Unmanned Aerial Vehicle Use for Search and Rescue and Disaster Relief

Liberty V. Burckhard

South Dakota State University

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Richard Stevens

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In 2019, the FBI reported that there were 609,275 missing person cases across the United States. (FBI 2019). These cases include missing person records for individuals "Who have a proven physical or mental disability, are missing under circumstances indicating that they may be in physical danger, are missing after a catastrophe, are missing under circumstances indicating their disappearance may not have been voluntary, are under the age of 21 and do not meet the above criteria, or are 21 and older and do not meet any of the above criteria but for whom there is a reasonable concern for their safety." Also in 2019, there were 293 natural disasters, causing "…11,755 deaths, 95 million people affected and 103 billion US$1 in economic losses across the world." (Centre for Research on the Epidemiology of Disasters 2020). In recent years, unmanned Ariel Vehicles (UAVs) have become a vital tool in solving these missing person cases. In this paper, I will be explaining the expanding use of UAVs in search and rescue cases and disaster relief for the modern era.

How Time Affects Search and Rescue and Disaster Relief

The first 72 hours, in a search and rescue or missing person case, is the most important part of the investigation. After these 72 hours, the likelihood of finding the victim alive decreases drastically (Jacobo 2018). ABC News interviewed Dr. Bryanna Fox, a former FBI agent and criminology professor at the University of South Florida, regarding search and rescue operations. Fox explained that "The first 48 hours are also critical because that's when investigators have the best chance of following up on leads before people's memories start to fade." Additionally, former FBI Special Agent in Charge and ABC News contributor, Steve Gomez, said that "…it's important to generate as much awareness and as many leads as possible…they tend to slow down after the 72-hour mark." These statements support the notion of how important the first 72 hours

in an investigation are. In certain cases, the missing person could be in grave danger, especially in cases where children have been abducted. Gomez added, “For others who go missing, there is usually a point in time in the investigation when objective switches from attempting to find a live person to trying to locate a body.” This point usually occurs after the 72-hour mark has been reached.

Search and rescue cases can put the victim in dire situations. In the case of 80-year-old James Clark, who was incapacitated on the hike up to the summit of New Hampshire’s tallest peak. “When rescue teams found James Clark on Mount Washington’s Lion Head Trail at 1:15 a.m. on June 14, 2019, the 80-year-old Dublin, Ohio, resident was barely clinging to life.” (Welch 2020). These situations can result in either life or death depending on mere hours. Searching large areas can take volunteers days, weeks, or months to scour the entire area, and very few missing persons could survive a long time stranded in a dangerous area.

Disaster relief is another situation where time is a key to finding as many victims as possible. Recently there was a condominium collapse in Florida, and EMS responders searched for days to find as many people as possible (Martínez et al. 2021). These situations can take hundreds of searchers, dozens of helicopters, and numerous supplies. Sometimes, the victims are stranded in areas impossible to reach by a person but a small UAV could reach them.

Money as a Contributing Factor in a Search and Rescue or Disaster Relief Situation

In all these situations, funding plays a large factor in how many resources can be used to find missing persons, send relief, and search for survivors after disasters (Sharples 2005). Having helicopters, Emergency Medical Services (EMS), volunteers, and other resources costs a large amount of money. The New Hampshire Fish and Game (NHFG) reports that they “…made an

average of 189 rescues a year, costing between $500 and $3,000 each, since 2008. Where NHFG's cost of search and rescue missions averages $309,000 each year, the department's annual search and rescue budget is much lower – approximately $180,000…" (Welch 2020).

Addition of Unmanned Aerial Vehicles

The addition of UAVs can decrease the cost of search and rescue. AirMed&Rescue reports that "…conventional solutions involving manned aerial assets such as helicopters and fixed-wing aircraft, where hourly rental rates up to €3,000 ($3,528) per hour exist" (McGrath n.d.). In the case of UAVs, a Mavic Air 2 can be a one-time cost of between $799 to $1,399 (DJI n.d.).

UAVs have also changed how search and rescue operations are conducted. With a UAV, there is less time than it takes to search a larger area. An investigation on methods for integrating unmanned aerial systems in search and rescue operations was conducted by the School of Aviation and Transportation Technology, Purdue University, West Lafayette, Indiana (Weldon & Hupy 2020). This investigation used computer-assisted techniques connected to an Unmanned Aerial System (UAS) that was equipped with a Red-Green-Blue (RGB) color sensor. The UAS used a UAV to collect images that were then searched for images of six articles of clothing, and a mannequin that was used as a simulated missing person for the study. A DJI Mavic 2 Pro was used in the study to search the area by passing in parallel lines above the ground surface methodically collecting imagery. The UAV was able to search a 48-hectare area for the 7 objects for a basic search and rescue operation. Different groups of volunteers used the generated imagery from the UAS to locate the objects. One group used software in an automated search system. Another group found 5 of the planted objects in under 30 minutes, compared to the software group which found three objects in around 36 minutes. Both of these times were much

faster than having ground volunteers search for the simulated objects but the procedure still requires some research to find a best practices approach for using UAVs.

Disaster relief operations are also changed with the introduction of UAVs because they can carry payloads to victims stuck in situations in locations that are inaccessible by foot and other methods of rescue, such as helicopter rescue, will not be available for a longer time. Packs of supplies such as food and first-aid, radios and portable chargers, and other supplies like sleeping bags or heat blankets can be dropped to survivors. This can turn a situation around from life or death because of how long it can take to reach someone on foot or in areas where a helicopter can't land. Search operations can also occur at night since UAVs can be outfitted with thermal sensors and predetermined search paths negate the need for the drone to be able to see (Blue Skies Drone 2021). However, the FAA still requires a visual line of sight to be maintained while operating a UAV.

The use of UAVs is increasing even in South Dakota. The recent recovery of two bodies found near Farm Island in Pierre, South Dakota, was aided by the use of UAVs (Dakota News Now 2021). The Sioux Falls police department had access to UAVs, even though it is a police department in a state with a low population. This goes to show that UAVs are affordable, in some cases much more affordable than helicopter searches.

Conclusion

In the past, search and rescue operations have taken countless time, money, and resources. While there have been a large number of successful operations, the addition of Unmanned Aerial Vehicles has increased the success rate and decreases the number of resources needed. In the future, this should lead to more lives, money, and other resources saved, with less stress and families reunited with their loved ones faster.

References

Blue Skies Drones. (2021). “Drone for Search and Rescue.” Retrieved on August 5, 2021, from www.blueskiesdronerental.com/industries/search-and-rescue/.

Centre for Research on the Epidemiology of Disasters. (2020, August 5). *Natural disasters 2019 - world*. ReliefWeb. https://reliefweb.int/report/world/natural-disasters-2019.

Dakota News Now Staff. (2021, July 22). Bodies of two missing fishermen recovered near Pierre [Review of Bodies of two missing fishermen recovered near Pierre] Dakota News Now. https://www.msn.com/en-us/travel/news/bodies-of-two-missing-fishers-recovered-at-farm-island/ar-AAMrya2

DJI. (n.d) Mavic Air 2 -Up Your Game. Retrieved August 6, 2021, from https://www.dji.com/mavic-air-2?site=brandsite&from=nav

Federal Bureau of Investigation (FBI). (2019) 2019 NCIC Missing Person and Unidentified Person Statistics. https://www.fbi.gov/file-repository/2019-ncic-missing-person-and-unidentified-person-statistics.pdf/view

Jacobo, J. (2018, October 8).Why the first 72 hours in a missing persons investigation are the most critical, according to criminology experts. ABC News; ABC News. https://abcnews.go.com/US/72-hours-missing-persons-investigation-critical-criminology-experts/story?id=58292638

Martínez, A. R., Morales, C., Medina, E., & Robertson, C. (2021, June 28). 11 People Confirmed Dead in Florida Condo Collapse. The New York Times. https://www.nytimes.com/live/2021/06/28/us/building-collapse-miami-beach

McGrath, O. (n.d.).Are UAVs the future of search and rescue? AirMed&Rescue. https://www.airmedandrescue.com/latest/long-read/are-uavs-future-search-and-rescue

Sharples, T. (2005, April 25). Get into Trouble Outdoors —Who Pays for the Rescue?[Review Get into Trouble Outdoors —Who Pays for the Rescue?]. Time.com; Time magazine. http://content.time.com/time/nation/article/0,8599,1892621,00.html

Weldon, W. T., & Hupy, J. (2020). Investigating Methods for Integrating Unmanned Aerial Systems in Search and Rescue Operations. Drones,4(3), 38. https://doi.org/10.3390/drones4030038

Welch, K. (2020, February 27). Who Pays for Search and Rescue? Behind the Tricky Economics of New Hampshire SAR [Review of Who Pays for Search and Rescue? Behind the Tricky Economics of New Hampshire SAR]. Appalachian Mtn Club; Appalachian Mtn Club. https://www.outdoors.org/resources/amc-outdoors/features/who-pays-for-search-and-rescue-behind-the-tricky-economics-of-new-hampshire-sar/