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Drones in Modern Weather Industry

Understanding weather has become a crucial component of modern industry. Knowing when and where devastation will take place is a matter of life and death for others. Weather descriptions and forecasts have become a common commodity that is heavily relied upon. But even with modern technologies, data sets, and observations, plenty of weather data awaits to be discovered, understood, and implemented into current weather models and data sets. The complications lie in the inability of humans to observe such data safely and reliably. Many data gaps occur during treacherous and extremely complicated weather events. Not only is human life at stake but time and money too. Unmanned aerial systems (UAS) come into the picture to eliminate that. UASs will be used in place of a person flying an aircraft so that cost of life is no longer a factor of any mission. Many UASs also be made relatively cheaply, decreasing an expense factor to missions as well. UASs industry growth will become a steppingstone for understanding meteorology and climate.

The RQ-4 Global Hawk unmanned aircraft system is the premier provider of persistent intelligence, surveillance, and reconnaissance information. Able to fly at high altitudes for greater than 30 hours, Global Hawk is designed to gather near-realtime, high-resolution imagery of large areas of land in all types of weather – day or night (“Global Hawk”). Global Hawk can be used during time windows to gather data that satellites, nor aircraft can supply adequate data especially during tropical cyclones like typhoons and hurricanes. Many times, has the projection of a typhoon or hurricane did not reflect the true devastating characteristics of such storms. Storms like Typhoon Haiyan and Hurricane Katrina are recent examples. The models that scientists currently use have large gaps of data that if known could be used to create a larger prognosis and forecast. NASA Global Hawks can help close the gaps. For example, one of the NASA Global Hawks can safely drop probes into the storm giving detailed data of internal structures. They can also fly to high altitudes and measure [tropical cyclones] outflows of upper altitude flow patterns and have potentially increased model prediction by 30% ("Drones Are Helping Meteorologists Decipher Tropical Cyclones"). NASA has used the Global Hawk for a few other missions all attempting to prove the usefulness of using UAVs as meteorological surveyors. Some examples are the Airborne Tropical Tropopause Experiment to study moisture and chemical composition, Sensing Hazards Operational Unmanned Technology Program where the National Aeronautics and Space Administration (NASA) partnered with the National Oceanic and Atmospheric Administration (NOAA) in 2015 to investigate the use of a High Altitude Long Endurance aircraft in sensing high impact weather-related hazards, and the Hands-On Project Experience Eastern Pacific Origins and Characteristics of Hurricanes 2016 field campaign that studied storms in the Northern Hemisphere to learn more about how storms intensify and over oceans and develop (Dryden). Global Hawk has proven its capabilities.

Despite the sophistication of the Global Hawk system, it was not optimized for weather observation. It can do a lot, but the platform is a retrofitted platform rather than a design built for the ground up for and by meteorologists and climatologists. To add, it also is incredibly expensive. The $130 million price tag reflects its ability to gain intelligence for the Department of Defense. Simply, Global Hawk is not a viable option for private industry. NASA is simply attempting to prove drone capabilities.

Another drone developed for the Department of Defense but used by the NOAA for hurricane tracking and modeling is the Raytheon Coyote. The Raytheon Coyote is a cheaper and smaller option compared to Global Hawk. Initially developed for surveillance, intelligence, and reconnaissance, the drone is now used to increase internal knowledge of tropical storms. The Coyotes are packed into three-foot-long sonobuoys, then dropped from the belly of the NOAA P-3 hurricane-hunting aircraft. As they fall, the Coyotes spread their wings and take off. The unmanned aircraft can travel 50 miles or more from the host aircraft, which can continue to perform other mission tasks while receiving data updates from the Coyotes (*Need to Know: Weather Drones*). Where the Coyote stands out is because of its versatility, single-use, and inexpensive design. NOAA and other atmospheric observers do not have to worry about retrieval or damage as it planned to not be recovered from the beginning unlike the $130 million Global Hawk. The Coyote can also operate as a swarm. The ability to operate as a swarm is helpful so that the data set can have some sort of dimensionality. Whether they are formed into a straight line, a shape, or a complete three-dimensional block, each will provide spatial data.

Projects that use the Raytheon Coyote and the Global Hawk are parts of nationally supported missions that require a lot of support and funding. There is plenty of volatile and adverse weather on the local level that is incorrectly forecasted because of data gaps. The mission at Oklahoma State is to create a platform that is cheaper and easier to use for local weathercasters that also increase the scope of what weather balloons can normally not gauge. “Part of what is going to drive the cost down is the scope of the measurements. Whereas some of these larger platforms are focusing on almost trans-Atlantic flights, we are really focusing on the lower atmosphere. So, our platforms by design can be much smaller,” says Dr. Philip Chilson of Oklahoma State. Projects like the one Dr. Philip Chilson is conducting is going to be a massive driving force for using drones as meteorological and climatological observational tools on a larger scale.

The drone industry will continue to shift and change because of many driving forces. The industry is already volatile as it is with regulations making factors subject to change. But work done by NOAA and NASA has proven that drones will work in acquiring more data to understand weather systems and patterns. Now it is time for a trickle-down of technology from the government. Once the useful technology is diluted down to a utilitarian commodity, drones will become a sure and definite component to understanding meteorology and climatology.

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