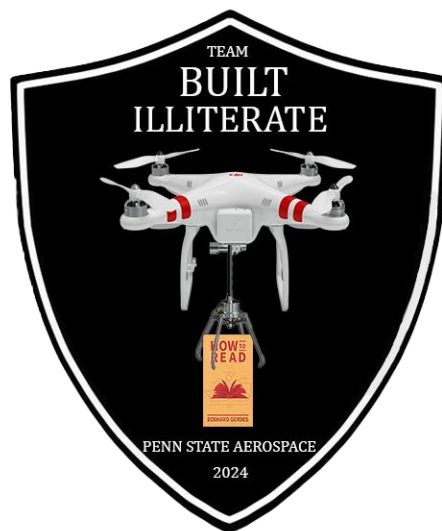


# Full Autonomous Flight Milestone



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### Principles of Success

The metric of success for this milestone was not able to be demonstrated, but it was conceived if the team were able to meet the deadlines. To consider the full autonomous flight a success, the drone must autonomously take off to a height of 2 meters, dynamically plan a path to the beacon, follow the path to the beacon, hover 1 meter over the beacon, drop the payload mass on the target, and then return and safely land within 1 meter of the starting location. In addition to this, having no human interference between the takeoff and payload release intervals will also be a requirement of a successful flight. If the drone were to need manual assistance to return to the takeoff location, then that would still constitute a success. However, since there will not be a fully autonomous flight, this milestone cannot be considered a success.

### Achievement

The team was not able to achieve the milestone of a fully autonomous flight. The work needed to accomplish this was more extensive than initially thought. There was still the simulated autonomous flight in the way before it could have been possible to start working towards this milestone. The team is still attempting to autonomously takeoff and hover, so the drone currently has no autonomous features within the current logic. To get to that point of autonomy, there would need to be some path planning implemented, a Kalman filter to muddle the noise from multiple sensors, and then a way of detecting the location of beacon wherever it is in the box. These steps require a lot of time that the team did not have. For the mentioned reasons, the fully autonomous flight milestone cannot be considered a success.

### Roadblocks

There was no main roadblock that prevented the team from accomplishing this milestone; there was simply just a lack of time. As milestone dates got pushed back and less tasks were being completed, there was much less time available to complete every goal. Beyond the setback of the manual flight demonstration, the data processing between the ultrasonic and Pozyx systems to implement an altitude controller took much longer than expected. The time needed to complete these tasks has led the group to divert all work to develop an autonomous takeoff feature for the drone. This would provide some level of autonomy that would earn points in the competition.

### Lessons Learned

Since this milestone was not attempted, there were not any lessons learned from it directly. If there had been more parallelization throughout the team for entirety of the semester, then it could have been possible – but still unlikely. The main problem with parallelizing work is that not everyone knows how to do everything. Those specialized in areas like structures are not as knowledgeable about the coding side of the project, making it hard to utilize everyone in the group for one task. In addition to this, other classes and limited time in the hangar have gotten in the way of being able to further the progress on the drone. These were problems that the group expected to happen but did not manage them well.

The effort needed to build a fully autonomous drone from the ground up within 4 months is essentially impossible for a group of undergraduate students. There is a level of experience and knowledge that the team lacked that led to slow accomplishments throughout the semester. Even though the project is seemingly impossible, it shows the effort, communication, and experience

needed by engineers in the real world to figure out seemingly impossible problems. In order to solve these problems, it is not about how often you fail, but how you recover from it. There is almost always a solution – sometimes several – to a problem, so taking a step back to figure out a way of overcoming it can make the path to success much smoother.

### New Timeline Review

With the setbacks encountered leading up to the manual flight demonstration, it seemed unlikely that this milestone would be completed. In the new schedule, all assigned tasks after than manual flight demonstration and the remaining milestones were inactivated since they could not be completed. Not only this, but the direction of the tasks did not directly align with the work that the group had been doing. Therefore, a new goal (represented by a milestone) and the associated task was added to show that an autonomous takeoff is the final push for the group to make before the competition takes place. It will be the sole focus of work throughout the following week, besides the preparation needed for the Design Showcase.