## Five GIS Trends Changing the World



2017

Maps are a simple and efficient way to understand and communicate rapidly. Looking at a spreadsheet, we see rows and columns of data. Using charts and graphs, that data can be seen as a pattern. But when that same data is presented on a map, we suddenly have context for the information. Because most of us are already familiar with geography, when we see data as a map it is usually understood much faster. We are now at a stage where we can display 3D imagery and information on the web very easily. Web-based 3D visualizations are everywhere, and maps are among the most common manifestations of this.

At Esri, we are investing in things our users want at scale, while still keeping abreast of the cutting edge. The geospatial industry is quickly evolving because the capabilities of digital connectedness and collaboration are moving ahead exponentially. In fact, the five biggest trends in the area of geographic information system (GIS) technology are centered on making data more accessible and creating context to visualize this data in an age when fast, easy access to information is taken for granted.

#### 1. Location as a Service

There was a time when GIS use was limited to the niche market of government, telecommunications, utilities, and oil and gas sectors. That market has grown substantially, as large retailers and tech startups have seen the benefits of understanding data geospatially. The fundamentals of GIS and what it can do have also evolved dramatically. We are entering an era of services-based GIS. This means the GIS professional connects with consumers directly through web-based applications that provide easy-to-access visualizations. GIS also has huge implications for the enterprise user at a business or a city organization, where departments have enormous amounts of geographic data. Performing spatial analysis on the web and having access to distributed servers where different layers of data exist allow users to bring this data together, fuse it, and analyze it across the network.

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#### 2. Advanced Analytics

Spatial analysis is important to any business that values location as a variable to success. Site selection is a crucial function that is dependent on geospatial analysis. A retailer that wants to set up new stores needs to understand where there are existing successes for similar ventures as well as hospitable demographics. All this data can be overlaid onto a map to perform statistical analysis in order to make a decision about the location of a new store. Maps communicate this information well, and in a web services environment, professionals will be able to make maps, graphs, and charts and perform analytics easily. Accessible from an organization's cloud, the power of GIS and mapping is opened up across the enterprise.

#### 3. Big Data Analytics

The ability to access the vast amounts of data that provide us with insight into the environment and human behavior has changed the way all organizations function. That capability has also evolved to include the integration of big data operations into spatial analysis. Today, anyone in the enterprise can access billions of environmental observations or tens of thousands of raster images from spacecraft and analyze them easily. This will greatly expand what traditional GIS has done. Enterprise users can now build their own imagery and raster analytics workflows for fast, multi-CPU, parallel processing of massive imagery collections.

#### 4. Real-Time GIS

The world of citizens and consumers is already interconnected digitally—people are connected with each other and with their governments and businesses. Leveraging this vast network of devices and sensors is perhaps the latest trend and the number one priority for organizations that want to remain ahead in terms of having a comprehensive enterprise GIS for the future. Everything from smartphones to crowdsourced social media feeds is being used to integrate real-time data from the Internet of Things (IoT) directly into a GIS layer stack, where the data is analyzed, visualized, and

reintegrated into online applications for use by either professionals within the enterprise or by consumers and citizens.

#### 5. Mobility

Another way GIS is breaking out of its traditional space is by becoming more consumer-friendly. Just as data from mobile devices is liberating professionals and consumers who've been accessing GIS online and from the desktop, this same data is being used to power a new generation of easily accessible applications that tap into the rich science and analytics that only GIS can deliver. A much simpler user experience is now possible for GIS users with the creation of a suite of apps and app builders. iPhones or Android devices can be used to collect geospatial data or explore it visually, anywhere and at any time. Professionals in the field can use these apps for data collection or as observational data, which they can then bring directly into an enterprise services environment in the cloud. Field information is immediately input and analyzed.

#### Creating Big Understanding from Big Data

The last leap in computing was the shift from the server to the cloud. Software as a service (SaaS) opened up a world of opportunities for GIS, as shared map services like the *World Imagery Basemap* are no longer separate from the unique services offered to users. GIS users can share data, collaborate, make mashup maps in the server, then connect to the cloud.

The next leap in GIS technology and computing is connecting to the vast network of devices providing data in real time. It is the most revolutionary change we have seen since Esri began and brings great opportunity. The more accessible data is, the more important it will be to understand it. And maps are the visual language for understanding the context of data.



SOURCE: http://geoawesomeness.com

### How Drones are being used in Disaster Management

### Lia Reich

1.2 million deaths. 2.9 billion people affected. \$1.7 trillion in damages. According to data from the United Nations Office for Disaster Risk Reduction, these staggering figures are the total economic and human impact of global disasters from 2002 to 2012. With a steady growth in annual disasters, especially climate-related ones, emergency management strategies are being put under the microscope. Disaster management technologies, on the other hand, have seen some remarkable breakthroughs in the past decade.



Infographic prepared by the United Nations Office of Disaster Risk Reduction

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PrecisionHawk's Lancaster

#### How drones fit

Many technological breakthroughs in recent years have emerged in places areas where it was least expected. Unmanned aerial systems, for example, have transitioned from highly defense-focused applications to a multitude of commercial use cases that transcend industries. But what makes UAS, more commonly referred to as drones, fit for emergency response?

As previously discussed, aerial views are critically helpful in large-scale disaster zones. Drones, designed to be agile, fast and robust, empower response teams with a substantial upper hand without costing as much as manned flight operations. Because many are autonomously flown, drones can access hard-toreach areas and perform data-gathering tasks that are otherwise unsafe or impossible for humans.

#### Hurdles in traditional methods

Many disaster management protocols have been tested over the years. While many of these strategies have been successful, they also come with major hurdles. Time is the most important commodity in disaster response. Emergency responders know very well the irreversible consequences of critical delays, so their playbooks are inherently designed to address urgent, high-pressure scenarios. On top of urgency, disaster response faces another major challenge in logistics, as evidenced by the 7.8 magnitude earthquake in Nepal that claimed the lives of 9,000 people and injured 23,000 others.

As debris and rubble piled up on the streets following the biggest natural disaster in the country since 1934, most of the roads were blocked, denying access to outlying areas. In situations like this where land access is off the table, government agencies are forced to deploy manned aircraft to continue immediate search and rescue, and later on, relief efforts. In theory, this sounds like a winner, but resource allocation, especially in poorer countries, poses another major challenge. Search and rescue operations from the air are expensive, and as we've seen in the past, these operations can stretch for months, even years. In countries where resources are already scarce, this option is not viable.

Outside of these safety concerns, there's another major hurdle that is often overlooked: first responder safety. In the case of earthquakes, landslides, hurricanes and wildfires, first responders are deployed immediately in rough and dangerous working conditions. In 2014, a mudslide roared through the rural community of Oso, Washington, destroying over 30 homes and taking the lives of 43 residents. The response team had to move quickly. The risk of another mudslide was looming over them, while the first one dammed the river and flooded the valley, essentially turning the entire disaster zone into quicksand. Given all these uncontrollable elements, it was not safe for the ground crew to investigate the scene. To make things worse, only 30 minutes of clear skies were left for helicopters to conduct an aerial survey - not enough time to gain an accurate account of what was happening on the ground. The team did, however, have a drone.



3D terrain reconstruction of the Oso mudslide zone created using PrecisionHawk's software arm, DataMapper

Immediately following the Oso mudslide, PrecisionHawk, an information company out of Raleigh that manufactures a drone for data collection and software for processing and analysis, was called in through involvement with Roboticists Without Borders (RWB) to provide geologists and first-responders with actionable insights. Using their Lancaster UAV platform, PrecisionHawk surveyed the terrain from the air to create an 3D map. RWB's Dr. Robin Murphy recently told CNN, "[The UAV] acts like a plane. It's smarter than a plane because it's got all sorts of onboard electronics to let it do pre-programmed surveys. It takes pictures like on a satellite or a Mars explorer and then pulls those back together into a hyper-accurate map — a 3D reconstruction."

In Oso, PrecisionHawk used high fidelity sensors and intelligent back-end software to reconstruct and analyze the terrain in 3D — a step that not only helped geologists detect the pace of land movement but also provided first responders the time-sensitive data they needed to safely infiltrate the disaster zone. This all happened in a matter of hours. Historically, emergency response teams used manned LiDAR flights and satellite information to gather such data, actions that are costly and take days to weeks to accomplish.

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Additionally, drones are also outfitted with various sensor options that include visual, thermal, LiDAR, hyperspectral and multispectral. Why are these important? In earthquakes and landslides, these sensors can be flown to conduct ground truthing surveys. The thermal sensor, for example, is perfectly suited for detecting the heat a human body emits, which helps locate survivors. Various sensors suites are efficient in obtaining data to create an exact 3D reconstruction of disaster zones, which when compared with historical data from satellites, offers new perspectives on the extent of damage, and terrain or field deviation that could help manage future disasters.

With the advent of UAVs in emergency response, it is important to note that commercial drones operated by professionals and emergency organisations do not offer the same applications as hobby drones recently seen disrupting wildfire containment efforts. Commercial UAV platforms are designed with the on-board intelligence to empower, not deter. In order for drones to become a vital part of emergency management, hobbyists need to avoid irresponsible use cases that overshadow the massive benefits of UAV technology and manufacturers need to continue to inbuild tools that promote safety.

#### Data analysis - beyond hardware



PrecisionHawk team with Texas A&M University's Dr. Robin Murphy at the Bennett Industrial Landfill in Lockhart, SC

Advanced data analytics are the next frontier in leveraging drones for emergency response. One of the advantages of solution-focused algorithms is the ability to apply them across industries from emergency response applications to agriculture to energy, even identifying toxic waste in the air in real-time.

In mid-February last year, PrecisionHawk was issued an emergency COA to conduct an aerial survey over the Bennett Industrial Landfill in Lockhart, South Carolina. Toxic particulates were being released into the air, including asbestos and other potentially harmful chemicals, so it was crucial that the Environmental Protection Agency (EPA) assess the situation guickly.



VIDEO LINK: https://youtu.be/qc6cAZ1J1Ss

The EPA, however, could not obtain an accurate volumetric survey of the area due to an active fire affecting some sections of the landfills, plus chemical exposures that made the scene unsafe for ground surveyors. To address the situation, PrecisionHawk flew a drone to create a 3D reconstruction of the site and conduct volumetric analysis to help the EPA determine an appropriate response.

The demand and desire for this type of technology to assist in emergency response is apparent as disaster response teams search for strategies to accomplish tasks easier and more efficiently. The convergence and advancement of technologies, including unmanned aerial systems, will grant first responders with enormous opportunities to save more time, money and lives.



Drone exhibition, New York City. Image: L Chaffer

