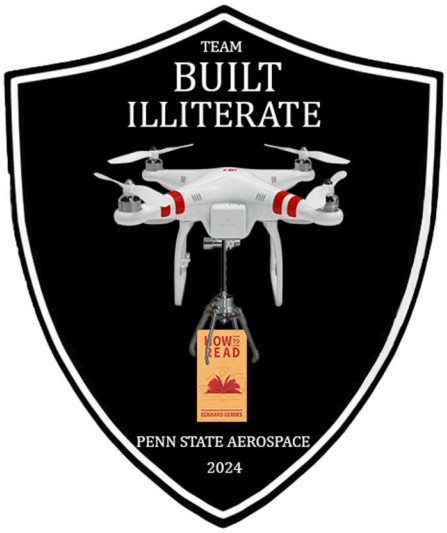
Manual Flight Milestone



April 2, 2024

Principles of Success

The most important criterion of success for this milestone was the approval from Dr. Johnson stating that our drone flew well enough to begin working towards autonomous flight. As for our personal success criteria, it was based on the quality of flight – which is not something that could be calculated. The team used the Cooper-Harper handling qualities scale, which is an assessment conducted by the pilot of the vehicle on how well they feel the vehicle can be controlled.

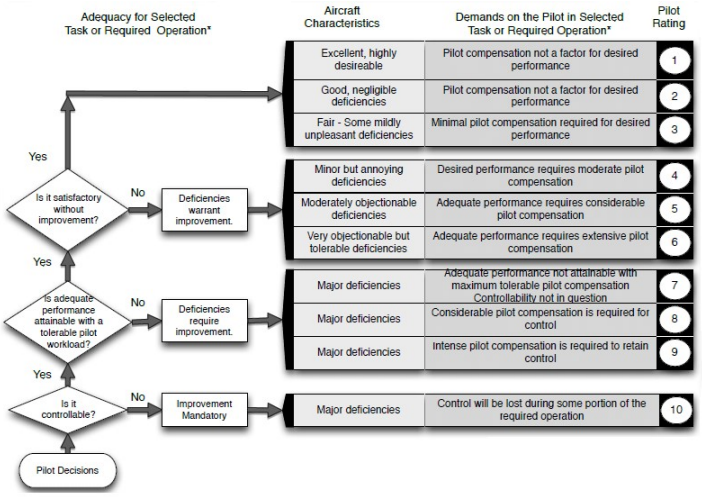


Figure 1: Cooper-Harper handling qualities rating scale

Figure 1 shows the metrics used for determining the pilot rating of the flight, where a 10 is not at all controllable and a 1 represents a vehicle with near-perfect handling. In our case, we were looking for a 6 at the highest setting. This would mean that our drone would be able to be controlled but could just use some gain value tuning during the process of working towards the Dynamic Path Planning Milestone. Our initial flights put the drone at a 10 since it was extremely difficult to even get it off the ground. Once issues were resolved, the team pilot felt that the drone had a handling quality of 4, marking the manual flights as an official success.

Achievement

For what our team understood as the evaluated criteria of the milestone, we did not complete it on time, as we were a month behind schedule. The date we set for ourselves to be ready to be evaluated was February 29th, but manually flew the drone successfully on April 2nd. The first time the group attempted to fly manually was on March 21st when the drone spun all four motors briefly before pitching into the ground. This was due to the drone having a low pass filter, which was delaying the inputs from the IMU. It took 12 days to figure out that the low pass filter was causing the issue – not the gain values. They were collectively believed by the group to be the problem, so searching for a different answer was not a thought. Once the group knew that the issue was the low pass filter, the drone was successfully piloted the same day.

Roadblocks

The primary roadblock to achieving the manual flight demonstration was realizing that the issue with the drone not flying correctly was the low pass filter and not the gain values. The group was stuck for 12 days on tuning the gain values before realizing that the true issue was the implementation of the low pass filter in the code. This segment of the controller simply needed commented out, and the drone was able to be manually controlled.

Lessons Learned

Not too many lessons were learned during the work of this milestone, but a realization of how the engineering world operates is becoming more apparent, and delays should be part of the plan. Also, it can be hard to decide to look for other solutions to a problem when it seems there is only one path to follow. Taking a step back, asking those more knowledgeable, and discussing the bad results with the group could have helped to speed up the process of discovering that the

problem lay within the low pass filter the entire time. Exploring other solutions when stuck like this will allow for better time management on milestones moving forward.

New Timeline Review

A three-week setback on the Flight Safety Check, and then 12 days spent solving an issue that was not the problem to begin with, has pushed the team into an uncomfortable position. Understanding that the issue was the low pass filter and not the gain values took longer than expected, and now we face the chance of not being able to perform an autonomous flight by the end of the semester. All hard and tedious tasks from now on have been crammed into several day windows at the most (albeit work can be done on the weekends even though it is not shown in the Gantt chart). The next milestone the team has set for ourselves is the Simulation Autonomous Flight Milestone, which is meant to be completed by the end of week 13 of the semester. This seems unlikely to happen given our current state, so deadlines will only continue to become more crammed in the future.