



FIVE BARRIERS DRONES WILL NEED TO CLEAR FOR COMMERCIAL SUCCESS

When the FAA published its regulations for commercial drone use in June 2016, it did more than clear the way for unmanned aircraft systems to hit US airspace for commercial use; it was a near final hurdle in bringing commercial drones to the biggest markets in the world.

With China and much of the EU already allowing for commercial drone flights, the FAA's regulations brought the US into the fold. And that means more opportunity to expand the growing commercial drone industry.

And it's no small opportunity.

Goldman Sachs, which estimates the global drone market will reach \$100 billion by 2020, said in January that it expects businesses to invest \$13 billion globally in commercial drones by 2020.

In the US alone, it's projected that the FAA's June 2016 regulations will create 70,000 new jobs in the first three years of commercial drone use and bring more than \$13 billion to the US economy over the same time period. The trade group that researched these projections, the Association for Unmanned Vehicle Systems International, also estimates a total economic impact of \$82.1 billion for the US economy by 2025.



There's a catch, though: in order to reach its projected level of impact, the commercial drone industry not only will need to meet evolving government regulations across the globe, it'll need to meet the exacting specifications required of businesses that are poised to benefit the most from the technology, too.

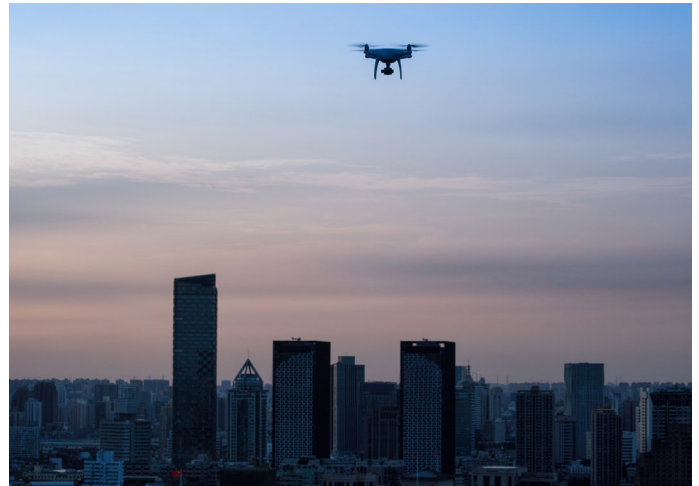
And sensors of all types will play an outsized role in helping drone manufacturers and the industries they serve get the optimized drones needed to drive commercial impact. From Altimeter to temperature and humidity, the average commercial drone will have a minimum of 10 sensors on board. Inside this report, we'll explore the role sensors will play in helping commercial drones meet their real-world potential in those areas.

- Safety
- Contact Avoidance
- Consistent Airspeed
- Localized Weather Reporting
- Steadying Capabilities

BARRIER 1: SAFETY

While it's unknown what additional regulations or guidance the FAA and international agencies like the European Aerospace Safety Agency, will impose on commercial drones, it's clear that regulators are largely concerned with overall safety.

In the US, for instance, the current regulatory framework requires that a pilot only operate one drone at a time, within his or her line of sight; operations are also limited to daytime hours. The regulations also restrict the weight of drones, the speed they can



travel and the height at which they can fly. To meet those safety standards, it takes a combination of **high-grade sensors**, including:

- Barometers
- Altimeters
- Temperature
- GMR
- Tilt & Angle
- Vibration

While many of these sensors are found in all drones, the build grade and engineering of these sensors is a critical differentiator: commercial drones need to be operable in conditions far harsher than those encountered by drones designed for hobbyists and personal use. Exposure to extreme temperatures, high humidity, and radiation is common when drones are used for high-risk activities like fighting forest fires, agricultural spraying, and surveying disaster areas.

Additionally, larger commercial drones will benefit from vibration sensors that can power an early, predictive failure system and GMR sensors that can help return wayward and out-of-range drones to their home base. Both sensors provide features that not only protect businesses' investments, but that may also appease regulator's future safety concerns.

BARRIER 2: CONTACT AVOIDANCE

While current regulations require commercial drones be flown within a pilot's line of sight during daylight, there is a push from businesses to eventually allow for fully automated drone flights.

The argument for it focuses on scalability. The argument against it focuses on safety. (There's that word again.)

If automated drones are allowed to fly, they'll likely need a number of additional safety features, including a contact avoidance system. Even if that's not fully embraced by the FAA or other regulators, similar systems will need to be developed once pilots are allowed to operate drones outside of their line of sight or are allowed to operate more than one drone at a time.

Mid-air collisions with other drones or other objects (birds, buildings, and trees all come to mind) wouldn't just prove costly to businesses. They'd pose a danger to anyone at ground level.

In order to develop contact avoidance systems, drone manufacturers are poised to use ultrasonic sensors in drone innovation to detect whether objects are approaching and whether the drone is on a path to collide with them.

Those signals received from the sensor could then be used to provide a warning to pilots or to override the pilot's control of the drone.

BARRIER 3: CONSISTENT AIRSPEED

According to the Association for Unmanned Vehicle Systems International, agriculture alone will create roughly 85% of the demand for commercial drones by 2025.

One reason for that is the potential cost-savings drones can bring to crop spraying.

In order to achieve those savings, though, drones need to fly at consistent airspeeds with a great deal of precision. More precise and consistent airspeeds mean more control over crop spraying, allowing for even distribution and accurate spraying, two critical factors for success in spraying.

That level of precision requires a skilled pilot, but it also requires constant and refined feedback on airspeed.

Differential pressure sensors deliver this feedback by measuring the speed of a drone throughout its flight and its changing conditions.

What's more, drones used for crop spraying can have their tanks outfitted with liquid level sensors, so that farmers or operators know how much spray they have left and can plan accordingly.

BARRIER 4: LOCALIZED WEATHER REPORTING

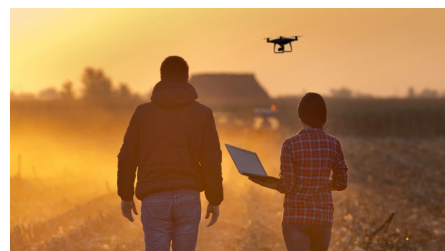
When outfitted with **humidity sensors**, drones have the ability to accurately report on microclimates. The data drones can provide in this context can bring a new level of application capabilities for commercial operators.

For example, adding humidity sensors can make drones incredibly useful in severe weather conditions, such as combating forest fires. Humidity levels play a crucial role in how forest fires become fueled, and those levels can vary wildly in short distances. Those microclimates, then, are critical to a combat strategy. When firefighting agencies can send drones in to take those kinds of measurements, they're better equipped to make the right and most safe decisions.

Second, drones with humidity sensors provide farmers a unique advantage when it comes to creating more efficient and effective agricultural plans. In fact, drones, in conjunction with other technologies, are being used to drive changes across the industry to create an emerging practice in agriculture known as smart farming.

Smart farming is the practice of combining information technology and agriculture, a response driven by the United Nation's Food & Agriculture Organization's 2009 report that agriculture production will need to increase 70% by 2050 to meet the world's projected population growth.

To meet that type of production increase, farmers will need to drastically increase yield. So, they're turning to technology to do that.



Those farmers at the forefront of smart farming are using a wide array of sensors and farm-management systems to collect new and more granular types of data, such as changing humidity levels and a plant's nitrogen needs, to create more precise farming practice.

Drones, too, play a large role in smart farming, as they allow farmers to act with the necessary precision to increase yield, but also do so in a way that's more efficient. Already, drones can decrease planning costs by 85 percent, and can survey up to 1,000 acres of farmland a day.

BARRIER 5: STEADYING CAPABILITIES

Drones that primarily collect data via cameras have yet another challenge: keeping steady.

While that may sound plenty obvious because of wind, rain and other weather factors, it's one that applies even in calm conditions. The vibrations created by a drone can be enough to cause a jittery shot or unclear picture—unless the camera can remain steady.

This need is particularly pressing in building inspections, disaster area surveys, and cinematography.

Stabilized platforms can deliver on this need with the help of position sensors, which can detect even slight bumps, pushes, and vibrations.



CONCLUSION

While regulations have opened the door to commercial drones, we're very much still at the beginning of a new industry.

Evolving regulations and guidance from the FAA and other regulations agencies will no doubt play a part in how quickly the commercial drone industry grows, but the capabilities of commercial drones will play a key role in the growth as well.

In order to fuel the industry's growth and help make the bullish predictions a reality, drone manufacturers will need to think deeply about the many ways in which sensors can help drones meet both core competencies and innovative use cases.

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