The Hidden Value of a Map: How to Supercharge Your Career and Business with the Power of Accuracy

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HEXAGON

Smart Phones and autonomous cars- two mega trends in society, another perhaps less visable is constuction automation. What is the common denominator ?- maps and geolocation. And what proffessionals are best suited to be sure these maps and geolocations are accurate, complete, and fit for purpose? - of course surveyors. I belive this is the opportunity to supercharge your career or business. Today I hope to inform you of the explosion that is taking place on the use of Maps and Geolocation.

Increasingly the appeal of surveying is the ability to work with amazing technology while solving some of humanity's biggest challenges. We've moved from the plumb bob generation to the PlayStation generation. And like it or not technology is now a natural extension of who we are. On a side note- we need to be getting the message out to High School counselors that Surveying has changed and that it is an industry that uses high technology like 3D graphics, Robots, artificial intelligence, augmented reality, etc- we need to market our industry!!

In an ever complex society where technology plays such an integral part, the underlying data that makes it function, becomes a necessity. It is no longer the killer app, it is the killer data that we need!! Geospatial information's use has grown to such an extent that in many aspects of our life we can no longer function without it. This holds true for professional applications like construction, services like communications and transportation and even consumer level applications such as social media or even tracking our children.

In 1998, Trimble published a book referring to GPS as “the ninth utility,” with water, sewer, electricity, gas, telephone, television, radio, and waste removal being the other eight. I would argue that today we’re at a point where the ninth utility is no longer just GPS, but the broader use of geospatial information.

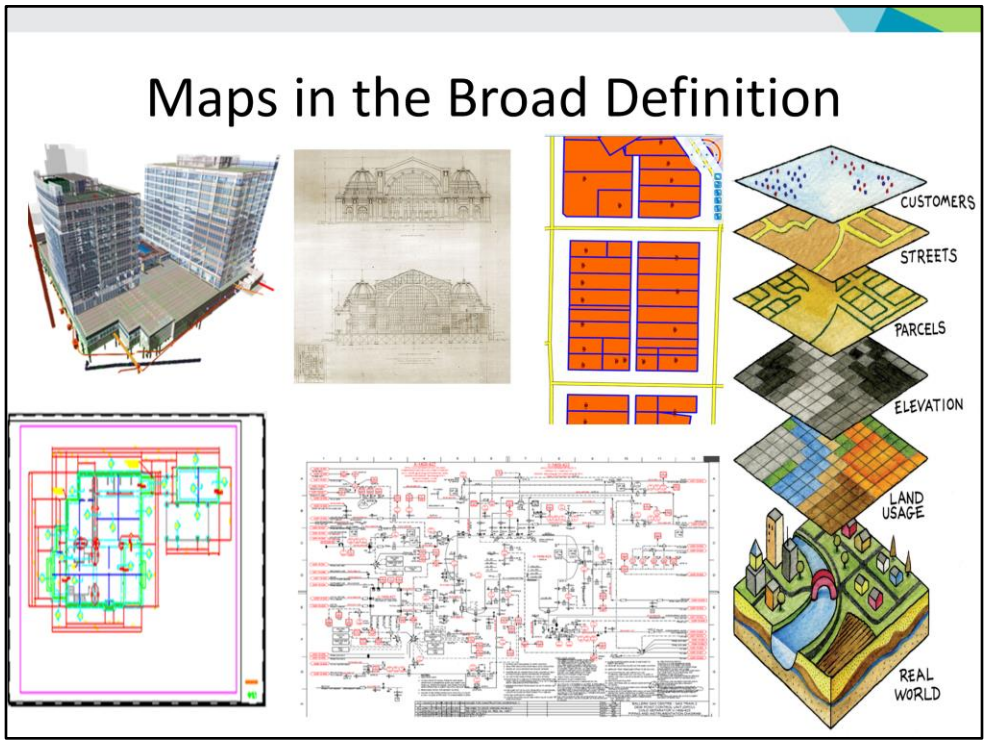
It has become such a ingrained part of our lives that we could NOT function as we do today without it . Like any utility, geospatial information is part of the infrastructure of our society.

Since the iPhone was introduced on June 29 in 2007 the use of consumer based geospatial information on Smartphones has increased dramatically.

Gavin Schrock wrote in the Feb edition of XYHT that it is estimated that 65% of cellphone apps use location capabilities, and there are greater than 3 Billion of these phones worldwide. With the widespread use on the consumer level, not only has usage increased but also the demand for accuracy, with real world applications such as social media, navigation, and augmented reality driving the way.

Because of this demand for accuracy on a consumer level, the lines are starting to blur between professional and consumer use. Due to the expansion of technology and geospatial information, cost has become less of a hurdle for the average person, bringing about the democratization of high accuracy geospatial data.

However, it’s not good enough anymore to know that you are in the vicinity of your final destination. You want to know that you are in front of the correct door or that your UBER driver can come right to you. Through the exponential growth of technology, wants have become needs and the demand for accurate geospatial information has become greater.



So before I go further into more professional uses of Maps we need a clear and agreed to definition of a Map so we can exchange our ideas.

I took the liberty and went to the one of the newer Urban dictionaries and found this definition -- MAP--representation of selected features of an area of interest usually to scale, (ie the surface of the moon, a geographic area or a section of a brain). For me a map is a document (paper or digital) that either represents existing reality (a county, city, site maps, buildings, my favorite fishing spot, etc)or a document that expresses desired reality, like blueprints, a building plan or a model. So for us at Leica a map is an EXISTING or DESIRED representation of the world or as you will see, sometimes BOTH. In 6 simple words I define a map as “what is or what should be”

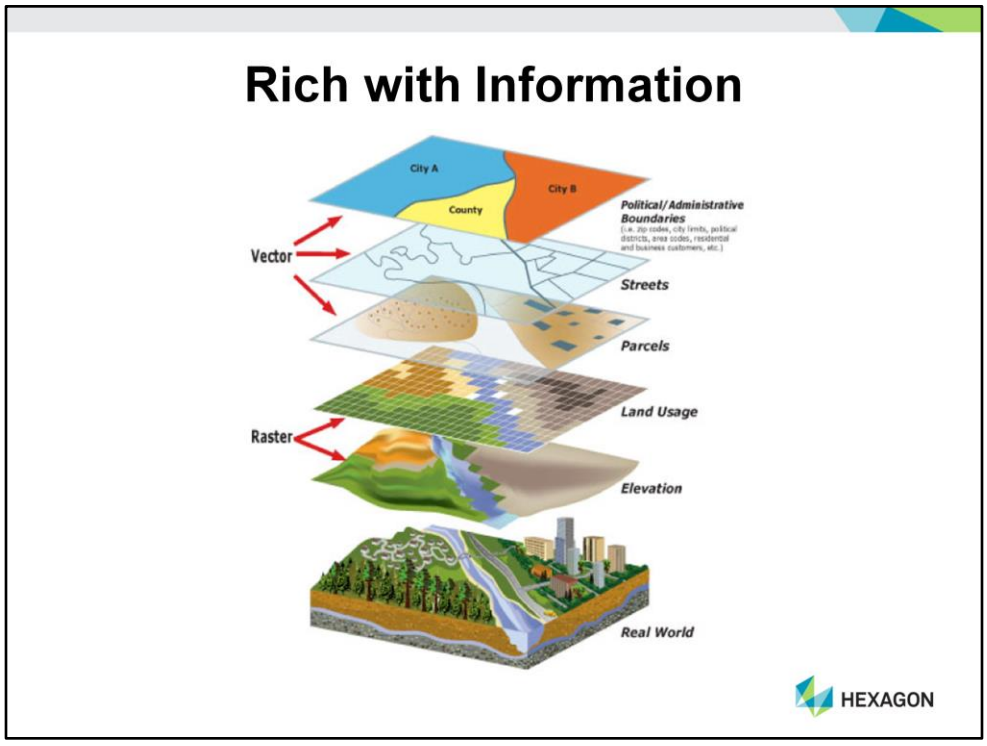
I hope this definition is OK for you.

… And maps have changed …Beyond the increasing need for accuracy, other demands are a being placed on geospatial information that bring into question what a map should or could be.

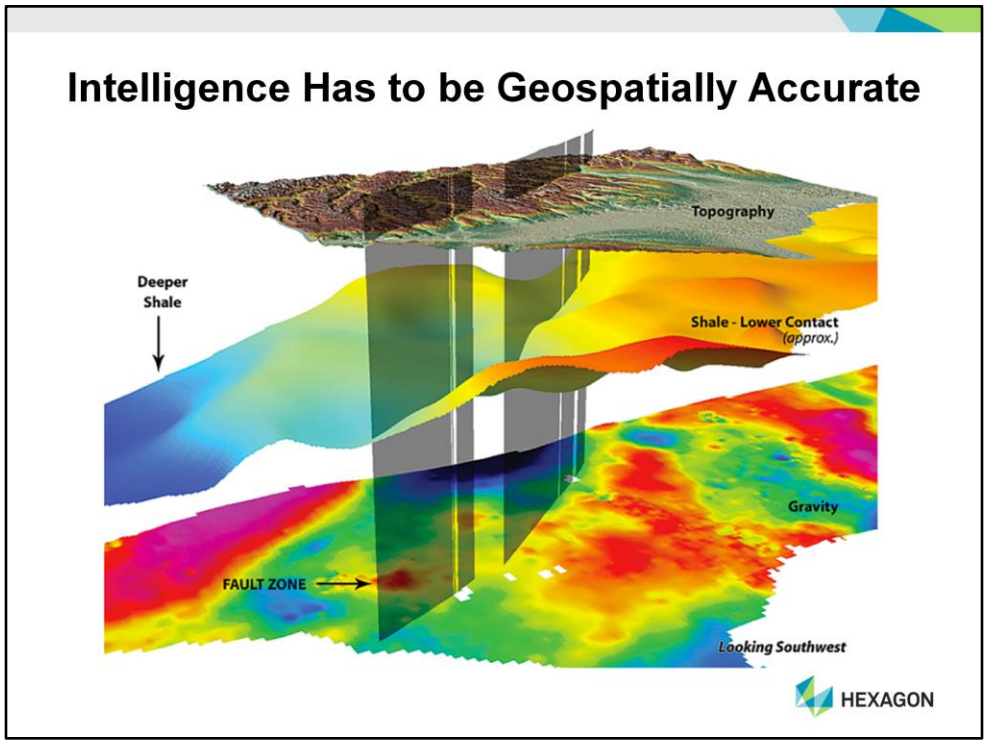
I am sure you have seen some emerging technologies that give you an idea of new opportunities in mapping.

These can be as sophisticated as an entire 3D environment or virtual space. (as seen in this graphic of a training SW). And accuracy in this context is no longer focused only on knowing an exact location, but also having access to a wealth of accurate metadata connected to that location.

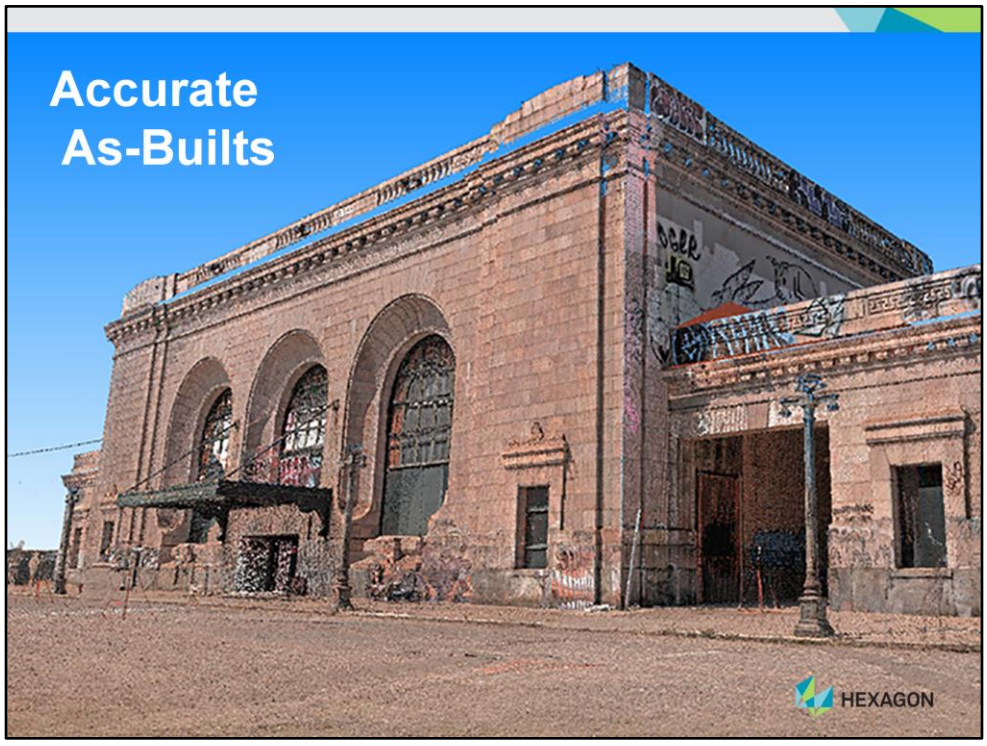
Think about this for a moment: Some analysts estimate the amount of digital geographic information in the world now doubles every 6 months. This represents a huge challenge and opportunity for geospatial professionals.



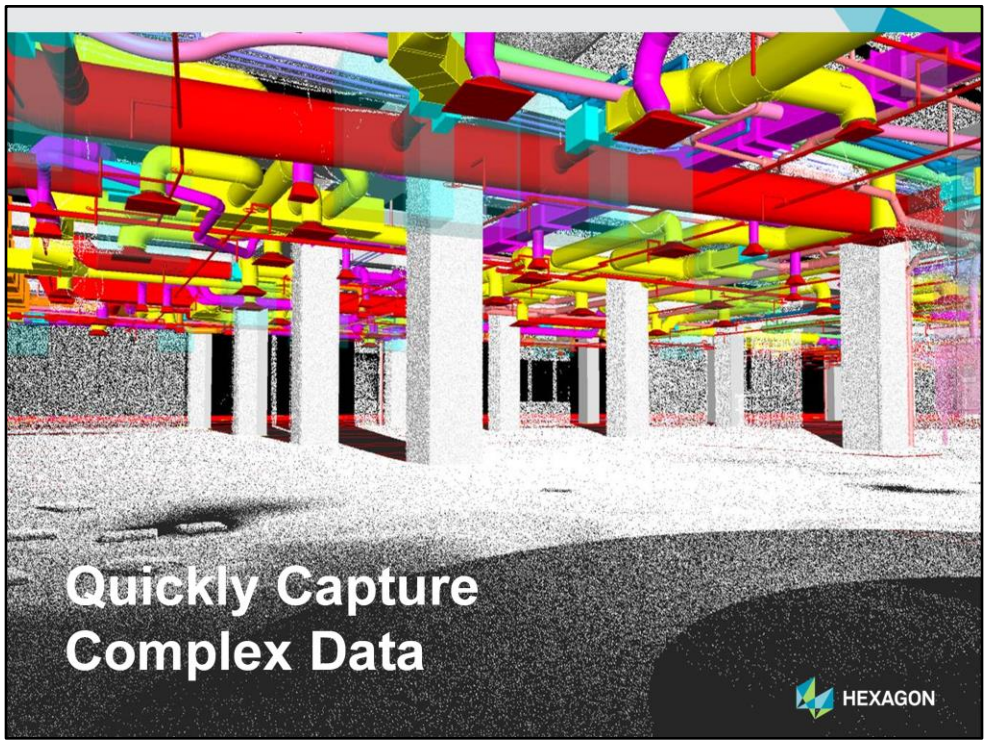
In other words we have moved beyond maps that capture just traditional survey information



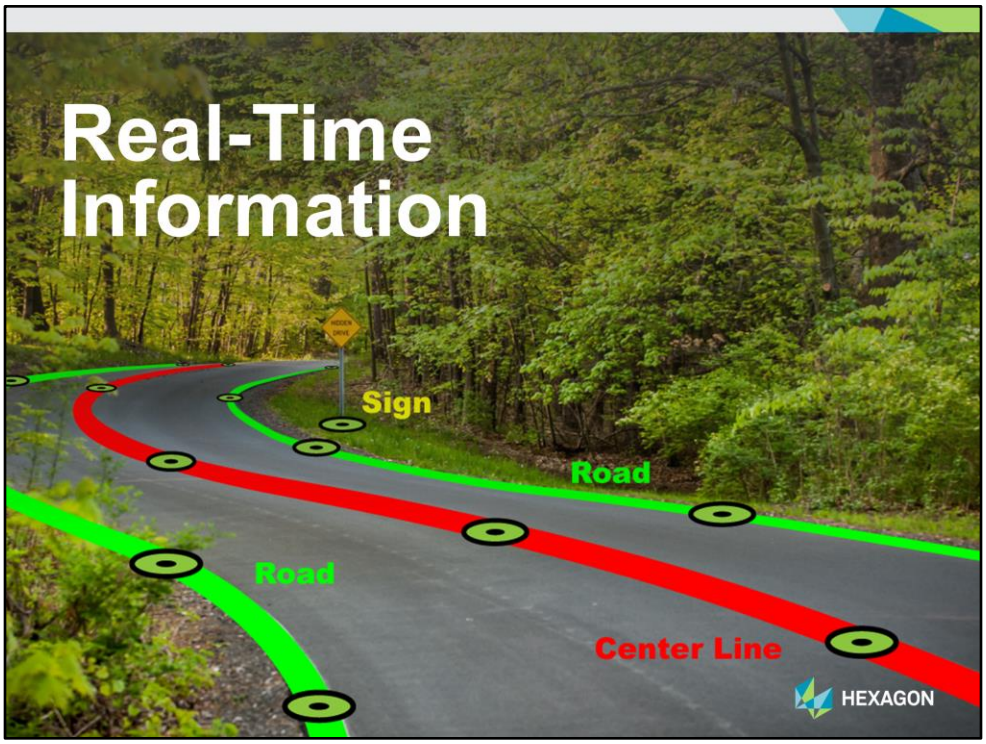
...into maps that are rich with added value, such as those that allow us to predict earthquakes and save millions of lives or to look for oil deposits to power our world. Modern maps help us understand and shape the world around us.



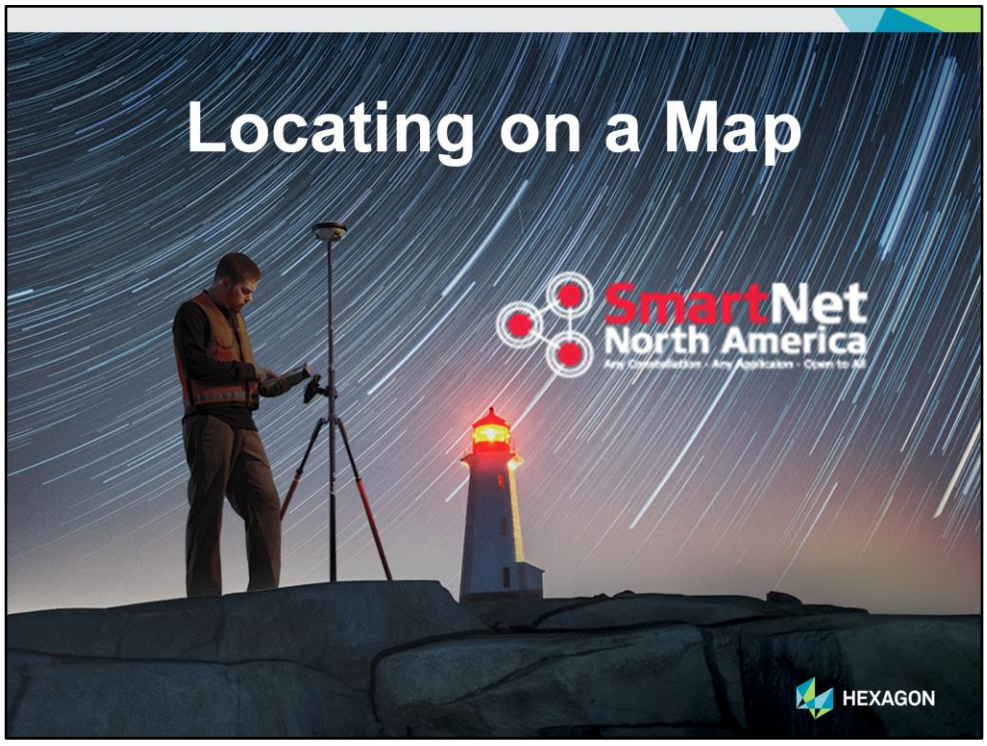
Millions of points become a geolocation that can identify amazing details. Experiencing details in 3D puts geospatial information on a whole other level. Maps can be created of objects, buildings, almost anything. The applications are boundless. That is why we as surveyors need to open our minds to new opportunities and redefine what a map is.



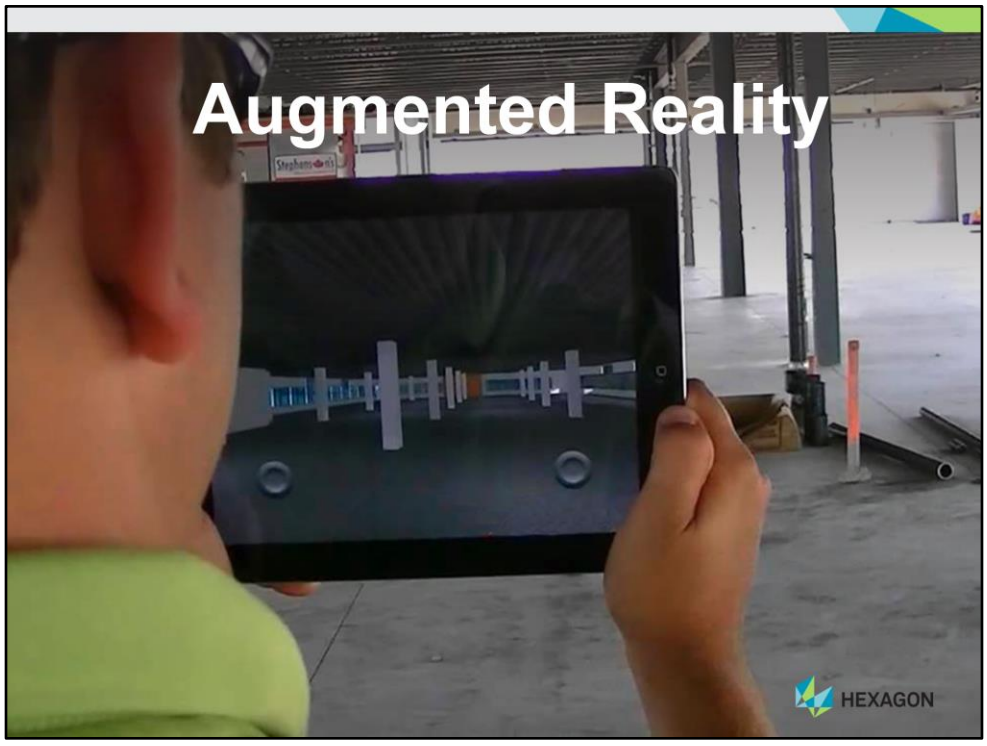
They also allow us to see the needle in a haystack, so to speak. Think about a building that needs piping repairs or maintenance. With a map generated from a point cloud, we no longer have to tear out an entire wall section to find the location to repair. We can now use our digital map of “scan data with imagery” and pinpoint exactly where a particular pipe is. What if the leak was caused by the fittings not being the right materials? Was this a mistake in the building process or in the design ? We could do a virtual search to determine if other locations used the wrong materials and preemptively replace them before they become an issue. This was a real life example where copper and galvanized steel fittings were used improperly.



Now, if you're driving down the road at 70 mph in a autonomous vehicle, you're going to want some level of assurance that the vehicle is relying on highly-accurate digital 3D maps that are being continuously updated with information about the surrounding environment, the road conditions, traffic regulations and other details. Accuracy is key, and building highly accurate maps is the world of a surveyor.

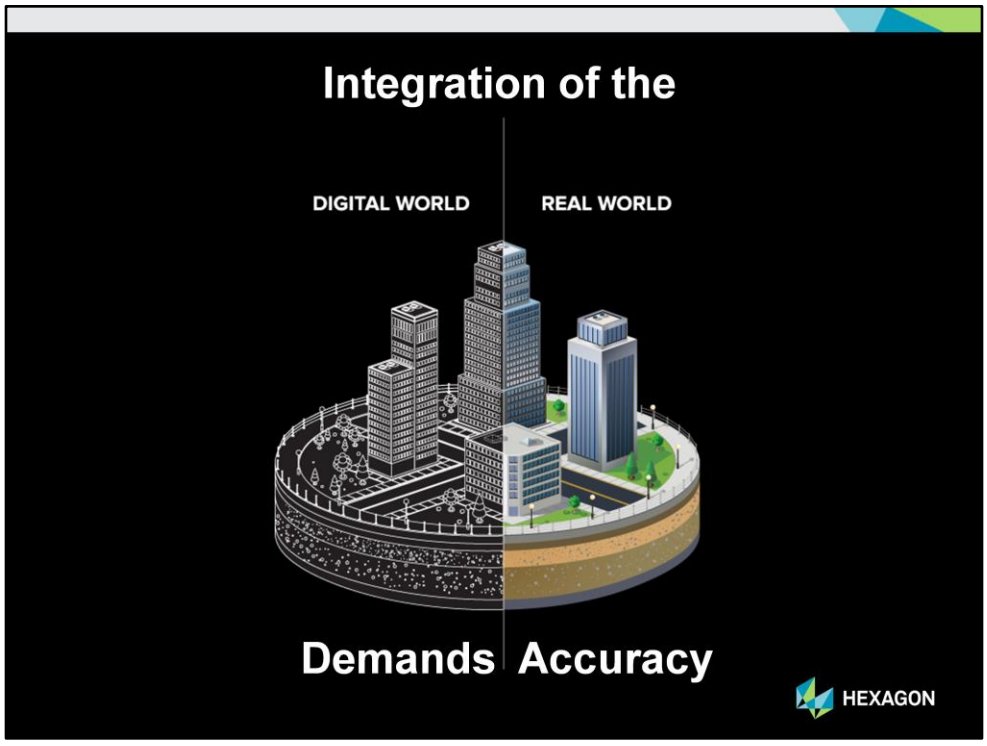


The ADDICTION to accuracy not only demands the availability of accurate information, but also that the information be available in real time everywhere simultaneously. Accessibility is key to making real time data valuable. This requires smart networks that provide consistent, high-precision, centimeter accuracy with reliable, widespread coverage.

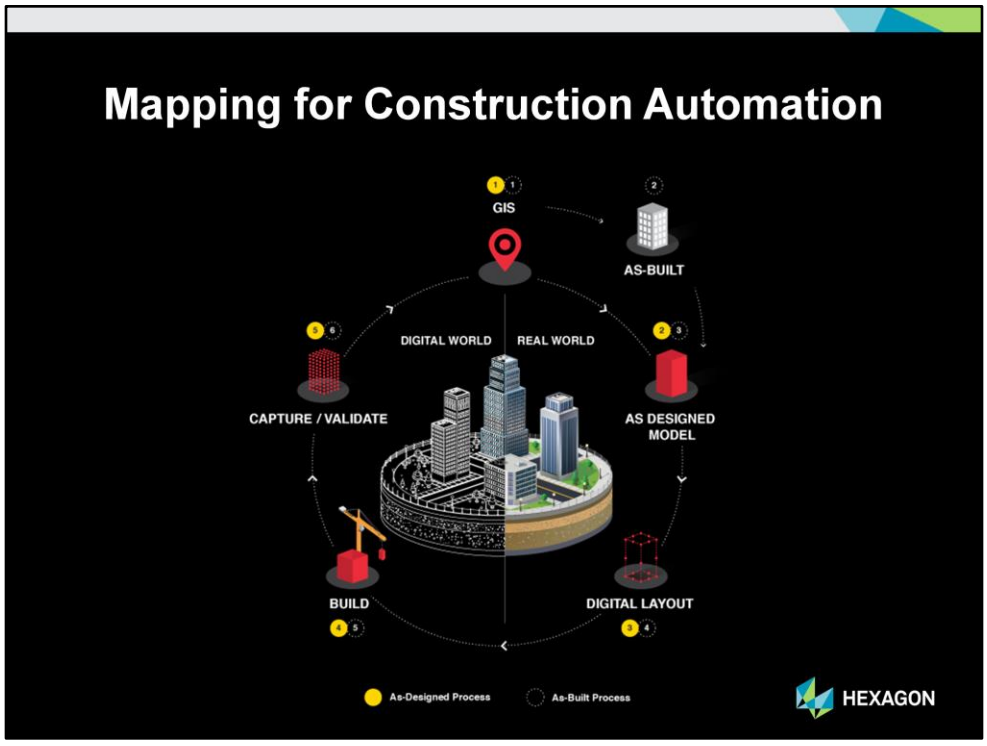


Not only can a map be a living, evolving piece of information in the present, but it can also exist in the future - helping us time travel, so to speak, so that we can predict and visualize outcomes with augmented reality. We can also look backwards to see what was done, that may no longer be visible behind the sheet rock or concrete wall.

Today's fast paced and complex world requires much more rich and complex mapping information. **In FACT Constructing and just living in the world of today requires continuous mapping**

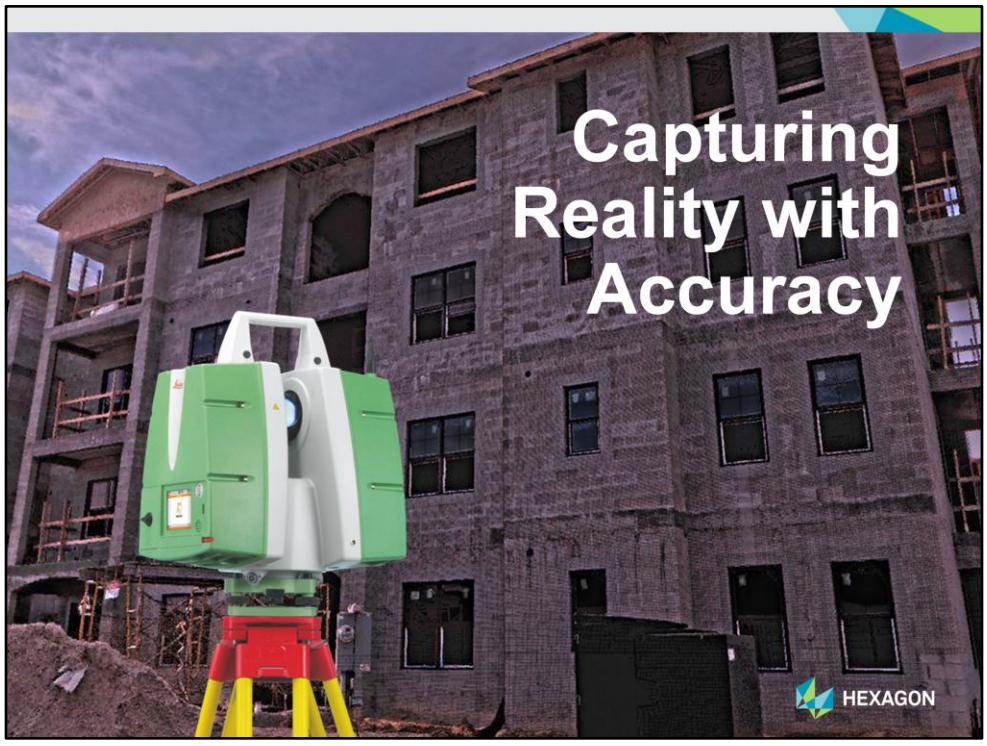


We could say that another function of a map is to bring together the real world and the digital world. It is the tool that allows us to move between What is and What should be. From this process we can be smarter in our planning and actions.



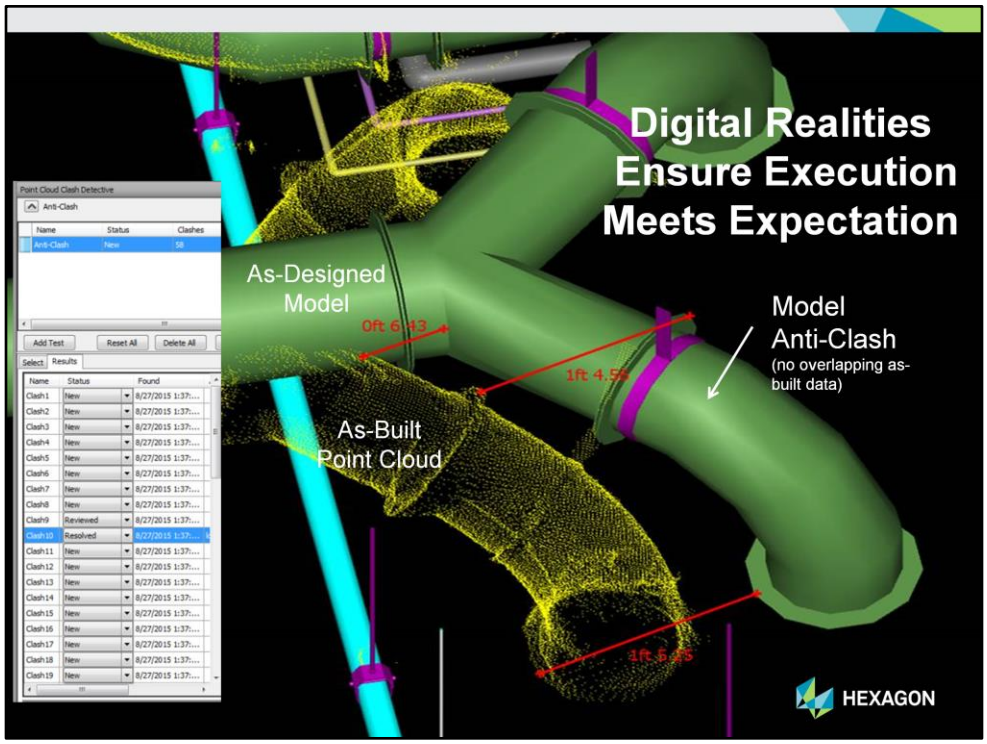
So let's think about how high-accuracy mapping adds value in the professional world. One application where it is having a big impact is in construction automation, where companies are able to successfully close the gaps in high-value processes such as building information modeling, or BIM, empowering their clients to substantially reduce rework and increase productivity. I will show you how maps help the design process, construction and validation.

Starting with the need to gather accurate GIS data to understand the as-is situation before initial concept or design. Professionals have the ability to collect reliable and accurate positioning data at any time from anywhere. Empowered by real-time GNSS networks and offering better satellite acquisition, today's innovative handheld GNSS solutions provide survey-grade accuracy with the simplicity of a smartphone app, creating a foundation for intelligent construction.

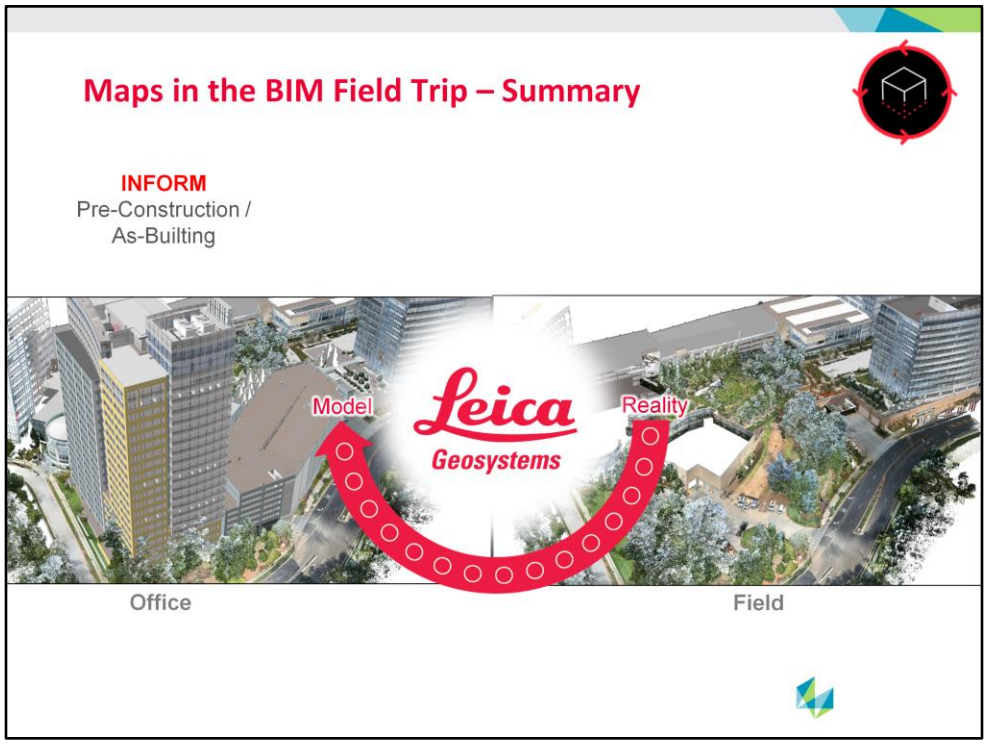


Once a project moves to the design phase, contractors are increasingly looking for ways to increase the accuracy of their models and visually convey information with the project stakeholders. The use of laser scanning to capture reality and communicate accurate as-built information is growing, bolstered by advances in hardware and software that make it faster and easier to create high-value deliverables.

In many construction projects a digital model is a result of the design process. But that Model needs to brought from the digital world to the real-world in what is called digital layout. Once again moving back and forth between the 3D digital and real world.

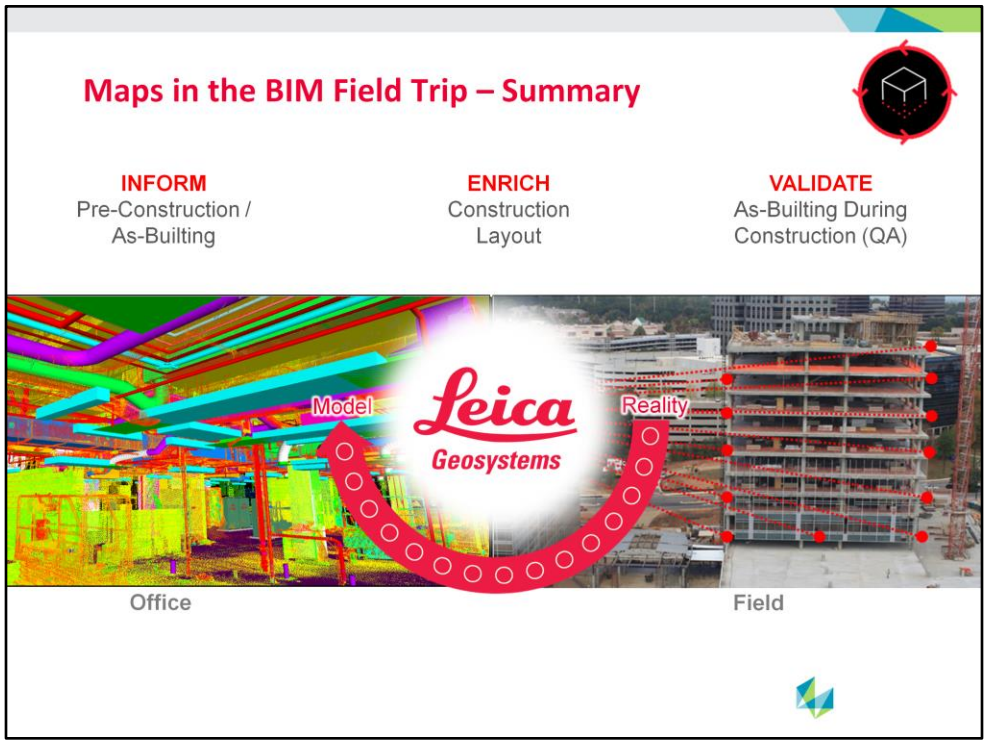


For many years the application of “clash” was a big driver for the use of scanning. Clash is where we insert the design of digital model to the existing as-built to see where the construction process may have a problem – the next big thing in construction mapping is ANTICLASH- where the post construction is compared to the digital world to be sure the construction built was to the original design. This is also referred to as Validation



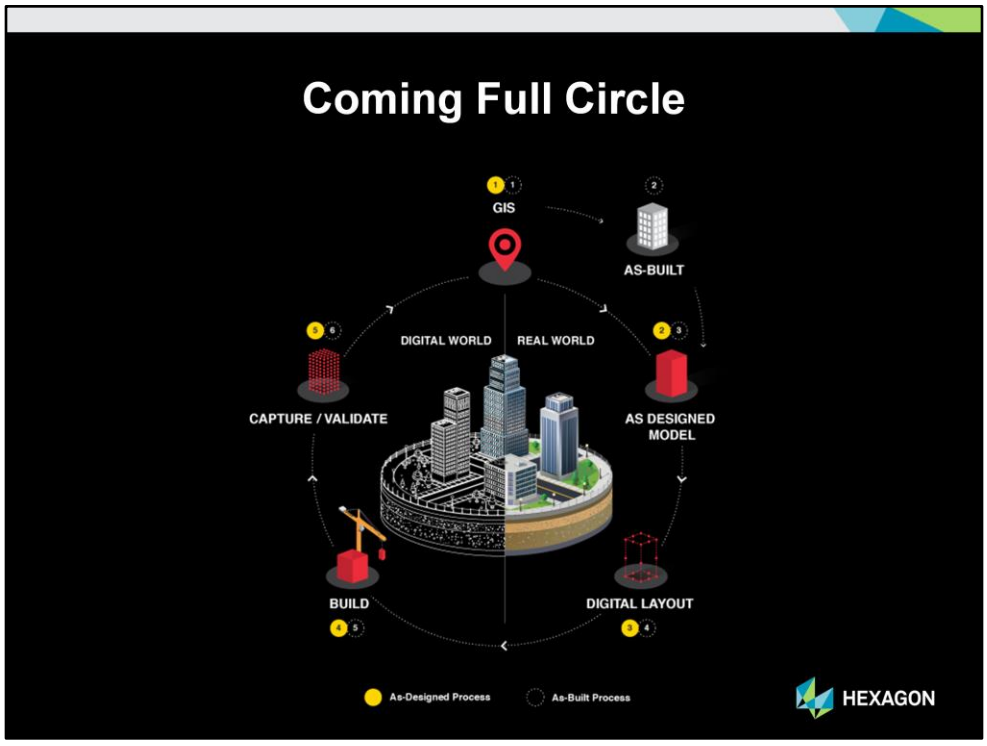
Technology advances are bringing the value of a model into the field and connecting field information back to the model in the office for a round-trip workflow that reduces rework and improves profitability.

[animation1]In summary As-built information of existing conditions are captured with scanners and other sensors to inform new construction – bringing reality from the field to the model in the office.



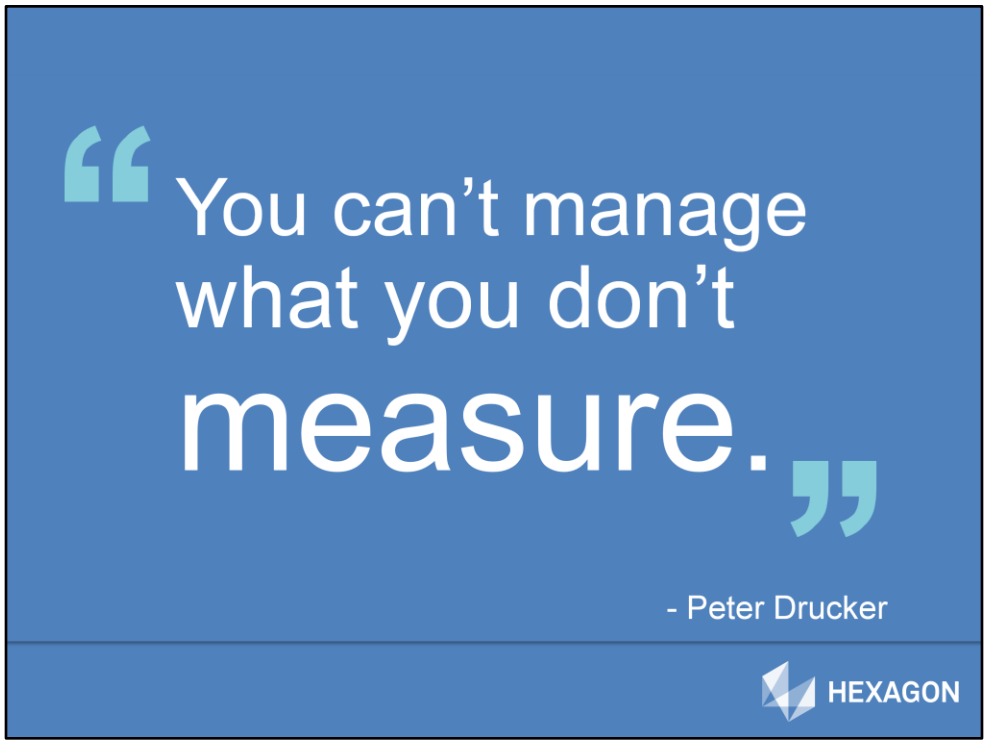
Then new construction layout information from the office is replicated on the job site using total stations – bringing the model into reality or physical construction

[animation3] And then new construction in the field is captured using scanners and total stations so the office can validate what was built is what was designed – bringing reality in the field back to the model in the office.



So we just finished our full circle journey on how information-rich, high-accuracy maps help us to bridge the real world with the digital world in the construction process. Once again geospatial competencies are needed for these processes to work efficiently.

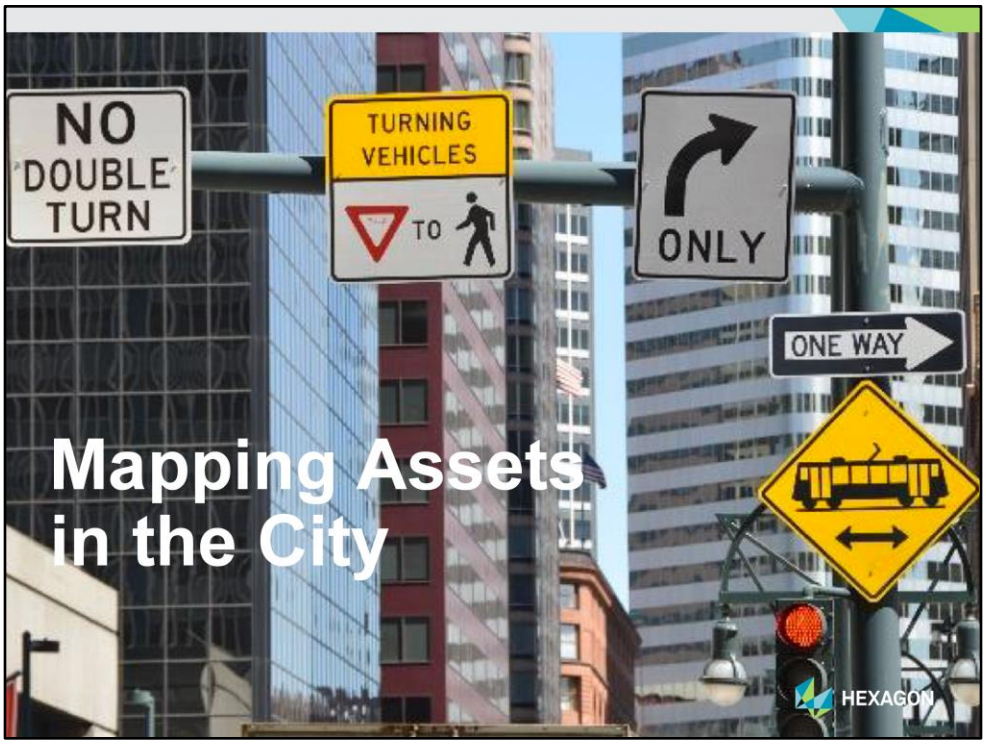
But what about larger area or high volume mapping? Such as managing assets in a city



I pretty sure that Drucker was not thinking of surveying when he said this but this quote should be the surveyors mantra.

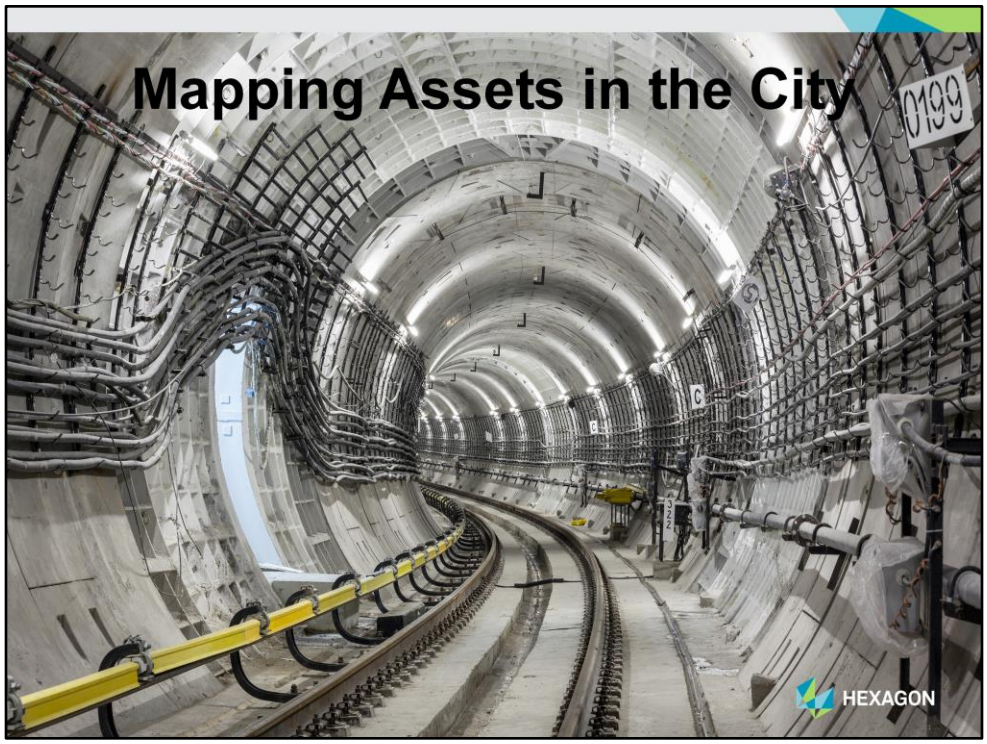
So how can you manage assets in a city…if they are not measured ?

Maintenace of assets remians one of the single largest challenges facing Cities today.

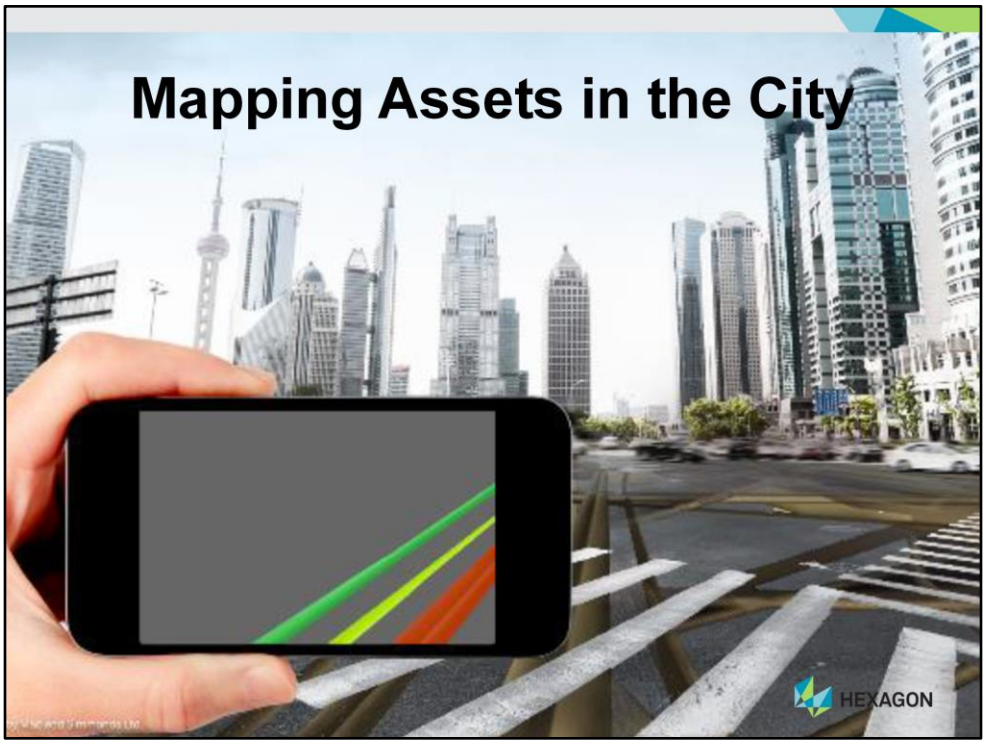


whether it is road signs…above ground

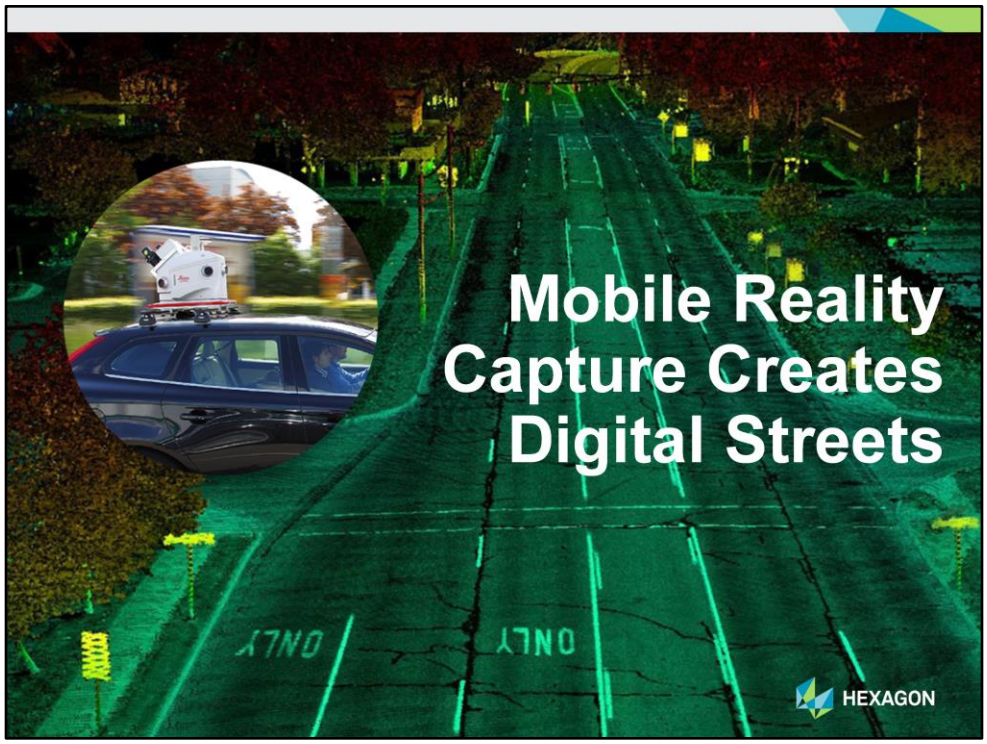
…pedestrian walkways…



…subways… inside but below ground



…underground pipes…outside below ground



Or even an entire street.

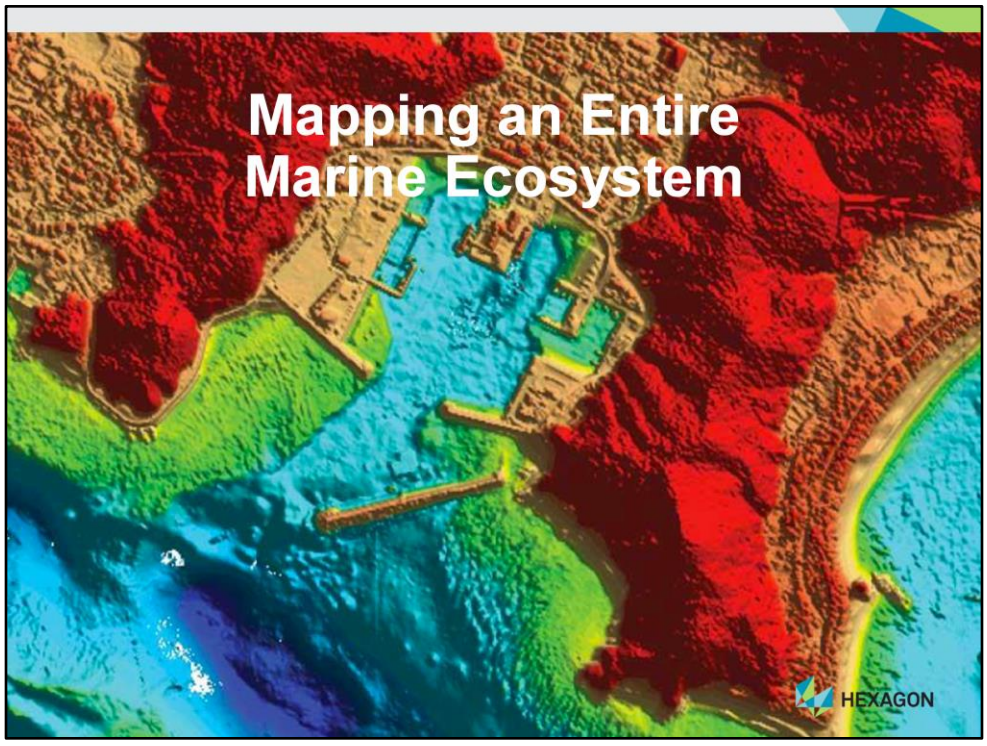
In order to keep up with the demands of large-area, high-volume mapping, many professionals are turning to mobile reality capture solutions. Modern mobile mapping systems can capture calibrated imagery and high-accuracy LIDAR data at highway speeds, while simultaneously analyzing pavement conditions and even collecting other data if desired through the addition of multiple sensors.

You certainly don’t have to stop there. With today’s incredible airborne technologies, quick and cost-effective mapping of entire cities, utilities and natural resources at high accuracy has become attainable.

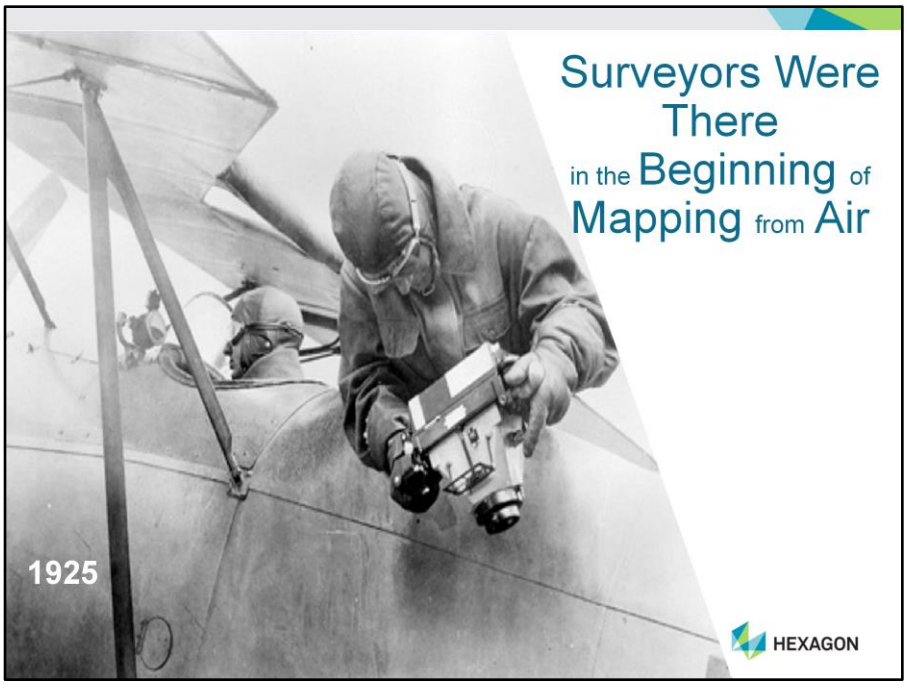
Today's airborne mapping solutions have optimized workflows so that now entire continents can be flown to provide accurate aerial images for infrastructure planning in specific regions and cities. For example, think about Shanghai, which has 24 million people living in roughly 2,400 square miles.

Urban planners rely on airborne mapping to understand the changes that are occurring in the city over time. Advances in sensor technology along with fully automated workflows make it possible to provide regular updates of city mapping models. Planners can click on points within these 3D maps and get measurements that are accurate enough to be used for planning purposes.

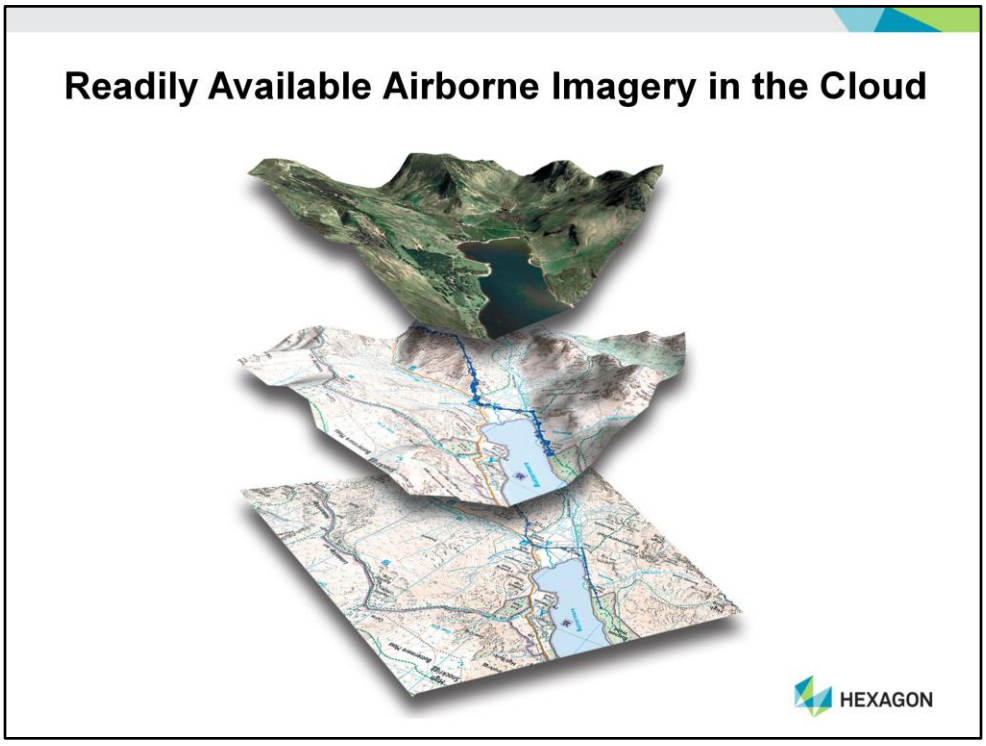
The REALCITY SW can compare maps that have been created over time and show change. Again you can't manage what you can't measure.



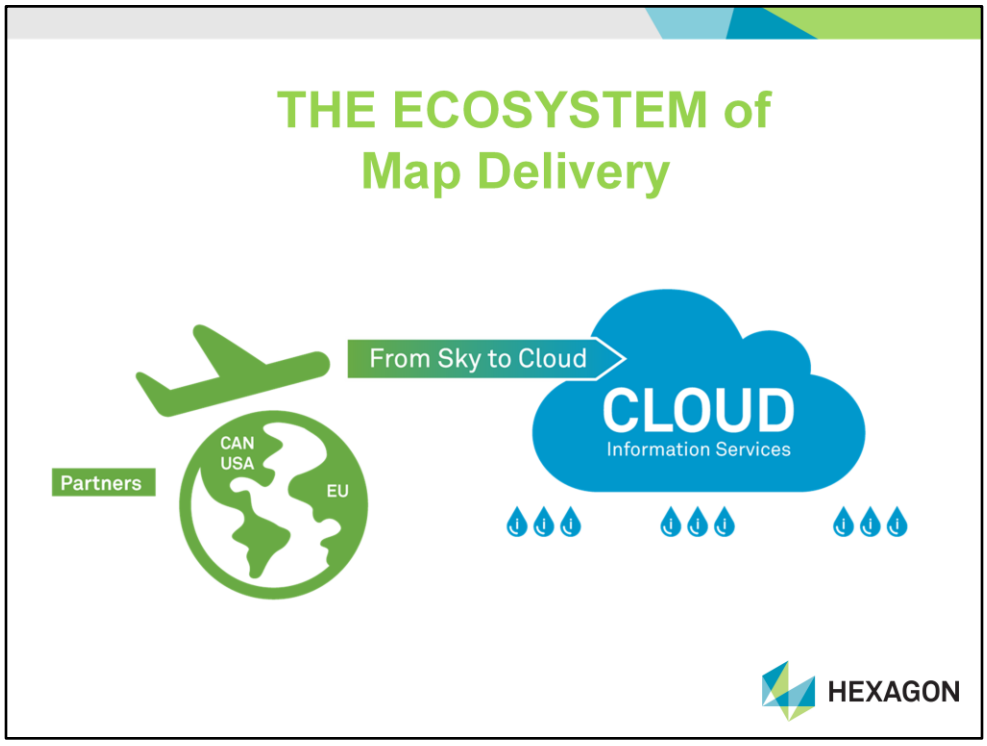
And speaking about water… what about coastal regions? Accurately mapping the changes that occur along coastlines is very important for understanding marine ecosystems, or developing flood mapping to help avoid disasters due to flooding. Surveyors are meeting this need by using an airborne LIDAR technology that now effectively creates height or bathometric maps in the water. Unfortunately preparations needed to address the rise of our oceans due to global warming will certainly be a driver for this kind of mapping.



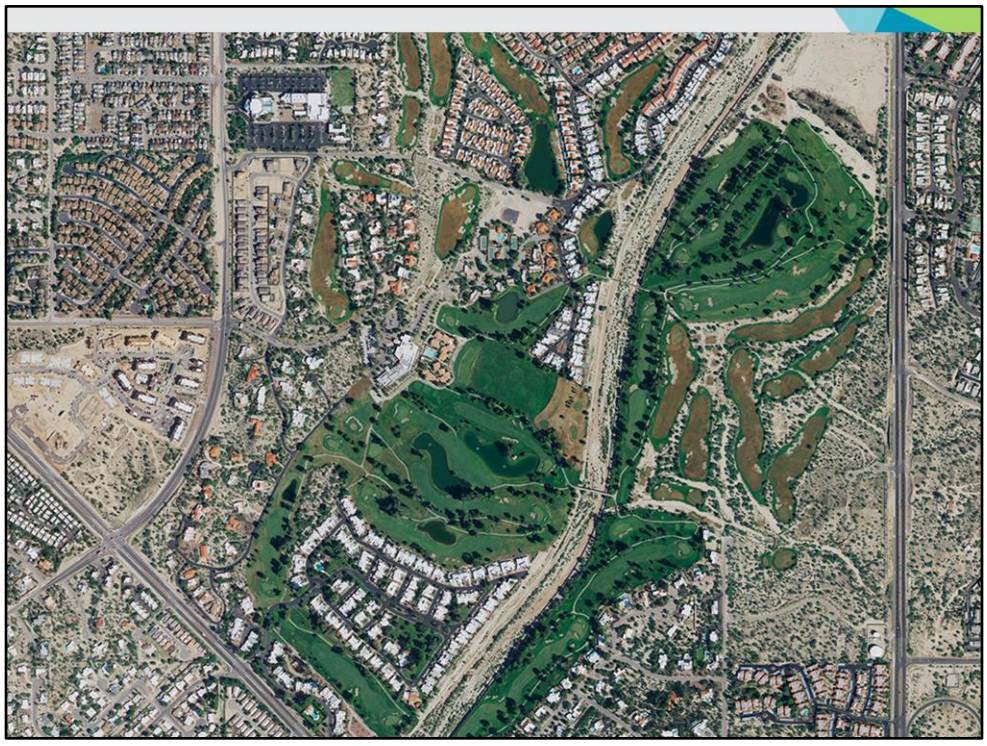
Let's think about how far we've come with aerial surveying technology. This is how we started 90 years ago. Those guys needed operators who were not only strong but also fearless since they had to hang out of an airplane with a camera. Today aerial surveying is more about IT and geospatial competencies.



And we're even moving away from that, because now you can get airborne imagery instantly at the push of a button from the cloud…



The cloud is now our friend in search of and delivery of rich maps . So even if buying a plane and aerial mapping system isn't in your immediate future, you can still get accurate georeferenced aerial imagery from the Hexagon Imagery Program (HxIP) at 15-cm resolution. You can think of it as carefully managed crowdsourcing of high accuracy mapping data! Via the cloud this imagery can be streamed to field software for use as background imagery and basemaps on the NEWEST robotic total stations.



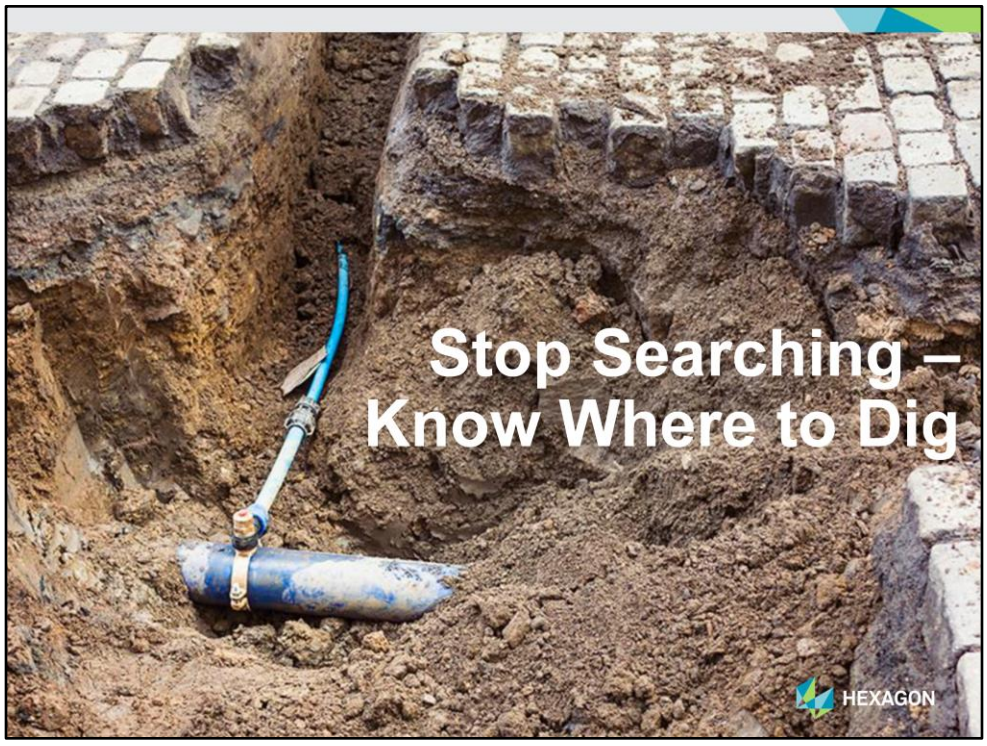
Access to HxIP imagery adds spatial and contextual awareness to surveys, enables better planning and decision-making for more efficient and productive time onsite, and eliminates the need to georeference data to the basemap during post-processing. The imagery can also be live-streamed to handheld GNSS solutions for real-time GIS information.

Police organizations use the 15cm maps to overlay crime or accident scenes to better interpret the evidence. Another example of the wider use of high accuracy mapping.

We’re only two years into the program, but we and our customers will have the entire U.S. covered by the end of 2016. Then the US will be completely reflown every 2 years. So the data is not only very accurate, it is also refreshed regularly and is very consistent. Another example of Dynamic Mapping.

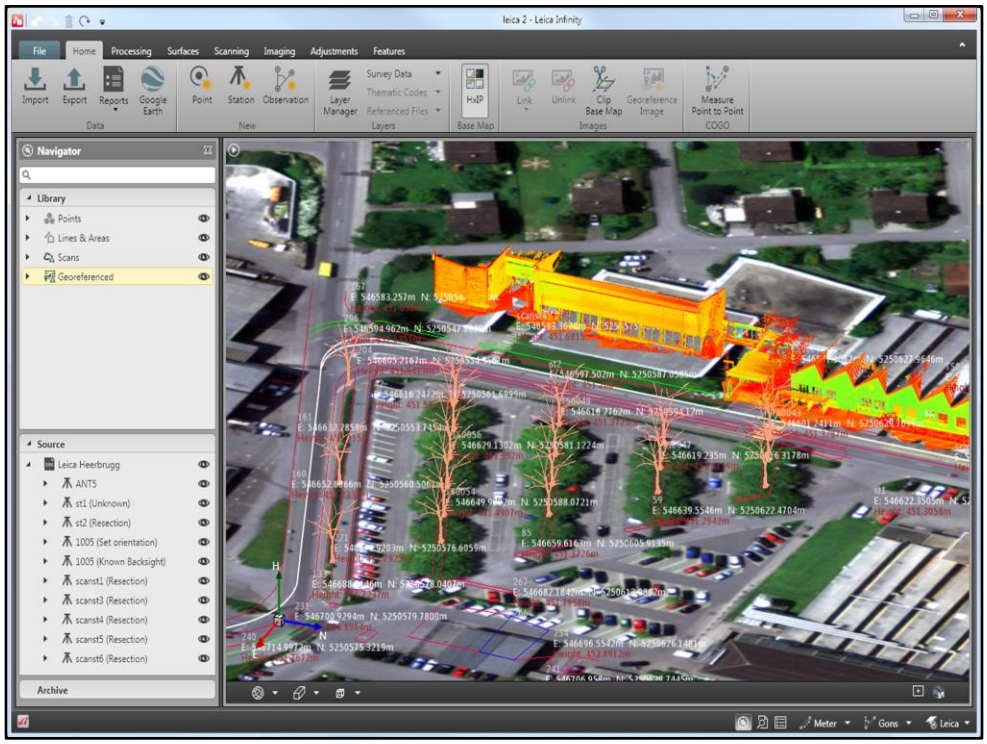
If you need even more detail, you can fly lower with UAVs that can provide just in time data, updating you on construction progress or asset inspection of hard to get areas that might not be easily identified by aerial imagery.

Perhaps you need to move from hard to see objects to impossible to see objects, simply because they are underground. With a combination of LiDAR and radar technology we developed a system which can see the unseeable…

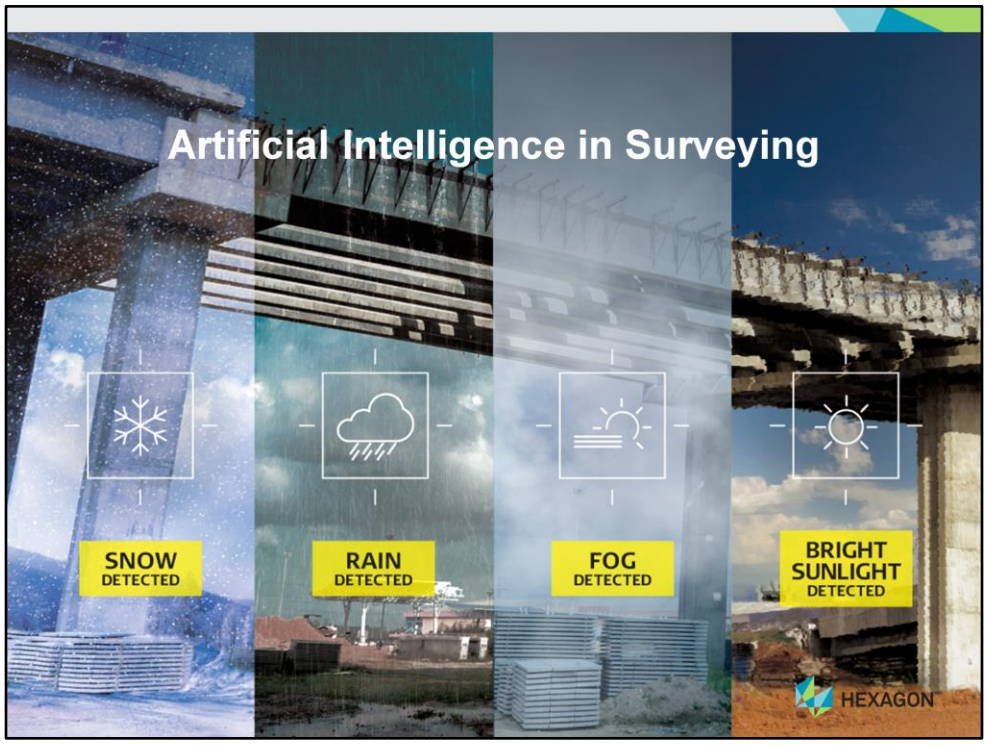


This helps the construction industry avoid guessing, resulting in more efficiency and a safer process. Giving them centimeter level locations on accurate maps enables them to dig more precisely where the piping needs to be maintained or installed with less risk of damaging other infrastructure that is close by.

Here is one of those examples of innovation, the idea of technology mash-ups like our Multi-Station, which combines a theodolite with an imaging device, a scanning device, the Internet of Things and a familiar total station interface to make capturing the right type of data fast and intuitive.

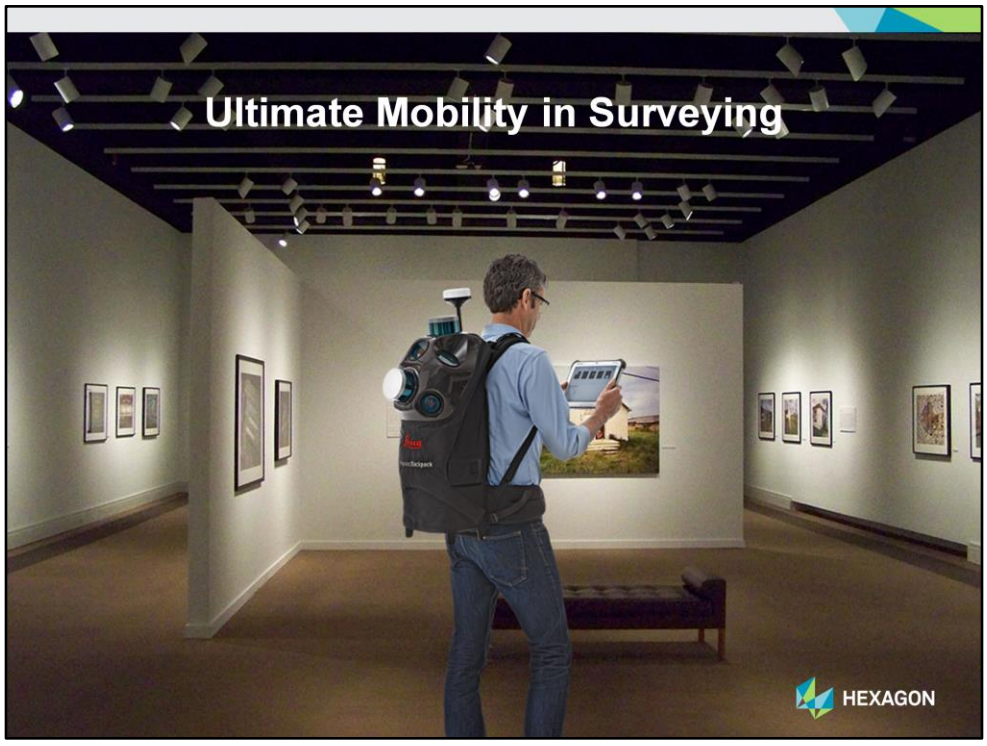


Surveyors like David Dossey of 1519 Surveying have been able to use the MultiStation to expand into fields like aggregates surveying, where having accurate volume calculations is extremely valuable. And firms like Baseline Corp. in Texas use the MultiStation to keep their field crews safer on bridge surveys while efficiently obtaining all the required survey data.



We are now seeing newer technologies also incorporate artificial intelligence, to not only allow for reliable accuracy but also for your own convenience, removing obstacles from your workflow…

Here is once again an example of increasing efficiency by connecting the real world with the digital world. SANDIS, an engineering and surveying firm based in Campbell, Calif., recently transitioned all of its field crews to new CS20 touch screen field controllers powered by the immersive 3D software Captivate. The large screen with the 3D view and user-friendly touch-screen interface give field crews easier control of linework generation and digital layout, as well as the flexibility to switch quickly from GNSS to a total stations. According to SANDIS President Ken Olcott, these advantages have enabled the firm to increase productivity of projects and improve quality across its field and office operations.



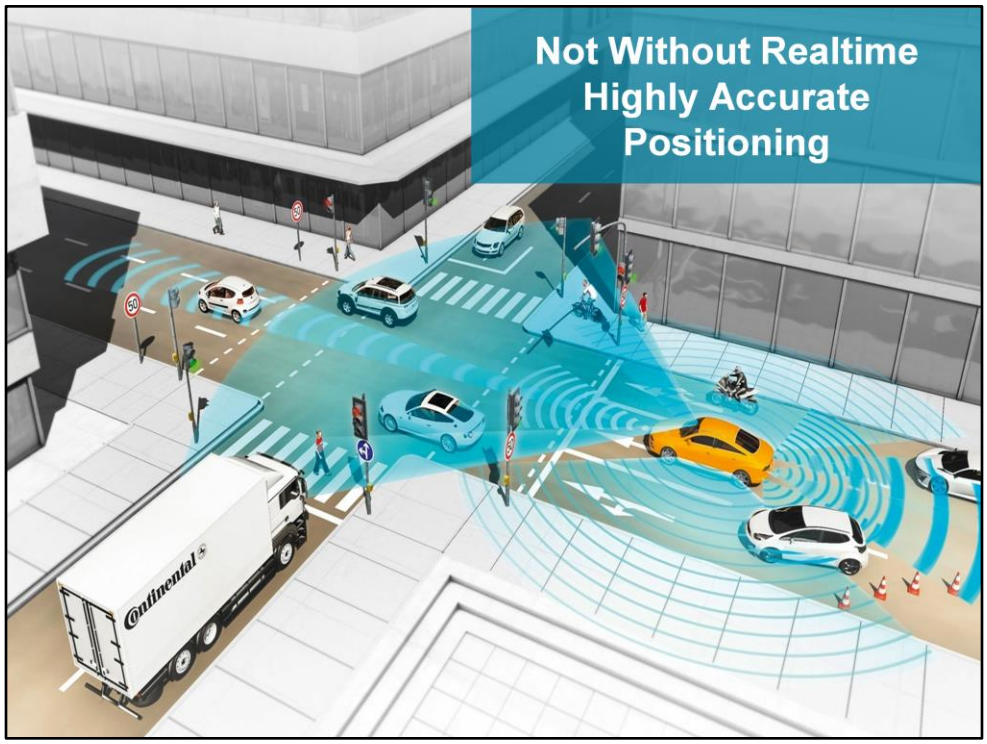
Vast strides have also been made in wearable technologies, which provide amazing flexibility and ease of use, allowing you to easily scan and map indoor or outdoor environments by simply taking a walk. Positioning is provided by SLAM technology which is basically a Photogrammetric technique that uses overlapping images to compute the sensors position and register the data.

Those of us who are in this room aren't the only ones who are interested in accurate, up to date maps and real time positioning. There are tremendous investments in geospatial positioning for autonomous vechicles by the transportation industry.

In January of this year, General Motors said it would spend $500 million with Lyft to build “an integrated network of on-demand autonomous vehicles in the US.” Toyota, Audi, BMW, Ford and others are also making progress in developing driverless cars. Uber has announced billions of dollars in autonomous car investment. Mercedes alone has employed 2,000 engineers to this project. Many with a geospatial background.

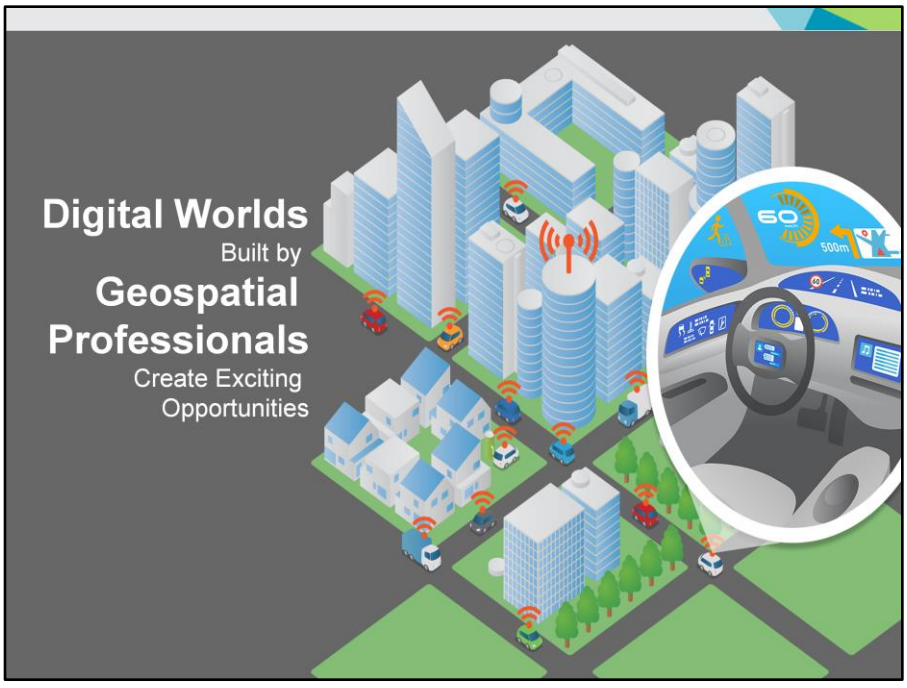
So once again an example of the real world interacting with the digital world but now at 60 miles an hour. 88 feet a second – accuracy is more than nice to have- it maters!

Think about all the split-second decisions that have to be made when driving from point A to point B - passing a vehicle, merging into another lane, avoiding an obstruction, alternate routing, etc. To make this all work two things need to happen: “The maps need to become more accurate, and the registration to them needs to get more accurate.” So real-time, information-rich, highly accurate mapping is a crucial need in the development of autonomous vehicles.



Of course your high accuracy realtime positioning needs to be GEOREFERENCED. This type of positioning can also create additional benefits in safety and security applications. I especially love Geofencing where you can “fence the car” into a certain route or location- If it goes outside the GeFence the car no longer runs. Time along with location can also be added as a parameter.

But how does an autonomous car navigate this ever changing environment? " this is a fantastic problem- how can we get Nationwide road maps that are accurate and that update in realtime- crowdsourcing may be the key - I think of the traffic app that WAZE has where users themselves are providing all the realtime updates OR WHAT if the final deliverable by the construction company is not just the completed road it is the completed road mapped!!



These fully autonomous cars are expected to be mainstream around the world by 2025. As you can see Moore's law is in full effect; the exponential growth of technology continues to shape the ever changing face of surveying and its opportunities.

So how can you tap into the hidden value of maps in your own career? Look for opportunities to use your geospatial competencies outside of traditional clients. Reach out to Consumer Positioning, Construction automation or Autonomous transportation applications or industries. I hope I have been able to show you that we've really only just scratched the surface in the demand for accurate geospatial data. I believe we are entering the Golden Age of surveying and you are our ambassadors that will lead the way.


Thank you
HEXAGON