ARTURO

How to Evaluate Imagery Providers

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Introduction

As an Insurance Carrier, determining the best imagery sources to integrate into internal workflows and systems can be very challenging. Arturo developed this white-paper to serve Insurance Carriers with a reference guide when evaluating imagery providers. The goal of this white-paper is for Insurance Carriers to feel confident when evaluating various imagery providers. Continue to read this white-paper to get a holistic view of how each imagery source stacks up.

Key Takeaways

- An overview of each imagery source type available for Insurance Carriers and Insurtech Companies
- An impartial examination of these types of imagery sources
- The specifications to consider when selecting an imagery vendor
- Learn how to evaluate an imagery provider based on specific evaluation criteria
- Determine which type of provider is the best fit for your organization

Who should read this paper?

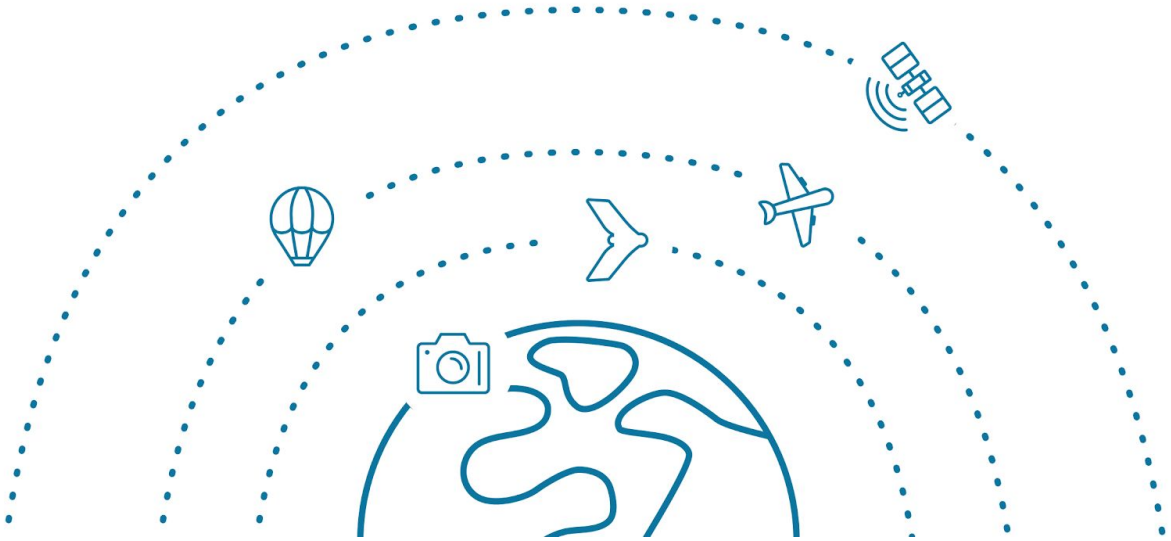
This whitepaper is intended for Insurance Carriers and Insurtech companies. Members of underwriting, innovation, claims, portfolio management and risk management teams will find this whitepaper valuable.

Why Arturo?

Arturo is an AI analytics provider that enables Insurance Carriers to improve the accuracy and speed of decision making across claims, underwriting, pricing, and renewals. Developed by and for Insurance Carriers, Arturo accesses a wide breadth of claims and policy data to continuously improve the quality of our predictive models and proprietary Confidence Scores.

Arturo delivers on-demand property data utilizing multi-source imagery via a configurable API, enabling better risk assessment. We partner with imagery providers across satellite, aerial, stratospheric balloons, drone, and ground imagery. Arturo is constantly identifying and evaluating potential new, cutting edge imagery providers to incorporate into our models. We have acquired valuable intelligence and experience that, we believe, will benefit Insurance Carriers and Insurtech companies. Client-centric innovation is at the heart of what we do and enables Arturo to deliver the most complete and comprehensive property coverage possible.

The Types of Imagery Providers



Aerial Imagery

Description:

Aerial imagery is the most beneficial for Insurance Carriers because certified aircraft can handle a large payload of heavy camera and sensor equipment (e.g., Ortho and Oblique cameras plus LiDAR) while remaining steady throughout the flight through gimbal technology. Additionally their technology includes IMU and GPS solutions which improves image accuracy and precision and has become a longstanding trusted source as they fly between 5,000 to 40,000 ft AGL. Some aerial imagery providers tout they have 90%+ coverage of urban areas with two looks at an urban property on average per year. We have found this to vary considerably and it is worth checking the relationship of your portfolio with the coverage areas of the given providers.

On the other hand, flying an airplane for imagery capturing is a costly endeavor as you must contract a pilot, schedule the flight far in advance, and you must follow strict FAA requirements.

Providers

- Vexcel Imaging (GIC / Geomni)
- Nearmap
- Aerometrex
- Hexagon
- Eagleview

Frequency of imagery:

Images from aerial sources are somewhat less frequent than the others listed in this whitepaper. Typically most major cities are captured and collected one to two times a year. However, of note is that many of these providers are also refreshing the same US Cities annually which actually translates to more imagery availability for Artruo, given we support multiple imagery sources.

Equally some of the imagery providers have multiple sensors in operation that offer different resolutions for urban than rural areas. For example, rural areas are being captured at 15-10 cm by certain providers in addition to capturing urban areas at 7.5 - 5cm. Additionally, some of the providers are now offering pre and post event imagery after a major natural disaster which is sometimes referred to as “Gray Sky” imagery. Data availability is critical to insurance carriers and accessing such data may vary between providers.

Resolution of imagery:

Aerial imagery Spatial Resolution varies between 15cm to 5cm GSD (i.e., Ground Sample Distance). The highest possible resolution commercially available is at 5cm.

Bottomline:

To date Aerial imagery provides the most current source of high-resolution Ortho and Oblique Imagery despite the refresh rate frequency which is why many carriers are looking for multiple sources as part of their AI approach.

We believe this will likely change as the new camera sensors are enabling imagery providers to fly at a much higher altitude and faster speed thereby capturing areas more quickly without undermining the resolution.

Satellite Imagery

Description:

Imaging satellites scan a particular area by utilizing the satellite’s remote sensing in order to collect property images. Satellites follow an orbit path over the Earth, which provides coverage of most of the continental US and Canada but, in many cases do not collect everything in their path. Depending on the sensor used, weather conditions can impact the quality of images collected. Satellite imagery can be a very helpful tool for Insurance Carriers to understand ground conditions around properties. Satellite imagery sources tend to have more coverage outside urban areas.

Providers

- Maxar Technologies (formerly DigitalGlobe)
- Planet
- Airbus
- Copernicus

There are more regulations in place around satellites versus airplanes. The US government, for example, will not allow a commercial company to collect and sell imagery at a resolution greater than 30cm. Satellites are typically deployed with Govt Agencies in mind for sub regional / continent surveillance in mind which has also allowed them to commercialize a sub sampled product (i.e., 30-50cm).

Frequency of imagery:

Satellite imagery has higher Temporal Resolution, or frequency, because satellites orbit certain areas at a consistent rate. Images collected from satellites have a consistent revisit-rate for similar latitudes. In general, higher and lower latitudes have faster revisit-rates than near the equator. Satellite imagery providers typically collect images four times a year, providing clients with more "on-demand" imagery.

Resolution of imagery:

The spatial resolution of satellite sourced images is lower than aerial because of where the satellite's are located within the Earth's atmosphere and the trajectory they follow. Satellite images produce around 30% accuracy within our data models with a resolution between 30cm - 1m. Because resolution is low, it's important to note that very few property characteristics can be derived from such imagery. Typically, where AI companies have produced services for Insurance Carriers using Satellite imagery they tend to only distinguish the outlines of buildings (e.g., structure or building footprints).

Bottomline:

Satellite imagery produces lower-resolution images at a high frequency and increased coverage of both rural and urban areas.

Drone Imagery

Description:

Drones, also known as "Unmanned Aerial Vehicles" (UAVs), come in a wide array of shapes and sizes, with the most popular being the DJI Mavic and Phantom product lines within the Insurance Industry. New upcoming technologies from Skydio are making an impact in this space. In general, drone imagery can capture both Ortho and Oblique imagery in close proximity to a property at a much higher resolution (e.g., sub 1" GSD). This type of imagery offers great versatility for Insurance Carriers but today there isn't one single provider that can fully serve all the data needs of Insurance Carriers.

Providers

- DroneDeploy
- Precision Hawk
- Dronebase

This is mainly due to the various challenges around drone imagery including:

- Drones and their operators must comply with ever changing FAA regulations
- Government regulations are still being defined for Beyond Visual Line of Sight (BVLOS)
- To scale you need a nationwide drone pilot network that is properly accredited
- Capture durability / extendability is limited to battery life limitations of drone assets themselves (e.g., 30 minutes)
- The GPS and Gimbal solutions for drones aren't as robust as aerial camera solutions, however ground control points can be added to projects requiring engineering grade (e.g., DroneDeploy, Propeller)

Within the Insurance Industry, drones have been proactively used to gain a better understanding of the implications of hail damage to a property and AI is now being used to identify such damage automatically. This has been made much easier through the flight automation and anti avoidance technology that is part of the solution platforms and next generation of drones from DroneDeploy and DJI respectively. Once the FAA mandates that flight automation around a building is safe and doesn't require a certified pilot to control, the optics will likely change.

Frequency of imagery:

Drone imagery collection flights are fully automated and can effectively be flown on-demand. When the need for imagery of a specific location arises, such as after a weather event (i.e., Tornado), a drone can provide the flexibility to fly over that area as needed. Larger weather events (i.e., Hurricanes) are more complicated to execute upon especially where Statewide restrictions are in place and gray sky imagery providers can offer better coverage and turnaround times.

Resolution of imagery:

Images collected from drones have a spatial resolution between 30cm and 1cm.

Bottomline:

Drone imagery produces high-resolution images at a high frequency. However, there is no consistent repeat coverage of large city wide areas restricting wide area temporal analysis. Additionally there are still many regulatory challenges to overcome and consider when implementing a drone program as an Insurance Carrier.

Stratospheric Balloon Imagery

Providers

- Near Space Labs
- Urban Sky

Description:

Stratospheric Balloons are manned or unmanned balloons that are filled with helium and released into the stratosphere between 60,000 - 120,000 feet in elevation. They are controlled by very precise weather modeling. This kind of imagery produces high-resolution aerial imagery at a cost that is far less than satellites, aircrafts or drones. It is fair to note that these balloons are still in an early stage of development for image collection.

Balloons offer an interesting opportunity for Insurance Carriers because they can be operated in a region of the atmosphere (15 to 45 km in altitude or roughly at 60,000 ft), which is too low for satellites and too high for aircrafts. This means they fall in an elevation that is between satellite and aerial imagery. Stratospheric balloons have been around for decades, and just recently they have been repurposed for imagery acquisition. They don't have the same FAA restrictions that airplanes have or the resolution restrictions that satellites have.

Frequency of imagery:

Balloon sourced images have a higher Temporal Resolution but they are still in a very experimental phase. There is potential for balloons to fly very frequently, up to once a week. No other types of imagery providers collect images that often.

Resolution of imagery:

Because the balloons are closer to Earth, they are able to produce images with higher spatial resolution, which is typically between 8cm - 30cm.

Bottomline:

Despite their experimental status, Stratospheric Balloon Imagery could produce near aerial-level spatial resolution with satellite-level coverage with similar or better revisit rates.

Ground Imagery

Description:

Ground level imagery provides great value in the ability to see changes in property conditions from the human eye-level perspective. Ground level imagery can be sourced across a number of different camera types including everything from smartphones to panoramic cameras to combined 360 degree camera and LiDAR sensor systems. Typically this type of imagery is collected by mounting the sensor system to a ground-level object that can be either stationary or mobile.

Providers

- Bing Streetside
- Google StreetView
- Apple Maps Look Around
- Carrier Specific Inspections

This kind of imagery is really beneficial for detecting the number of stories a property has, the classifications for building and roof materials, etc., However, ground level imagery does not provide a full 360 degree view of a property and can often be obstructed by an object on the ground. For that reason, ground level imagery is best utilized when combined with other imagery sources as described above. Data derived from ground level imagery does not meet the standards of most Insurance Carriers and therefore it should only be used supplementally, not standalone. Moreover, companies such as Google heavily restrict the use of their ground level imagery for the purpose of extracting property characteristics.

Frequency of imagery:

Ground level imagery has a lower Temporal frequency, typically collecting images just once a year. However, companies such as Google go back several years with their StreetView product.

Resolution of imagery:

Spatial resolution typically isn't a consideration for evaluation for Ground level imagery.

Bottomline:

Ground level imagery offers both Temporal and higher spatial resolution capabilities but should only be used as supplemental to imagery collected from other sources such as aerial.

Evaluation Criteria

As an Insurance Carrier, determining various imagery providers can be a daunting task. To help Insurance Carriers feel more confident when evaluating imagery providers, we developed the list of the following areas of criteria.

#1 Internal Data Requirements

When deciding which type of imagery to incorporate into your business's workflows, first think about your internal data requirements; even before you consider any of the following criteria areas. Consider the following questions:

- What is the geographical landscape of your portfolio?
- What is the distribution of addresses across highly urban and rural areas? Do you cover multiple countries?
- Are your portfolio's properties located in catastrophic-risk prone areas such as flood zones, wildfires, hurricanes, etc?
- How frequently do you want images captured?
- How quickly do you need images delivered?
- Which set of property conditions are most important?
- What volume of data can you store and analyze?

Bottomline:

It's imperative to consider your company's specific use cases prior to selecting an imagery provider. Each insurance company has a different and unique set of data requirements. Once you have an understanding of your internal data model standards, you can use the categories of criteria listed below to evaluate imagery providers.

#2 Resolution

In geospatial terms, image resolution is known as Spatial Resolution. This industry term refers to the smallest spatial element or object discernible on the image captured by the sensor. Spatial Resolution is often represented in units of meters or centimeters. Ground Sample Distance (GSD) states the physical distance between pixel centers of a given aerial imagery product. When thinking about resolution in this way, a pixel represents a certain distance on the ground, or the measurement. From a geospatial perspective, practitioners describe imagery as “two meter resolution imagery,” which means that one pixel is equivalent to two meters on the ground. One meter resolution imagery would have a higher resolution than this, and 50cm resolution would have an even greater resolution.

Spatial Resolution is the number one factor in determining a data model’s accuracy:

This criteria is highly important for Insurance Carriers to have a 360 degree understanding of properties across your book of business. Most data models require a very high Spatial Resolution of an image - roughly 15cm per pixel or higher.

When thinking about which imagery source will derive the highest resolution images, consider this: the closer the property is to the camera or sensor, the higher the Spatial Resolution. Because satellites are further away from properties, their highest resolution possible is at 30cm, whereas aerial imagery providers can produce resolutions up to 5cm.

Images captured at a lower Spatial Resolution (above 15cm) result in less detailed property information available. This means, for example, it’s impossible to build accurate roof level models for the roof condition and material, chimneys and skylights with a low Spatial Resolution.

Bottomline:

Images sourced from aerial, balloons, drones and ground offer higher resolution images. The higher the Spatial Resolution, the more detailed data to improve your models and derive the property characteristics you need across your business lines.

#3 Frequency

In geospatial terms, image capture frequency is known as Temporal Resolution. This term, also known as the revisit-rate, expresses how often a particular area is re-captured and reprocessed. The higher the refresh rate, the more up-to-date the imagery. It’s important to note that frequency is very location dependent. Rural areas will generally have a lower revisit rate (with aerial, drone, and balloon imagery) than urban areas. Same is true for satellite

imagery across rural areas, although to a less extent, because higher latitudes have a faster revisit.

Temporal Resolution typically includes factors like image capture frequency and imagery currency. Temporal Resolution can be thought of as a metric - the amount of time it takes to re-acquire imagery of the same area.

Every Insurance Carrier requires a different imagery collect schedule, so you must consider the Temporal Resolution, or frequency, of each imagery provider type. Depending on your specific use case, temporal property images can be extremely beneficial, especially prior to policy renewals or around a catastrophic event. For example, you may want property imagery today, before a catastrophic event a month prior, and on the date you wrote the policy last year.

Satellites orbit the earth consistently so images sourced from satellites have a higher Temporal Resolution. The provider Planet, for example, collects imagery of the entire global land surface everyday, but this is only at ~3m Spatial Resolution.

Adjacent to Temporal Resolution, but is a different factor, is image currency. When practitioners refer to currency, they mean how up-to-date the image is. It could be 2 months, 6 months or 1 year old. Insurance Carriers should also consider image currency in tandem with revisit rates across imagery providers

Another factor related to imagery frequency is the timing and speed that the image is delivered to you. There is always a lag time, it can be a few days or a number of months, from when you request imagery to when you receive it. Consider how long it takes for you to acquire the imagery per provider post-collection.

Bottomline:

Image collecting frequency is a very important factor and it is highly dependent on location (i.e., urban vs rural) and time of year (i.e., leaf on or off). To put this into context, most Insurance Carriers need to run an entire portfolio analysis four times a year, or once a quarter.

#4 Coverage

Coverage relates to the image collection flights that cover a particular geographical area. There are two aspects of coverage - Spatial Resolution and Temporal Resolution.

Each provider launches flights over a specific geographical area and each flight's purpose is for image collection acquisition. For each acquisition, providers will fly many aircraft that will

collect lots of images throughout that flight. The provider then stitches all of the images together, making them available on their server.

Regarding the location of their flight plans, each imagery provider tends to re-acquire geographical areas they have already flown over in the past. Depending on their flight schedule, or Temporal Resolution, each provider flies over the same area year after year. In this way, providers have already made up their minds, so to speak, on exactly where they have coverage. Once that plan is in place, they repeat that same coverage each year. The amount of unique square miles of US that a single imagery provider covers isn't actually increasing year after year because they fly the same areas.

Some providers do offer custom collects which can be advantageous for specific areas of interest (AOI) and expansions across a Insurers Portfolio. Be sure to get regular updates to the custom AOI's in future years.

Identifying where an imagery provider has coverage is very important to Insurance Carriers. If there is no imagery available for addresses within your book, then that provider isn't a good fit for you. During your evaluation, each vendor should be able to clearly demonstrate where they have coverage and if they can provide imagery across the addresses that you insure.

What about rural areas?

For Insurance Carriers that have addresses that fall within towns of a population of less than 50,000, it can be difficult to find an imagery provider that covers your properties. Two providers provide great coverage in rural areas, namely GIC-Geomni and Hexagon as they have programs in place to do so. However, you need to note for these programs the resolution of imagery is much lower than the 7.5 - 5 cm range associated with urban areas.

In 2017 GIC differentiated their offerings to cover areas that have towns with 50K population on a three-year revisit rate. For reference, most insurance providers cover towns with populations of least 100K- 200K. They now fly over more areas but the refresh time is longer than what you would get from other aerial providers, however the resolution is as per urban areas. Most rural areas are on a three-year image collection repeat schedule. Depending on your company's use case, this is a long time.

Many imagery providers can't afford to fly on a more consistent basis (remember, it's very pricey to lease and operate an airplane) and the providers must consider the demand and ROI for obtaining imagery in rural areas.

Bottomline:

One provider will likely not collect imagery across the entirety of a portfolio. By combining several imagery sources you are better positioned to have complete coverage of your portfolio.

Evaluation

This worksheet can be used to evaluate each imagery source against the top three criteria.

	Resolution	Frequency	Coverage
 **Aerial**	15cm to 5cm	1-2 / year	75%-80% urban areas in US
 **Satellite**	30cm to 1cm	4 / year	Typically global, but with more collects in urban areas than rural
 **Drone**	Sub 1" (Sub 2cm)	On-demand as required	Largely dependent on specific needs and not consistently flown globally.
 **Stratospheric Balloon**	8cm - 30cm	~12 / year	TBD
 **Ground**	Varies by provider	Usually refreshed every 2 years	90% - neighborhoods / major roads

Source: Nearmap, GIC/Geomni. Maxar, Nearspace Labs and Google 2020.

Honorable Mentions

The next three evaluation criteria may not be essential determining factors to all Insurance Carriers. However, they are worth mentioning in case they pertain to your particular use case.

#5 Scalability, Delivery, and Technology

Each imagery provider uses different data formats, programming languages, and service standards. Some provider's technology is therefore more scalable, configurable, and transferable than others. There can be technical roadblocks to integrating into your internal business workflows due to engineering architecture and infrastructure that may be outdated.

Here are a few questions to consider when thinking about each provider's technology:

- What is the data delivery format? API? SDK? Hard Drive?
- Does this provider have an API that is easy to work with and configure?
- What programming languages does the engineering team use?
- Where is the data hosted? In the cloud or on-premise?
- What data standards and web service standards do they support?

Integrating property and imagery data into your systems should not be disruptive to your internal business workflows and best practices. Consult with your engineering team when evaluating providers based on their technology, delivery formats and ability to scale.

#6 Bit-depth

Bit-depth is known in the geospatial space as Radiometric Resolution. The information stored for each pixel is captured and rendered at a particular bit-level. This dictates the number of potential values (from 0-256), or discrete colors, any given cell may represent. The Radiometric Resolution of an imaging system describes its ability to discriminate against very slight differences in energy. The finer the Radiometric Resolution of a sensor, the more sensitive it is to detecting small differences in reflected or emitted energy. For example, 8-bit indicates 256 possible values for each R-G-B (Red, Blue, Green) value. Data collected at a higher bit rate, such as 12 bits, represent the number of channels and the channels there are, the more accurate the measurements.

#7 Spectral Resolution

Spectral Resolution represents the ability of the sensor to resolve wavelength intervals (bands), within the electromagnetic spectrum. The Spectral Resolution is determined by the interval size of the wavelengths and the number of intervals being scanned from the sensor. In this way, Spectral Resolution refers to the number and width of wavelengths captured by the imagery sensor. The finer the spectral resolution, the narrower the wavelength range for a particular channel or band. While the human eye can see in R-G-B, capturing additional wavelengths such as near infrared, can show the presence of water and plants for further property analysis and insights.

Aerial and Balloon imagery often provides data with the standard three bands, R-G-B. Most Insurance Carriers' data models accept the standard three bands. On the other hand, Satellites often have wavelengths like LWIR, SWIR. These can be used to identify fires because they interact strongly with heat.

Conclusion

When evaluating each imagery provider, there will inevitably be ‘trades offs’ that you have to weigh across all of the evaluation criteria. For instance, imagery with higher resolution may be collected at a lower frequency while you should also consider coverage and delivery formats.

The most important factors Insurance Carriers need to think about in terms of data inputs are image resolution, coverage, and currency. To improve decision making across quotes, claims, and underwriting, Insurance Carriers need the most up-to-date property data. To attain the most accurate property data analytics, utilizing multi-source imagery across all categories of sources is your best option. That is exactly why we have worked so diligently to support multiple image providers.

Taking a client-centric approach to solving challenges across the insurance industry is at the heart of everything we do at Arturo. To better enable insurance companies with property analytics via multi-source imagery, Arturo is constantly seeking today’s most cutting edge providers across data, technology, and imagery.

To learn more about Arturo, visit us at www.arturo.ai or test drive our AI property analytics technology by requesting a demo.

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