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'Building Your Geospatial World'

Satellite Imagery –
Frequently Asked Questions

1. What is resolution and how does it impact my satellite imagery?

Simply stated, resolution is the size of the individual pixels (or squares) of color that make up your imagery. The smaller the pixels, or the better the resolution, the more detail you can see and the closer you can zoom in on the imagery before pixilation occurs. Pixilation occurs when you zoom too closely on a dataset and the individual pixels/squares of color become apparent. Below, the image on the left is zoomed to the closest level possible without pixilation. On the right is a subsection of the larger image that has been zoomed in to show pixilation.

2. Is there a difference between Archive and Tasked imagery?

Yes, archive imagery is delivered from a library of data that has been collected and stored since IKONOS and QuickBird were launched. When the archives do not contain the imagery you are looking for, tasking is the only option. Tasking is the process of programming the satellite to collect custom data for your project (see Question 3 for more details on tasking).

3. How does tasking work? How long will it take to collect my new imagery?

When a tasking order is submitted, a feasibility study is completed and an estimated collection window is generated. This estimated collection window is based on the size of the order; the average cloud cover; the average revisit time of the satellite (see Question 4); and the level of

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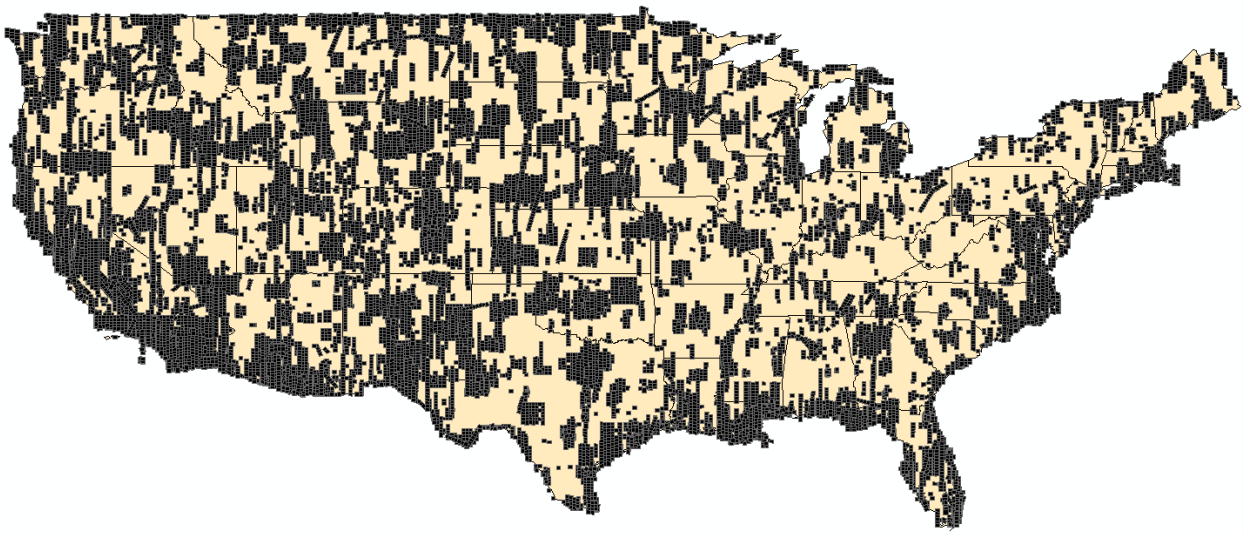
competition from other tasking orders in the region. Tasking orders come with a 20% or less cloud cover guarantee over the area of interest; and note that haze is not considered cloud cover if land is visible below the haze. With IKONOS, lower cloud cover guarantees are available in some situations for an extra fee. If imagery meeting or exceeding the cloud cover guarantee is not obtained during the estimated collection window, then you will have the option to either cancel the order or extend the collection window at no cost. While there is no way to determine a collection window without completing a feasibility study, in the continental US, a two to three month collection window is common.

4. Is there cloud-free high-resolution coverage of the entire world or the entire US?

No, even if you were to combine the entire archive of both IKONOS and QuickBird there would still be pockets of land with no high-resolution coverage. This fact is caused by three main factors: a limited field of view which restricts the amount of land visible to the satellite at any given time; cloud-cover obscuring the land as data is collected; and the time between visual accesses to any given point (also called revisit time). In the continental US, the average revisit time under typical operating conditions is ~5 days. As an illustration, below is a map of the entire QuickBird archive with 20% or less cloud cover and collected at 25° off-nadir or less (created on August 1, 2007).



5. What is the difference between natural color and multispectral imagery?

These terms refer to the spectral bands (or loosely the color layers) that will be delivered to you in the various imagery products. Natural color imagery will be delivered with blue, green and red spectral bands. When these three bands are displayed together, they create a true color picture as the human eye would see the landscape. For most applications, natural color imagery will suffice.

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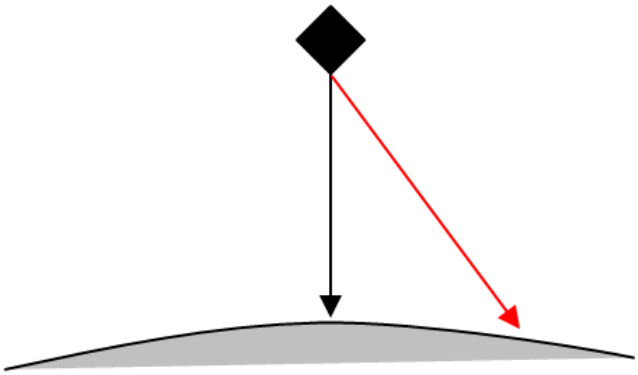
Multispectral imagery has four bands of spectral data: blue, green, red and near infra-red (NIR). Multispectral imagery is appropriate for those studying vegetation and/or undertaking spectral analysis and classification.

6. What does off-nadir angle refer to?

This is a term that is often associated with tasking orders. It defines the angle that the satellite lens looks at the earth from. At-nadir is the point the satellite is looking directly down at the ground; while the off-nadir angle would tell you how far from this point (in degrees) the lens is tilted. Imagery that is collected at over 25° off-nadir is often inappropriate for ortho-rectification and can appear grainy when viewed. In the picture below, the high-resolution satellite is portrayed with a black diamond. Imagery collected at-nadir would be directly below the black arrow. The red line represents imagery collected off-nadir; and the off-nadir angle would be the angle between the black and red lines (in degrees).



7. What is the difference between georeferenced and orthorectified imagery?

The main difference is the horizontal accuracy of the imagery you will receive. For many applications, georeferenced (Standard) imagery will suffice. While this product has lower accuracy than does orthorectified imagery, it can be produced quicker and at a lower cost. The higher accuracy of orthorectified imagery is achieved by tying the data to a fine Digital Elevation Model (DEM) at photo-identifiable points (Ground Control Points or GCPs) with known latitude and longitude.

8. What are the horizontal accuracies of the satellite imagery products?

The table below summarizes the horizontal accuracies of both georeferenced and the most accurate orthorectified imagery available for both satellites. With georefenenced imagery, the accuracies stated below are global averages. As such, imagery in flat areas will commonly have better accuracy than is stated, while imagery from mountainous areas will commonly have worse accuracy. There

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are two measures of horizontal accuracy that are typically employed: Circular Error 90% (CE90%) defines the distance that 90% of the pixels in an image fall within from their 'true' location on the planet; while Root Mean Squared Error (RMSE) is the square of the average error of every pixel in the image from its 'true' location.

Product	Satellite	CE90% (m)	RMSE (m)
Georeferenced	QuickBird	23.0	14.0
	IKONOS	15.0	N/A
1:4,800 Ortho-imagery	QuickBird	4.06	2.5
1:2,400 Ortho-imagery	IKONOS	2.0	0.9

9. Is there a product that I can process into orthorectified imagery?

Yes, with both IKONOS and QuickBird imagery there is a product (i.e. Ortho Kit and Ortho-Ready respectively) that can be orthorectified in a remote sensing software package as long as you have an accurate DEM and GCPs.

10. How is satellite imagery sold and at what price?

Satellite imagery is sold by the square kilometer and each satellite has a minimum order size that varies with product type (see Question 12). Pricing information can be obtained by calling our Sales Team at (720) 470-7988. Academic and large volume order discounts are available.

11. Is it possible to purchase lower priced imagery by decreasing the resolution of the data?

No, prices are not impacted for either IKONOS or QuickBird imagery by decreasing the resolution of the product.

12. What is the minimum order size for satellite imagery?

QuickBird imagery has a minimum order of 25 sq. km. for archived georeferenced data; 64 sq. km. for tasked georeferenced data; and 100 sq. km. for ortho-imagery. IKONOS minimum orders are more complex but in general can be summarized as 49 sq. km. for archived georeferenced data and 100 sq. km. for tasked data and ortho-imagery. More specifics on IKONOS minimum orders are available upon request. Note that all minimum order areas are contiguous.

13. What file formats are available?

QuickBird imagery can be delivered in GeoTIFF 1.0, NITF 2.0 or NITF 2.1 format; while IKONOS imagery can be delivered in GeoTIFF 1.0, uncompressed NITF 2.0 or compressed NITF 2.0 format. A GeoTIFF is identical to a TIFF file except that geographic information (i.e. latitude and longitude) has

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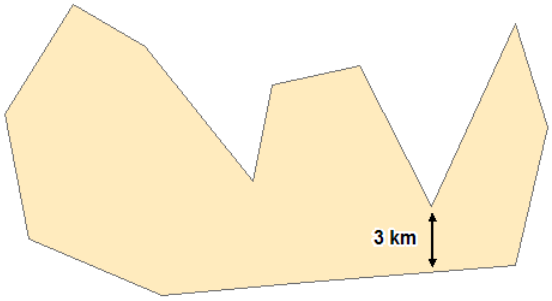
been embedded in the header of the file. NITF is a file format commonly employed by governments.

14. How can I define the geographic area I want to purchase?

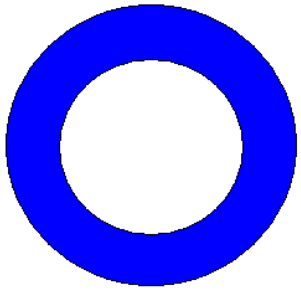
This area can be defined in several ways. For most, the easiest method is to supply eMap with a list of the vertices defining the polygon you wish to purchase. The vertices need to be in either degrees minutes second, e.g. 84° 23' 37" N, or decimal degrees (preferred), e.g. 84.39361, format and listed in a clockwise fashion. This geographic information can be obtained by using Google Earth or a similar such program. A second method is by ESRI Shapefile in Geographic WGS84 format.

15. What order polygon shapes are acceptable?

Order polygons can vary in shape as long as they are at least 3 km wide for archive orders and 5 km wide for tasking orders at their narrowest point. Further, they cannot have holes in the interior (i.e. 'doughnut holes') nor are circular orders allowed.



Acceptable



Unacceptable

16. Why is imagery tiled?

Many programs have limits to the file size they can open. As is discussed in Question 23, imagery files are often very large hence the need to tile the data when orders grow in magnitude. GeoTIFFs have a maximum file size of 4 gigabytes (GB).

17. Will my satellite imagery be delivered as a seamless mosaic?

That depends on the data you order and the type of product. If all of the imagery you are ordering is from one imaging event (i.e. from one day), then the imagery will be delivered as a seamless mosaic – though it might be tiled (see Question 16). When imagery is order from multiple imaging events, then mosaicking depends on the type of product. If othorectified imagery is ordered, then there is an option with both satellites for seamless mosaicking. With georeferenced imagery, the data will not be delivered as a seamless mosaic; rather, the imagery will be delivered in individual

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files corresponding to each imaging event. There is a strong likelihood that there will be misalignment between edge features from two imaging events.

18. What is Dynamic Range Adjustment? And who is this appropriate for?

Dynamic Range Adjustment (DRA) is a two step process that includes both color correction and contrast enhancement. It results in visually-appealing imagery. DRA is intended for users that cannot perform these enhancements on their own. As DRA alters the spectral information of satellite imagery, it is not intended for spectral analysis and/or classification.

19. What is Bit Depth?

Simply stated, bit depth refers to the amount of spectral information contained in a single pixel of imagery. For the vast majority of end-users, 8-bit depth satellite imagery is the most appropriate. Only if you plan to perform spectral analysis and/or classification is 16-bit depth imagery recommended.

20. What is the difference between a projection and a datum?

A projection is the manner in which data that is collected from a spherical globe is translated to a flat surface like a LCD monitor. They are also referred to as coordinate systems. There are a large number of projections, the two most commons ones in the US are Universal Transverse Mercator (UTM) and State Plane. A geodetic datum (such as WGS84 and NAD83) is a geometric model of the size and shape of the earth and is used to guide the orientation and origin of the projection system. Taken together, the projection and datum determine the manner in which the pixels that make up your satellite imagery are arranged on the screen as well as the geographic information (i.e. latitude and longitude) that is tied to the data.

21. What is resampling and which method should I choose?

Resampling is another result of transforming an image of a spherical world for display on a flat surface. Resampling determines the spectral values that are assigned to each pixel of your satellite imagery. The method you should choose depends on your project needs and the product you order. If you are completing spectral analysis and/or classification, you should choose Nearest Neighbor resampling. For the majority of other users, either a Cubic Convolution or Pansharpening resampling method is recommended. Consult eMap's Satellite Imagery Sales Team for a recommendation on the correct resampling method for you.

22. How can satellite imagery be delivered to me?

Both IKONOS and QuickBird data can be delivered via FTP Pull or on DVD. With FTP Pull, data is posted to a password protected site and can be downloaded from anywhere with a high-speed

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Internet connection. FTP Pull is more restrictive for IKONOS imagery as there are limits to the amount of data that can be delivered. For very large orders, delivery on an external hard drive is possible for an additional charge.

23. How big are satellite imagery files?

The size of the file(s) is dependent upon the resolution of the imagery; the product you purchase; and the size of the order. In general, it is safe to assume your dataset will be on the order of hundreds of megabytes (MB) to several GBs – or even more for very large orders. As a reference, if you were to purchase 25 sq. km. of 60-cm natural color data, your imagery file would be approximately 150 MB. With high-speed Internet, this dataset would take less than one hour to download from an FTP site.

24. Once an order has been placed with eMap, how long does it take to receive my satellite imagery?

There are many factors that control the delivery timeline of satellite imagery. Geo-referenced archive imagery is the quickest product to deliver. For this product type, FTP Pull is the most rapid delivery method for both IKONOS and QuickBird imagery with data typically posted to an FTP site within 48 hours of order confirmation. DVD deliveries are shipped via FedEx or DHL and typically take 5 business days to arrive to addresses within the continental US. If georeferenced tasked imagery is ordered, once the data has been successfully acquired (see Question 3 for details on tasking) by the satellite the same delivery timelines stated above apply.

Orthorectified imagery generally requires 30 days to produce and deliver, though this can vary greatly based on the size of the order; the accuracy level of the ortho-imagery; and the degree of difficulty required for GCP collection. For tasked ortho-imagery, the collection window needs to be added to this estimate.

25. What programs can I use to view satellite imagery?

The program you can use depends on the file format. If you have a natural color GeoTIFF, this imagery can be viewed in most software packages that can open TIFF files such as Photoshop and CorelDraw. In order to utilize the geospatial component of satellite imagery and/or to view mutlispectral imagery, you will need to use a GIS (e.g. ArcGIS or MapInfo) or remote sensing (e.g. ENVI or IMAGINE) software package. Remote sensing software is required to view NITF file formats.

26. How many end-users can I share my imagery with?

With QuickBird imagery, up to 5 end-users can share the data for no additional charge; with IKONOS imagery only 1 end-user can use the data. Additional end-users can be added to the imagery license for a fee. Contact eMap's Sales Team at (720) 470-7988 for details on end-users definitions and additional licensing fees.

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27. Can I resell my imagery?

No, there are strict regulations in end-user licensing agreements which do not allow for resell of your imagery. Only authorized resellers, such as eMap International, are permitted to do this. There are other restrictions in the end-user licenses that should be considered before purchasing satellite imagery. Contact eMap's Sales Team at (720) 470-7988 for details on these additional restrictions.