

INCITE

Your **Eye** In The **Sky**

How Satellite Imagery Propels The
Energy Sector Into The Future



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AN OVERVIEW

Border disputes, pandemics, international conflicts, displaced populations numbering in the millions and new natural disasters seeming to occur every day. In a complicated and chaotic geopolitical landscape, how is it possible to keep track of it all? How can an organisation truly achieve total awareness of the numerous variables that affect them on a daily basis?

There are few industries on Earth that deal so directly with human lives like the defense and intelligence community. With stakes so high, new processes and technologies have come to form the basis for Geospatial Intelligence (GEOINT), the collection and analysis of vast amounts of satellite imagery and other types of locational information in regards to human activities around the globe.

While GEOINT is typically associated with military activity, it is in fact, a critical tool for civil, humanitarian and environmental security as well. The concepts of ISR or Intelligence, Surveillance and Reconnaissance can be applied to everything from monitoring the safe passage of refugees to predicting crime rates within certain urban neighborhoods. The ability to use satellites in order to monitor both wide areas and specific locations has become crucial to analysing volatile situations and react to potentially damaging events.

What is Intelligence, Surveillance & Reconnaissance ?



Intelligence, Surveillance & Reconnaissance (ISR) is the seamless integration of data gathering and field operations. This coordinated acquisition and evaluation of up-to-date information aids in critical decision making during the planning and execution of any mission.

GEOINT is a key feature in ISR activities as it allows for near real-time visual analysis from within a command station. Maps and annotated satellite imagery can be sent to officers in the field, allowing them to react better and thus increasing the chances of success and potentially saving lives.

Very High Resolution (VHR) optical satellite imagery can be an essential tool in security monitoring as it offers recurrent information from both a local and global scale. By combining data sources with artificial intelligence and machine learning, further insights can be gained autonomously and in a timelier manner. Advances in these technologies is increasing the affordability for most users, making the exploitation of remotes sensing more ubiquitous.

Other areas whereupon VHR optical satellite imagery can provide benefits include natural disaster response, event security planning, monitoring critical infrastructure, maritime domain awareness, detecting illegal activities and damage assessment.

“When integrated with other forms of monitoring data, satellite imagery can provide further levels of confidence.”

**RICHARD BRITTAN, FOUNDER & MANAGING DIRECTOR,
ALCIS**

ATTACKING OPIUM

ASSESSMENT OF OPIUM CULTIVATION IN AFGHANISTAN

In 2018, the U.S. Air Force released videos depicting the destruction of dozens of opium laboratories across the Helmand province. The attacks intended to make a dent in the international drug trade as well as cut off funds to the Taliban who benefit from these labs.

Using VHR satellite imagery from the WorldView constellation combined with other data sources collected in the field, the geospatial analytics company, Alcis, was able to determine that the attacks were largely ineffective and costly in civilian casualties. Because of the level of detail contained in 30 cm satellite imagery, they were able to confirm a number of locations had little to no activity during the attacks.

Alcis continued to investigate the opium industry in the region with the aid of satellite imagery. They discovered that between 2014 and 2018, solar powered water reservoirs in Afghanistan increased exponentially from 200 to over 50,000. The adaptation of this technology has significantly boosted the cultivation of illicit opium. This information has led to more reliable intelligence about where illegal opium cultivation is taking place so that a more strategic approach for controlling it can be implemented.

WHAT IS VHR SATELLITE IMAGERY?

Very High Resolution (VHR) satellite imagery are images of Earth taken from space in sub-meter resolution – that is every pixel of the image is under one metre in width and height. VHR imagery can be delivered in different combinations of multispectral bands allowing the user to see more detail than possible with the human eye.

EUSI utilises the Maxar WorldView Constellation from their ground station in Munich, Germany to acquire imagery at 30 – 50 cm resolution with rapid revisit. Rapid revisit refers to the ability of the satellites to collect imagery over the same area within a short time frame.



10 M

Suitable for large land area coverage but will not provide any details – for example analysing critical infrastructure



1 M

Provides some level of detail but will hinder detection and identification objectives – vehicle and activity analysis will not be clear



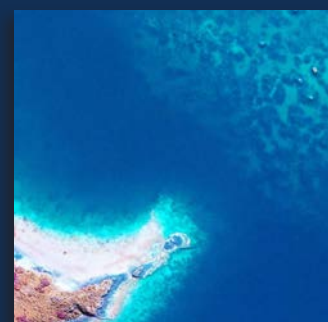
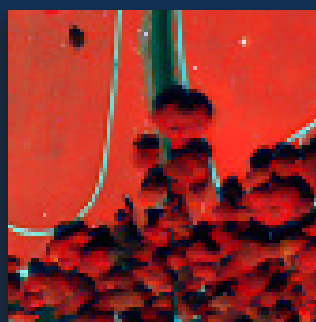
30 CM

The highest amount of detail commercially available and



What can multispectral bands do for me?

The WorldView satellite constellation has 16 multispectral spectral bands that are focused on a part of the light spectrum and sensitive to a particular feature on the ground. By arranging these multispectral bands in various combinations, additional information can be extracted that is invisible to the human eye, such as material composition, vegetation health and water depth.



WHAT SOLUTIONS CAN SATELLITE IMAGERY PROVIDE?

The power of 30 cm resolution in combination with frequent revisits and rapid delivery are crucial in making informed decisions. With the increase of soldiers, aid workers and rescue personnel carrying laptop and tablet based information terminals into the field, the need for actionable high-quality geospatial information has never been higher.

Very High Resolution satellite imagery comprises an essential element of ISR with the ability to identify vehicles, see through camouflage using multispectral analysis and accurately map the finest details of any critical situation.

Beyond the details, satellite imagery has the added advantage of access to anywhere in the world. There is no border too remote or ocean too vast to capture enormous strips of imagery or pinpoint a narrow area of interest. It allows government and private users to monitor any situation without expensive and dangerous field inspections.



Monitor Infrastructure

Near real-time observation of infrastructure to assess weak points, monitor new construction and evaluate change in activity



Mission Planning & Execution

Accurately map features in the planning phase and quickly analyse near real-time imagery for Blue Force Tracking (BFT) efforts



Emergency Management

Assess damages, create detailed maps and monitor relief efforts for efficient deployment of resources



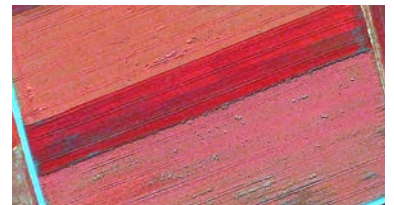
Digital Elevation Model

Stereo VHR satellite imagery is used to make 3D models of terrain, vegetation and structures which is crucial for "Line of Sight" analysis during event security and mission planning.



Tipping & Cueing

A widely used technique that provides fast and cost-effective results. SAR data is used to monitor large areas and identify possible sites of interest. VHR satellite imagery is then collected over these sites for analysis.



SWIR

Short-Wave Infrared (SWIR) allows you to see through thick smoke, detect heat from thermal emissions and identify materials such as metal, plastic, paint, geological minerals and various chemicals.



SECURING RIO

Security Measures for the 2016 Olympics

Safety for both the athletes and attendees of the 2016 Olympics in Rio de Janeiro was of the utmost priority leading up to the games. Brazil was relatively known for its high rate of murder and street crimes as well as for large slums surrounding Rio de Janeiro. In the midst of it all, the city was a hotbed for the mosquito-borne virus, Zika.

In addition to increased officers on the ground, security officials utilised the highest resolution satellite imagery commercially available from the WorldView constellation to plan and map every possible contingency. The imagery focused, not only specific venues but the city as a whole.

They were able to map, with incredible detail, areas of increased risk, mosquito infested neighborhoods, possible security breaches for VIP visitors and escape routes in the event of emergencies. They even used the most advanced Digital Elevation Models (DEM) to evaluate the “Line of Sight” between key areas throughout the event.

Why not just use Google?

Google Maps is one of the most widely used services on the internet and allows high quality data free of charge. Google Earth has significantly lowered the barriers to accessing high resolution satellite images, however it does come with limitations.

- Ⓜ Data is not current and Google has no publicly available schedule of updates
- Ⓜ Populated areas are imaged more frequently than rural or coastal areas
- Ⓜ Images extend only a short distance off-shore – i.e. no images in open waters
- Ⓜ It is not possible to download geo-referenced images from Google
- Ⓜ Multispectral band combinations cannot be changed to reveal additional insights

HOW DO I GET VHR IMAGERY?

Traditionally VHR satellite imagery could be obtained via an order processing system whereby a user contacts an Earth Observation company. The user either requests a specific area of interest and date from the catalogue or order satellite tasking for a future image to be collected.

This method of obtaining data is useful for users who require infrequent data or who need new collections. For more demanding users who need continuous access to the whole archive catalog, SecureWatch is the smarter and more cost-effective option that allows users to view satellite imagery right in a web browser or integrate into their preferred software through an Application Programming Interface (API).

EUSI offers both traditional and cloud-based imagery delivery options combined with personal customer support to guide users to the perfect image.



Traditional Order Processing

- ✓ Search the catalogue dating back to 1999 or request a new image collection
- ✓ Pay for each image upon delivery
- ✓ Global coverage – no geographical restrictions, simply define area of interest from available global coverage
- ✓ Average delivery in less than 48 hours
- ✓ Ability to order imagery with different processing methods (band combinations, pan-sharpening and atmospheric compensation)
- ✓ Satellite Tasking – the ability to request a new image collection at specific location
- ✓ Smarter model for tailored projects or if new collections are needed



SecureWatch: Cloud-based

- ✓ Stream full resolution imagery dating back to the year 1999
- ✓ Subscription based service – a yearly price to view, stream and download
- ✓ Global coverage – no geographical restrictions, simply define area of interest from available global coverage
- ✓ Instant access to imagery via a user friendly web interface or API
- ✓ Ability to enhance imagery on screen (band combinations, atmospheric compensation, adding layers and making annotations)
- ✓ Set alerts that notify you when new data is collected in your area of interest
- ✓ Perfect for customers who need a regular access to archive imagery or integration into software solutions

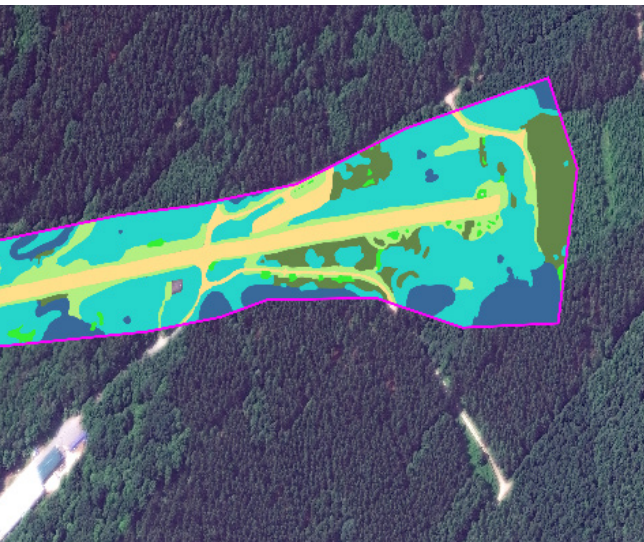
APPLICATIONS



Monitor Displaced People

Millions of people are forcibly displaced every year, creating complicated situations for both border security and humanitarian efforts. Officials on both side of the fence are utilising satellite imagery to both secure fragile territories and ensure the safety of refugees.

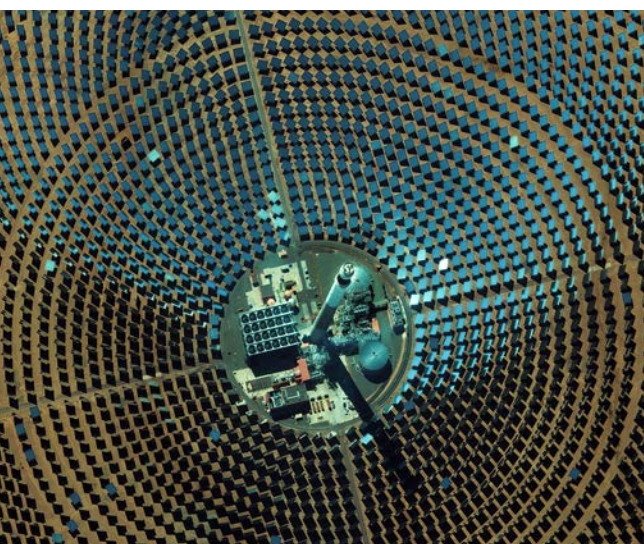
VHR satellite imagery allows officials to view situations as they develop in regions where they may not be able to quickly deploy personnel. The high level of detail and frequent revisit time allows for the accurate estimation of refugee camp populations as well as possible security breaches.



Assess Early Violence

The monitoring of early onset violence in a potential conflict area can help with more efficient strategic deployment and circumvent any further escalation.

Satellite imagery can be used to detect when protests turn to riots and begin to cause damage to buildings and vehicles. Analysts do not need to rely on reports of violence in order to see and evaluate damages. This is ideal when communication infrastructure is interrupted or areas are too dangerous for police inspection. Maps can be created to pin point events and potential hazards before security personnel are sent into the field.



Crime Detection

How do officials spot illegal fishing or logging? How do they track down a hijacked ship or catch a company disposing of hazardous materials? Satellite imagery plays a crucial role in the detection and eventual prosecution of illegal activities that can be difficult to track. The ability to search wide areas but also zero in on a target with great detail gives authorities an incredible advantage.

In recent years, researches have used machine learning along with satellite imagery to study the features that correlate with crimes in urban areas and even accurately predict crime rates in specific areas.

EBOLA RELIEF

Delivery Supplies Safely and Efficiently

In 2014, Liberia had only 50 doctors serving over 4 million people. Already one of the poorest nations in the world, and crippled by recent civil wars, the Ebola outbreak hit Liberia especially hard. Governments and humanitarian organizations were quick to offer aid, but with no accurate maps for affected areas, transporting supplies was difficult.

Helicopter transports become an essential part in the delivery of medical supplies and food to suffering villages. One of the main challenges facing the pilots was where to land within the major urban areas that would offer efficient access to medical facilities.

Using VHR satellite imagery, infrastructure such as roads, bridges, tunnels and medical facilities were mapped out. A Digital Elevation Model (DEM) created from stereo satellite imagery was used to evaluate vertical obstructions and uneven surfaces.

Advanced algorithms quickly identified the ideal helicopter landing zones throughout the city of Monrovia which lead to a more efficient supply chain and saved lives.



Map from Maxar, depicting ideal helicopter landing zones for the city of Monrovia, Liberia during the 2014 Ebola pandemic.

CONCLUSION

Seeing The Big Picture From Space

By remotely sensing from their orbits high above the Earth, satellites provide us with much more information than would be possible to obtain solely from the ground.

In particular, Very High Resolution satellite images offer a unique view of what lays in, on and around potential conflict areas . It provides a cost-effective and simple method of monitoring wide areas both locally and globally and is an indispensable tool for managing the actions and events that impact security.

From this data you can gain insights for better planning, monitoring, responding and decision making within the military, civil and emergency response sectors.

The Future of Satellite Imagery

In recent years there has been a surplus of satellite imagery available. Advances in technology have seen data analytics leverage the power of Artificial Intelligence (AI), cloud computing and machine learning.

These advances have a huge potential to disrupt traditional business and provide enormous benefits in the long term. Ultimately the future lies in cloud based multi-source data platforms that have high powered analytics integrated within. SecureWatch is an example of a satellite imagery platform incorporating features pertinent to Earth Observation and providing the user with an tremendous array of analytical tools at their fingertips.

In the past we only had traditional methods of ordering imagery from Earth Observation companies, however the future of satellite imagery lies in the cloud – that is delivery of images via web browser or API.

This interface provides the user with instant access to satellite imagery that can be immediately analysed and manipulated. This is especially important for time sensitive projects and firms with limited geospatial intelligence resources.

Arming yourself with the right tools is the first step for any intelligence organisation and one of those tools should be VHR satellite imagery.

The background of the slide is a high-resolution aerial satellite image. The top half shows an industrial complex with several large, white, cylindrical storage tanks and various buildings. To the right of the industrial site is a lush green golf course with distinct fairways and trees. The bottom half of the image shows a large body of water, likely a port or harbor, with a large green cargo ship moving through the water, leaving a white wake. Several long piers or docks extend into the water.

About European Space Imaging (EUSI)

Since the launch of the first commercial VHR satellite, we at EUSI have committed ourselves to providing much more than the world's highest quality satellite imagery.

We provide solutions. Utilising our multi-mission ground station at the German Aerospace Center, the team of geospatial experts at EUSI are able to bring together unique partnerships, innovative techniques and tailored services to achieve results for any project.

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