out during exploration flying, (b) how to fly so as to get real units on maps (e.g. how to establish horizontal and vertical scales), (c) how video and sensor data will flow in real time – on-board SD card logging (strongly recommended) and/or live video/data telemetry (optional, but might be quite useful), (d) what roles team members will play during challenge flying – pilot(s), spotter(s), monitor(s) of live video feed and/or data telemetry laptop, etc.

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 parts (in an Excel spreadsheet). Include vendor, cost, and any other details that may be relevant (especially weight and size). Describe or list (separately) your planned future purchases, as many as are known at this time.

1. **Schedule**

This should include past as well as future dates, sort of like a journal. Detail how the past semester went (what you got done, how long it took, etc.). Lay out a timeline for the upcoming semester and what you are hoping to accomplish and by when. Look up “Gantt Chart” to see one way in which a schedule might be laid out. In addition to listing deadlines and tasks, add names of team members to the schedule (i.e. include who will be in charge of getting each part done). Spread the load!

1. **References**

Cite web links or other references you have used. This will definitely include the Flame Wheel F450 instruction manual, the DIY book, the posted TA notes, and the challenge web site. This might include links to instructional videos you found useful, additional Arduino teaching materials, data sheets for sensors and other electronics, etc.

1. **Appendices (also expected for later reports, including oral and video reports)**

This section is for additional supporting documents. There might not be many yet, but you will need to supply these in conjunction with all future (oral and video) reports as well. For example, in this PDR at least include a list of specific challenges – call that Appendix A. This section will eventually include flight code for your Arduino (or other microprocessor) system for logging sensor data and/or for controlling servos, supporting calculations (like weight sums used to help you decide whether or not you can fly all your equipment at the same time or need to swap things out), etc.