National Oceanic and Atmospheric Adminstration

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Unmanned Aircraft Systems: Addressing the Global Environmental Challenge

Environmental change around the world has become one of the pressing issues of our day. The realization that the Earth is a finite size and that problems started in one part of the world can affect the entire planet is one of the most important changes in environmental monitoring during our lifetime. Examples from pollution emitted in a localized region finding its way to the most remote regions of the Antarctic to *el nino* phenomena affecting African rain are reminders of the need for international collaboration and are shaping NOAA's stewardship of important natural resources. Information is key to all decisions related to weather, the oceans and the environment. Satellites, while developed for military and communication purposes, are one of our most powerful tools for understanding the Earth as a whole and making advanced five day weather forecasts. Now, Unmanned Aircraft emerge as a technology that can fulfill critical gaps in our current ability to gather information about the environment, particularly in remote and dangerous areas. NOAA is a part of a handful of countries working collaboratively to apply unmanned aircraft to critical environmental monitoring problems.

Over the last few years, NOAA has been involved in working with other countries to develop the Global Earth Observing System of Systems. Bringing together critical partners in government, academia and the private sector from countries around the world, we have worked to identify all available environmental data and move forward the process to turn those data into information. This process has revealed that with all of our satellites and monitoring stations, there are still critical questions that we can not address even with our existing best efforts. We can not fully monitor storms as they develop over the Oceans, and that lack of information results in the loss of both lives and property. We cannot even describe why the Arctic sea ice is disappearing as fast as it is, and that lack of information prevents us from knowing what will happen in the future. We can not, in general, know what is in the effluent from erupting volcanoes until after the gases have spread to the nearest monitoring area, often an area with considerable populations. Without these critical and basic observations we are limited in our ability to act as proper stewards and put our efforts to saving lives and protecting the environment. NOAA is looking at all possible technologies and approaches to filling these critical gaps in an effort to fulfill its basic missions.

Some, although not all, of our critical environmental data gaps exist because we can not obtain detailed measurements without operating in the area of interest. We can not monitor seal populations from space, we need to be closer to their environment to do that. And often the reason we can not be near there habitat is that it is either too dangerous to fly there or the area is so remote that pilots can not loiter long enough to gather important information. One example is the disappearance of Arctic sea ice. Over the Arctic Ocean, the cloud level is often so low that collecting good observations of the sea ice means flying for hundreds of miles just a hundred feet over the sea ice. With limited search and rescue available over the Arctic Ocean, manned planes can not gather the data needed to understand both the ice loss and the full effects on ecosystems of the ice loss. Similarly with hurricanes, these storms start over remote areas of the ocean and take days to develop to their full strength. When they're closest to land and at their peak strength, it is impossible to send manned aircraft to get important information such as maximum wind speeds, and amount of energy and water vapor coming off of the ocean's surface. These are two examples where unmanned aircraft are our best possible approach to understanding what is happening, while not risking human lives.

NOAA is moving forward with its international partners to address some of these important data gaps with Unmanned Aircraft. NOAA is starting with three focal areas in its first year of a formal UAS program: the Pacific Ocean, the Arctic and the hurricane region. Academia and industry are active partners to guide the UAS efforts along a path of success. Internationally, NOAA is engaging neighboring countries, particularly, our Arctic neighbors in Canada, Sweden, Finland and Greenland and our neighbors affected by hurricanes including Barbados and other partners in the Gulf of Mexico/Caribbean region. We will continue to work with GEOSS, the Arctic Council and the World Meteorological Organization to assure that of the benefits of UAS obtained results can be shared internationally. The international community has been active as strategic partners with NOAA in the use of UAS for environmental purposes. This is a reflection of the global nature of NOAA's missions to understand and predict changes in the Earth's environment.

The transition of UAS technology to environmental applications has the potential of taking our understanding of the Earth as a system to the next level. This transition will not be easy. It will require transitioning of technological capabilities, cooperation with key political and scientific partners, original thinking and effective management. NOAA's goal, however, is simple: to provide the right information, in the right format at the right time to the right people to make the right decisions. UAS, as applied to environmental measurements, are an irreplaceable component to this goal.