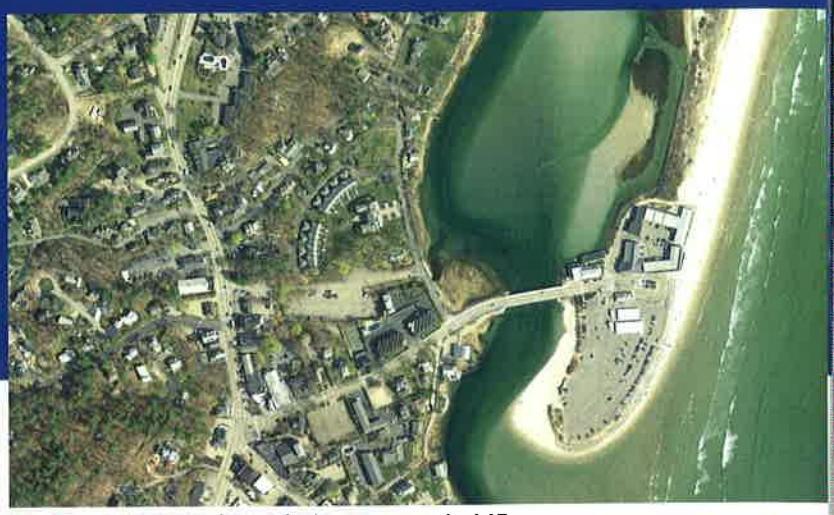
Natural color, 3-inch resolution,
Portland Head Light, Cape Elizabeth, ME

MAINE GEOLIBRARY ORTHOIMAGERY PROGRAM

Infrared, 3-inch resolution, Ogunquit, ME



Natural color, 3-inch resolution, Ogunquit, ME

As conditions in the economy increasingly impact resources, a more cost-effective and efficient means of managing and maintaining assets is essential. With reliable, statewide data, agencies and departments benefit from more accurate information for better, timelier decision-making to reduce unwanted costs or, at times, eliminate them altogether.

The Maine GeoLibrary is coordinating a five-year program to collect new orthoimagery for the entire state. If your county participates, **the program includes base imagery at two feet and one meter, with acquisition buy-up options for local governments and organizations, including both increased resolution orthos (three or six inches) and LiDAR.** Reflights for areas in the program are scheduled every three to five years.

The program also includes products that can be derived from the imagery, such as the following:

- Automated feature extraction
- Digital terrain models with contours
- Planimetrics
- Land use/land cover
- Solar maps
- Building footprints
- Impervious surfaces

These derived products can be purchased at the time the imagery is flown, or later, as budgets allow.

Imagery collected through this program will include four-band GeoTiff images (including infrared) and will be available to the municipalities and state/local organizations. In addition to the base imagery, municipalities have the opportunity to acquire a number of buy-up options at a reduced cost.

This data can be used for a number of projects or activities, including:

- Emergency response
- Wildlife management
- Natural resource planning
- Transportation planning and management
- Economic development
- Impervious surface/stormwater billing
- Land use/land cover
- And much more

"Why can't I simply use Google Earth or Maps to plan my projects?"

The answer is simple: the accuracy, resolutions and updates for free sources of imagery are undetermined. They lack flexibility and accuracy. And, most importantly, the data can't be integrated into GIS software.

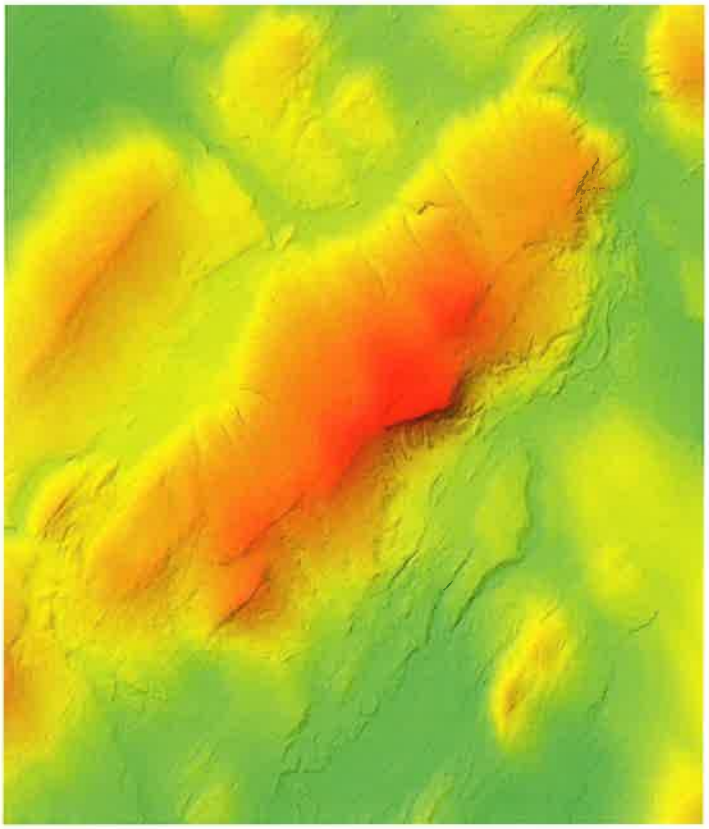
LiDAR

Light detection and ranging (LiDAR) is an optical remote sensing technology that can measure the properties of a target by illuminating it with pulses of light from a laser. The laser captures information in point clouds, which can then be used to determine the size, shape and distance of a target. Technicians can then use these point clouds to create contours, digital terrain models (DTM) and digital elevation models (DEM). Using automated feature extraction, these point clouds can be rapidly processed to provide a wealth of data that can be used to assist with tax assessment, determine ground cover or create maps that outline the best placement for solar panels.

The Value of LiDAR

With automated feature extraction, LiDAR (when combined with four-band imagery) can be used to create many value-added products, including:

- Land use/land cover
- Solar potential maps
- Impervious surfaces
- Building footprints
- Planimetrics
- Vegetation classification
- Transmission and utility maps
- Emergency response plans



LiDAR shaded relief map, 1.5-meter point density, Hogback Mountain, ME

Derived product: impervious surface

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WWW.MAINE.GOV/GEOLIB

MICHAEL SMITH | 207.215.5530
MICHAEL.SMITH@MAINE.GOV

WWW.FACEBOOK.COM/MAINEORTHOS
WWW.TWITTER.COM/MAINEORTHOS
LINKEDIN GROUP: MAINE ORTHOS

kappa mapping, inc.

SEWALL

MAINE GEOLIBRARY ORTHOIMAGERY PROGRAM

Cost

The funding for the base program is split between the county, state and federal partners. Additional buy-ups are funded by the municipality, COG or other organization requesting the buy-up.

The schedule to the right reflects the cost per square mile for the base two-foot or one-meter imagery collection. It's important to note that a collection requires multiple passes that include some overlap to facilitate post-processing of the imagery, and these overlaps are added to the total square footage for any collection. Every effort is made to keep this overlap to a minimum.

Resolution	Cost per square mile	
	31-1,000 sq. mi.	>1,000 sq. mi.
2 foot	$58.30	$52.80
1 meter	$53.90	$48.40

For example, although York County is 1,012 square miles, the total square miles collected for the county was 1,297 after the inclusion of overlaps and boundaries. So the total cost of acquisition for two-foot imagery for the county was $68,500.

Acquisition Buy-Ups

There are a number of buy-up options, in addition to the base imagery. The table below reflects the pricing; however, keep in mind, overlap will need to be included in total square miles for these options, as well.

Resolution	Map scale	ASPRS class level	Horizontal accuracy	Cost per square mile	
				31-1,000 sq. mi.	>1,000 sq. mi.
3 inch	1" = 50'	1	6"	$908.60	$897.60
		2	1'	$466.40	$455.40
6 inch	1" = 100'	1	1'	$257.40	$246.40
		2	2'	$140.80	$129.80
1 foot	1" = 200'	1	2'	$92.40	$81.40
		2	4'	$58.30	$47.30

1 meter

2 foot

6 inch

3 inch

MAINE GEOLIBRARY ORTHOIMAGERY PROGRAM

Return on Investment Analysis for Maine GeoLibrary Orthoimagery Program

Produced for the Maine GeoLibrary Board by Applied Geographics, Inc., (AppGeo) with Sebago Technics

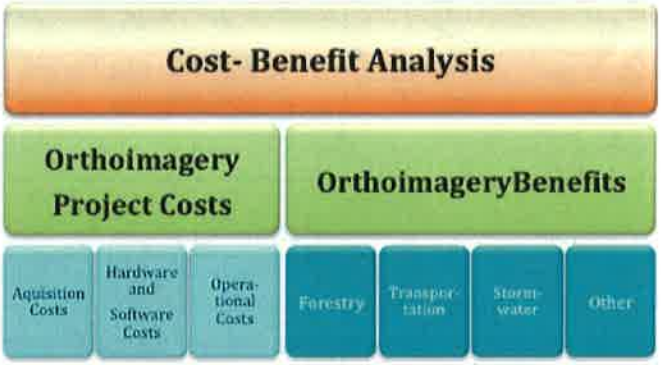
Orthoimagery is geometrically corrected aerial imagery that provides a comprehensive view of the earth's landscape and features. The business case for investing in a recurring statewide orthoimagery program for the State of Maine is clear:

- The economies of scale of a statewide program dramatically reduce the cost per participating organization in both the short and long term
- Collaboration between organizations provides orthoimagery at a lower cost, higher resolution, and on a better schedule – all of which improves the availability and usefulness of the data
- There is no suitable substitute for meeting the State's business and operational needs – commercial websites popular with citizens, such as Google Earth and Microsoft Bing, depend largely on publicly funded imagery as a resource

Based on a conservative analysis of just 3 of 13 sectors using aerial imagery, this investment still showed a return of over 400%.

A study was undertaken to quantify the benefits of the statewide orthoimagery program. The study identified thirteen statewide examples of how orthoimagery can be beneficial, but narrowed its scope to an in-depth treatment of only three use cases of statewide importance: Forestry; Stormwater; and Transportation.

The results, based only on these three use cases, make an economically compelling case for investment with net benefits totaling $10 million on the low-end, to $30 million on the high-end. This range compares very favorably to the expected costs for the corresponding five-year time period of $2.4 million. ***The resulting return on investment (ROI) is projected to be 421% to 1264% based on this range, which would exceed the returns on many other alternative financial investments.*** If all thirteen use cases were similarly analyzed, it is safe to say that the total ROI would be substantially higher.



Conceptual diagram of Cost-Benefit Analysis components.

This analysis presents a strong case for the public sector investing in the statewide orthoimagery program proposed by the Maine GeoLibrary Board.

Cost-Benefit Analysis - "Low"	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Benefits "Low"	$2,623,006	$2,463,393	$2,453,578	$2,591,780	$2,434,067	$12,565,824
Costs	$475,852	$593,802	$690,670	$315,993	$335,249	$2,411,566
NET PRESENT VALUE	**$2,147,154**	**$1,869,591**	**$1,762,908**	**$2,275,787**	**$2,098,818**	**$10,154,258**
Return on Investment (ROI) "Low"	**4.21** If this result is greater than "0" it is favorable for investment					

Cost-Benefit Analysis - "High"	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Benefits "High"	$6,766,742	$6,516,037	$6,490,077	$6,686,186	$6,438,466	$32,897,508
Costs	$475,852	$593,802	$690,670	$315,993	$335,249	$2,411,566
NET PRESENT VALUE	**$6,290,889**	**$5,922,235**	**$5,799,407**	**$6,370,193**	**$6,103,218**	**$30,485,942**
Return on Investment (ROI) "High"	**12.64** If this result is greater than "0" it is favorable for investment					

The resulting return on investment (ROI) is projected to be 421% to 1264% based on this range, which would exceed the returns on many other alternative financial investments.

2003: Portland Seaport

2012: Portland Seaport Improvements

Importance of current aerial imagery as source for land use change detection.

AppGeo

WWW.MAINE.GOV/GEOLIB

MICHAEL SMITH | 207.215.5530
MICHAEL.SMITH@MAINE.GOV

WWW.FACEBOOK.COM/MAINEORTHOS
WWW.TWITTER.COM/MAINEORTHOS
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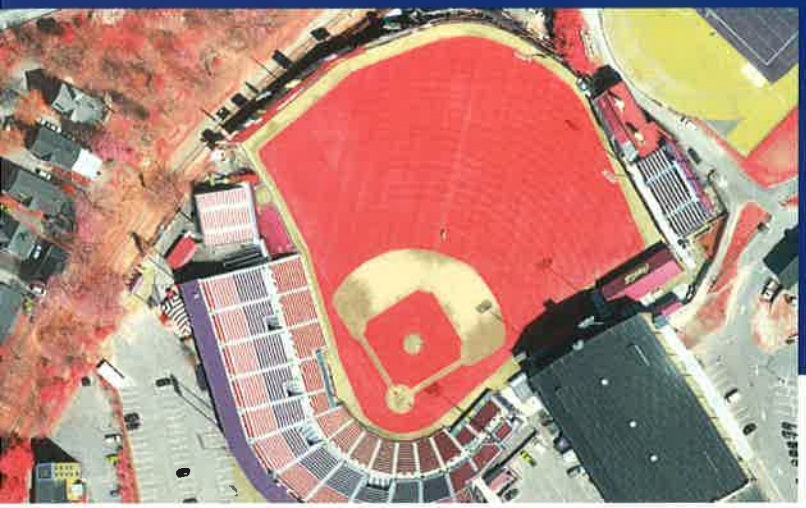
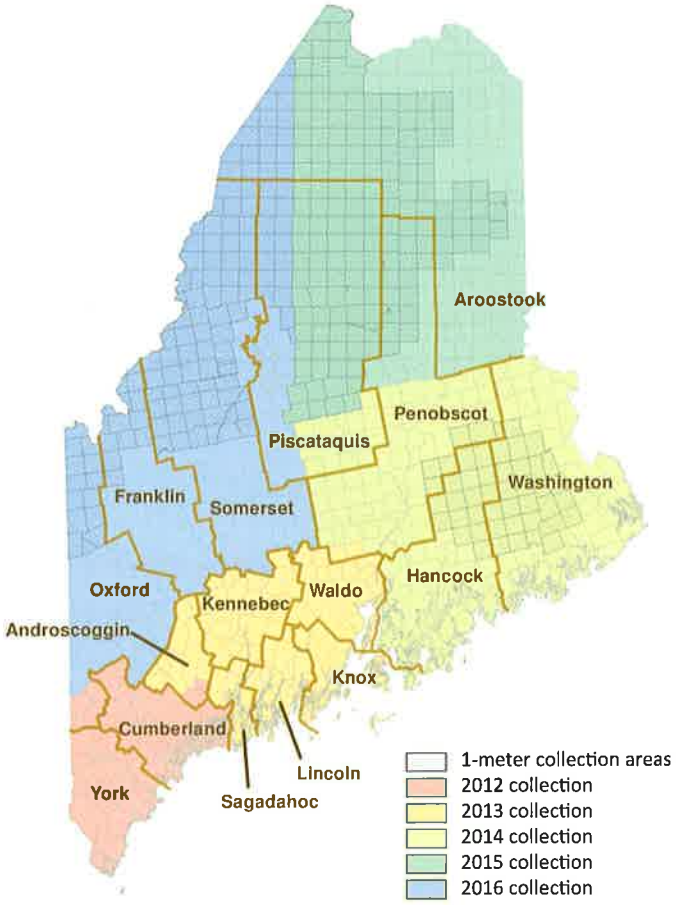
SEBAGO TECHNICS



Infrared, 3-inch resolution, Hadlock Field, ME

Natural color, 3-inch resolution, Hadlock Field, ME

Orthoimagery Refreshment Sections



Flight schedule is subject to change. Please refer to the interactive map located on the Maine GeoLibrary website (www.maine.gov/geolib) for the most accurate, up-to-date schedule.

Revised 07/17/2012

Using a conservative analysis of just three of 13 sectors which use aerial imagery, this investment still showed a return of over 400%.[1]

Orthoimagery

An ordinary image cannot be used to accurately measure distances between two objects because lenses can distort distance and size. A long lens (for example, 400mm) will produce a very short perceived distance between two objects in an image, while in reality, they are very far apart. And a wide-angle lens will distort images near the edges, making objects look wider or shorter than they truly are.

Orthophotos, or orthoimagery, on the other hand, can be used to accurately measure distances and sizes of objects. Aerial photos are prepared specifically for mapping, with the topography of the area "flattened" so the images are accurate.

Visit our website for more information on the program, such as detailed maps of the collection schedule, a list of frequently asked questions and more.

Contact your county for more information on buy-ups or the Maine Office of GIS:

Michael Smith
michael.smith@maine.gov
207.215.5530
www.maine.gov/geolib

[1] Applied Geographics Inc. *Return on Investment Analysis for Statewide Orthoimagery Acquisition for the State of Maine.* 3 Aug 2012.