

Week 15 Air Support from DJI M210 RTK

Date: 12/02/2021

DJI Matrice 210 RTK V2 is a quadcopter platform that is able to carry two cameras to the sky. In today's event, we were using a long-wave thermal camera (XT2) and a zoom camera (Z30) to do some searching in the forest. M210 uses a dual operator mode. One person controls the aircraft, and another person controls the two cameras, just like operating a DJI S1000. On the monitor, the larger screen is showing the image from the camera which is being controlled by the sensor operator. Clicking the smaller image at the corner is the way to switch the camera to control.



Figure 1: DJI M210 with Z30 (its right) and XT2 (its left).

Part 1. Mission description

1. Game 1: Hide and Seek

A pilot and a sensor operator will operate the M210, and the rest of the people will hide in the forest. The goal for the flight crew is to find everyone hiding in the forest with M210.

2. Game 2: Air Support

Our ally escaped and sent a signal in the forest, but there are two hunters after him. The flight crew must find the ally before the hunters kill him.

Part 2. Site Condition

1. Weather condition:

The strong wind was coming from the east, and the temperature was about 10 C. Clouds cover 95% of the sky.

2. Site condition:

Takeoff point was on a concrete path in an open area, exactly at 40.523677 N, -86.884030 W. We chose this point to takeoff was to avoid the multi-path air which is a situation when the signal of the GPS is reflecting everywhere on a surface. The forest was to the east.



Figure 2: Site and weather condition.

Part 3: Flight Operation

1. Game 1 Adam and Michael were the M210 operators, and the rest of us were hiding in the forest. After hiding for a while, we finally heard the drone flying near us. With the thermal camera onboard, only the people hiding behind a tree could hide. Finally, only one person had yet to be found. The two controllers were handed over to two people who didn't know his position.

Takeoff time: 9:52

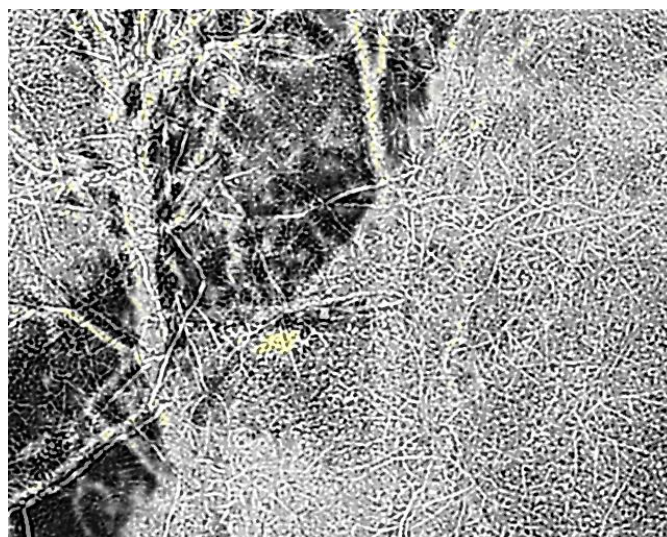
Landing time: 10:14

2. Game 1 continued.

From the zoom camera, we could clearly see the white notebook from the sky. The thermal camera showed a yellow spot on the screen.

Takeoff time: 10:17

Landing time: 10:24



(a)



(b)



(c)

Figure group 3: (a) and (b): The last person was still hiding in the forest (yellow spot in (a)), then walked out after he realized that he was spotted (c). The only hiding spot for him was under the trunk. If there is no cover on the top, we can see him anywhere we want because of the maneuverability of a quadcopter.

3. Game 2

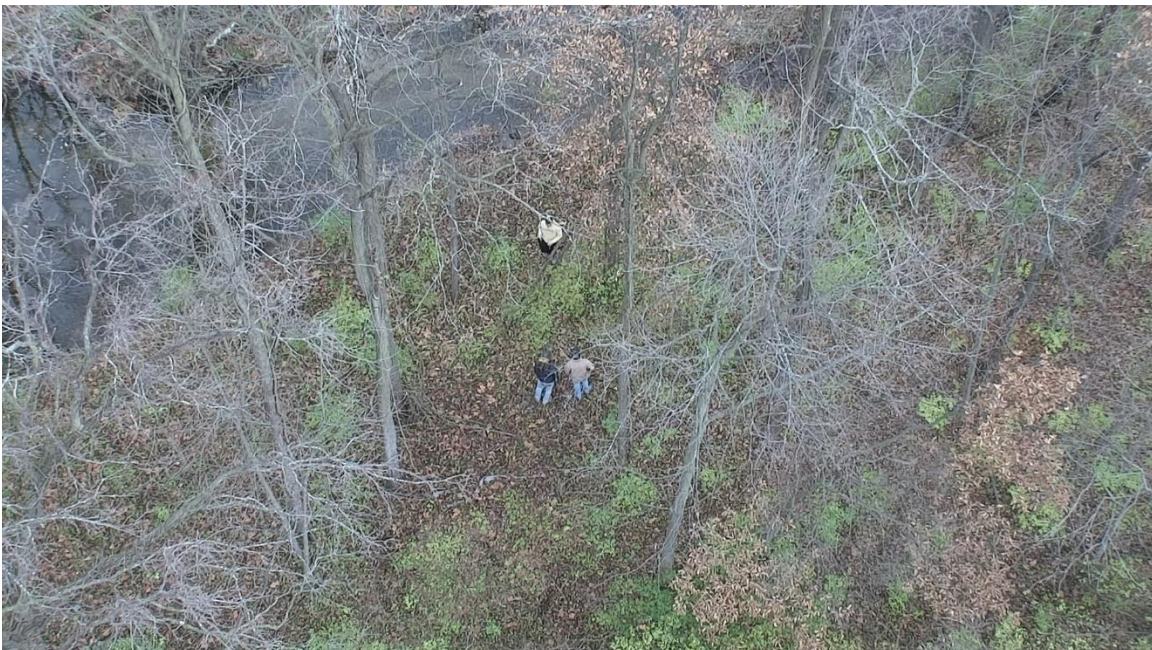
After the hider lit up the firework, the hunter and the crew began to search. The crew was switching two cameras constantly. They used the thermal camera to find the possible target and then switched back to the zoom camera to verify. The hider was found by the crew first.

Takeoff time: 10:33

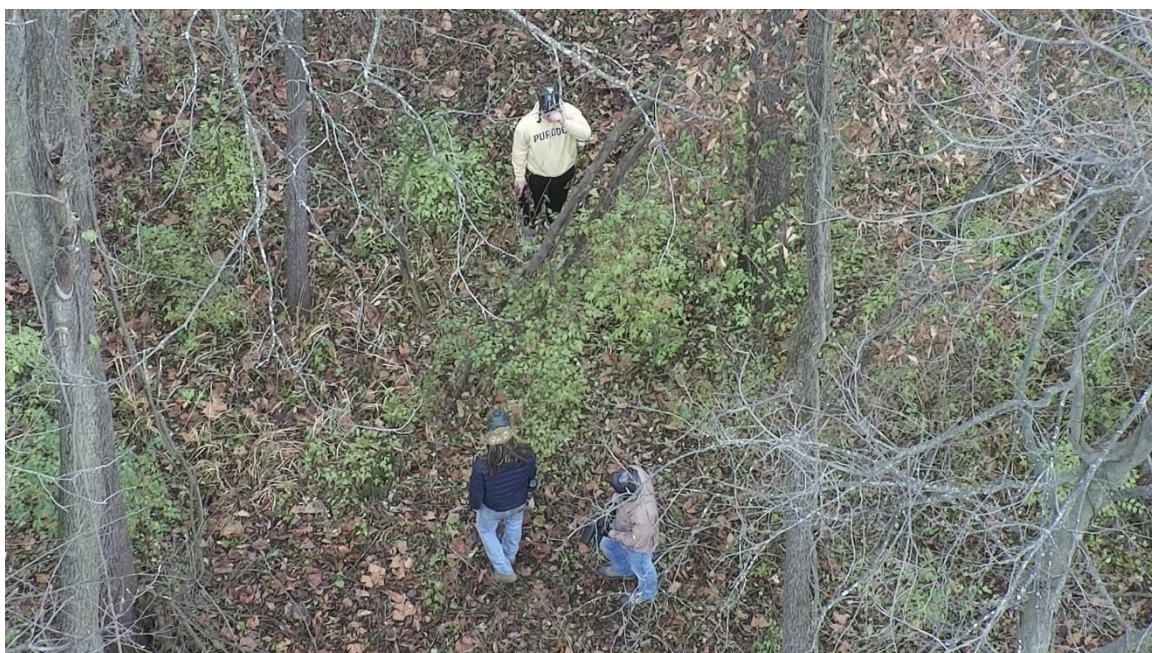
Landing time: 10:41



(a)



(b)



(c)

Figure group 4: (a): Hunters in action. (b) and (c): After zooming in, we can clearly see "PURDUE" on hider's hoodie. The zoom camera had no pressure to track objects in open area (i.e., small portion of the leaves remained on the trees, so we can see through the branches all the way to the ground)

4. Game 2 continued

In the second round, the crew couldn't find the hider from the sky for a very long time. While switching two cameras so many times, with many eyes watching at the monitors as well, they started to panic. I heard the pilot said, "Climb to 300 ft, screw it." The altitude might be too high to spot the person in the forest. When we find the hider, he had already been with two hunters, "killed".

Takeoff time: 10:51

Landing time: 10:59



Figure group 5: We can only spot the two hunters in grey and dark red. One of the reason was probably that the obstruction was too thick to capture the heat radiation from the hider by the thermal camera. Two hunters were in the open area, so it's easy to spot them with any one of the two cameras.

Part 4. Conclusion

From this event, we are able to see the potential of the air support from DJI M210 and also its disadvantages. During the total flight time of 47 minutes, we just changed the battery set once. Its flight duration allows the crew to search longer in time and distance. Two cameras with different functions allow the crew to find people behind the trees and see them clearly from a large distance. The thermal camera highlights the object on the screen, and the zoom camera makes the image larger. The advantage of the M210 itself is its high maneuverability of hovering in one place and flying to anywhere we want. However, if we are looking for a dead body, the thermal camera won't provide sufficient information to us since the dead body doesn't have thermal radiation. Also, the noise coming from the M210 can be heard far away, so the hider is able to take some actions to avoid the search in the forest.

Overall, the event was a success. The difficult part is how do we let more people be involved in the games and let them understand the advantage and disadvantages. There could be a large bright screen that displays the image from the camera. There could be more games with shorter time duration each time. Also when someone is in the forest, it's better to have a radio to communicate with caution of interference with the drone signal. Not only the gamer knows what's happening, but also the spectator knows what the progress is.