THE STATE OF OREGON

AERIAL IMAGERY PROGRAM

LONG-TERM FUNDING STRATEGY

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Executive Summary

Oregon's statewide imagery program has been highly successful, providing statewide aerial imagery from 1995 through the present. Formalized in 2016 as the Oregon Statewide Imagery Program (OSIP) and managed by Enterprise Information Services (EIS), the program has collected a new statewide orthoimagery digital geospatial dataset every two years. The success of OSIP has come through the substantial efforts needed to fund each update cycle. Each time, there was uncertainty as to whether there would be sufficient money to contract another update. Thus, a widely used and up to date basemap covering all of Oregon seems to face an uncertain future.

OSIPs goals are to:

- Create a common up to date basemap for government, business, and the public
- Provide high quality current data without regard to the ability to pay for data
- Meet the most common needs of every level of Oregon government (cf. ORS276A.500(5))
- Provide a stable program that can be expanded or enhanced over time
- Meet the Oregon Data Framework mandate to provide imagery as a consistent, updated data theme

This study examined how to transition OSIP from a two-year, uncertain, funding process to a long-term funding stream. The transition is essential for OSIP to continue meeting its goals. The study conducted a survey, interviews, and a workshop. Those activities showed that OSIP is doing an excellent job in meeting the goals listed above. The program has been highly beneficial.

A key finding of the study is that stable funding is essential to the program's continued success. Stable funding needs to include state staff time to manage it and provide technical services that support it. The most appropriate means of funding OSIP is through an enduring state budget appropriation. The state budget appropriation should be used to fund a multi-acquisition contract with one or more aerial photography vendors.

Another key finding is that there is great demand for improving the aerial imagery OSIP offers. Today, most local governments, industries, and many other government bodies use higher resolution imagery than OSIP produces. They also use oblique (side view) imagery. Oblique images now have more mapping and measurement capabilities than top-down orthoimagery like OSIP provides. Example capabilities include mapping and measuring structure heights, sloping roof areas, structure volumes, seeing signage and structure façades.

The study proposes three possible outcomes for OSIP in the long-term, designated as service tiers. These are illustrated in the following chart: white/green checkmarks indicates imagery that fully meets use needs, plain checkmarks show imagery minimally meets use needs and red cross marks show imagery does not meet needs. The Optimal Service Tier has the greatest number of uses, the Current Service Tier (today's OSIP) the fewest. In between is an Improved Service Tier. It is not as beneficial as the Optimal Service Tier but far better than the Current Service Tier.

Functional need	Optimal Tier	Improved Tier	Current Tier
Air quality monitoring	✅	✅	✅
Assessing property value	✅	✓	❌
Disaster recovery	✅	✓	❌
Economic development	✅	✓	❌
Emergency management	✅	✓	❌
Forestry and forest management	✅	✅	✓
Law enforcement	✅	✅	✓
Long-term planning	✅	✅	✓
Near-term planning	✅	✅	✓
Public health	✅	✅	✓
Public safety (fire and police actions)	✅	✅	❌
Site selection	✅	✅	❌
Transportation infrastructure	✅	❌	❌
Utility infrastructure (power, water, sewer)	✅	❌	❌

Annual costs range from 1.5 million dollars for Current Service Tier with dedicated support to 3.5 million dollars for the Improved Service Tier to 7.9 million dollars for the Optimal Service Tier.

It is hard to calculate direct financial return provided by aerial imagery. However, the fact that it is pervasive in every aspect of modern life, from mobile phones to large-scale emergency response and recovery clearly shows its value. The Optimal Service Tier, recommended by this study, will be a better investment of public funds than continuing with the Current Service Tier.

Introduction

The statewide imagery program has been highly successful, providing statewide aerial imagery from 1995 through the present. The statewide imagery program was formalized as the Oregon Statewide Imagery Program (OSIP) in 2016. OSIP, managed by Enterprise Information Services (EIS), has provided government, commercial, and public users with updated aerial imagery every two years. Before OSIP, from 1995 to 2016, Oregon used web services from the U.S. Department of Agricultural National Agricultural Imagery Program (NAIP). As technologies and needs have evolved, the characteristics of aerial imagery have changed too, but the fact remains that overall Oregon's aerial imagery framework data has been a very successful and beneficial program for Oregon.

To date, OSIP has created statewide orthoimagery. Orthoimagery (also called nadir imagery) is the familiar downward looking imagery seen in many web mapping applications. OSIP's orthoimagery has been collected, rectified, and released into the public domain through various means on a roughly two-year cycle. Processing the raw imagery over the entire state takes roughly a year, so the products are typically available in the second quarter of the year following aerial photography.

Funding statewide aerial imagery has been a continuous challenge. Each acquisition cycle has involved the complex and time-consuming effort of gathering sufficient funds from state agencies directly, in budget requests for direct support approved by the legislature, and from federal agencies in some cycles. Almost as soon as flying begins for one statewide collection effort, the OSIP members (including representatives from EIS and Imagery Framework Implementation Team (FIT) need to start building a coalition to fund the next cycle. This takes considerable time and effort, and the outcome is never certain. It is this uncertainty that can dissuade state program participants and, in turn, provokes agencies to independently fund their imagery needs, further detracting from OSIP funding.

Stable funding for the OSIP is the next logical step in Oregon's aerial imagery program. This will create a base for expanding the use of aerial imagery, since the OSIP team can now focus on applications for aerial imagery, new uses of it, and attracting new organizations and users to be part of the program. Stable funding will also allow the program to be innovative in what it produces, creating program products that are more useful and attract more users.

The amount of funding needed depends on the aerial imagery to be acquired. The general technical and program characteristics of the long-term OSIP program must be determined before a rough funding need can be known. The current situation is that since 2016, OSIP has had three acquisitions that have each produced 30cm ground sample distance (GSD

or imagery resolution) orthoimagery product. The most recent acquisition of 30cm imagery is uniform in resolution and pixel depth, varying only in that it has higher accuracy requirements for settled areas than unsettled areas of the state. Most of the funding for the past two acquisitions (2022, 2024) has come from specific requests to the state legislature. These funds have paid aerial imagery vendor contract costs. Dedicated funding has never been provided for coordinating acquisition and contracting, to perform quality control, or to support staff and IT costs for hosting the aerial imagery.

This study focuses on funding the OSIP as a long-term, sustainable, endeavor. However, as the discussion above indicates, the study necessarily includes recommending the characteristics of the program: types of imagery, technical specifications, frequency of collection, managing the program, and purchasing and contracting considerations. In short, the long-term funding strategies depend upon the long-term program strategy. Both are discussed in this study report.

Study Methods

Creating sustainable funding models for aerial imagery starts by determining two important factors:

1. The needs and interests of stakeholders in a long-term statewide imagery program
2. How one can fund a program that meets those needs efficiently

This study began the process by researching, interviewing, and investigating various stakeholders across the State for their imagery needs and their capacity to fund a long-term program. This information was collected and reviewed, then used to refine expected requirements of a successful long-term program strategy including continuous funding.

The study methods for this assessment included:

- Background research on Oregon's previous and current statewide aerial imagery acquisitions
- Meetings with OSIP; EIS staff and Imagery FIT Lead
- An online survey distributed to current and potential aerial imagery users and stakeholders
- A stakeholder workshop held on January 28, 2025
- Interviews with the GIS manager from the Oregon Department of Revenue
- Research on statewide imagery programs in other states

Background Materials

EIS staff and the Imagery FIT Lead provided background information on Oregon's previous aerial imagery acquisitions, a stakeholder survey conducted in 2024, Oregon's Strategic Plan for Geospatial Data Management 2023-2026, and a survey of Oregon's assessors.

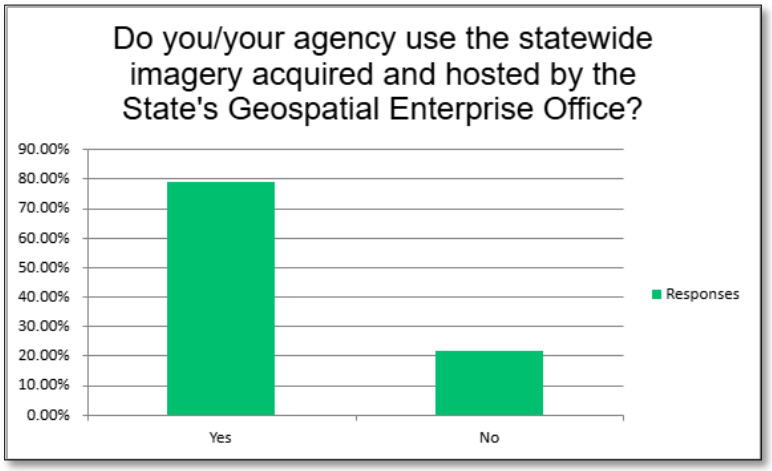
The Oregon team also provided a draft of the OSIP Portfolio. This document describes the roles of EIS, Imagery FIT and the Steering Committee within the OSIP, stakeholder outreach already performed (as of November 2024), technical factors, and products that the OSIP either has or might provide. This portfolio document, while still in draft form, could be the basis of a longer-term governance strategy for aerial imagery – a topic related to this study but outside of the scope.

Survey

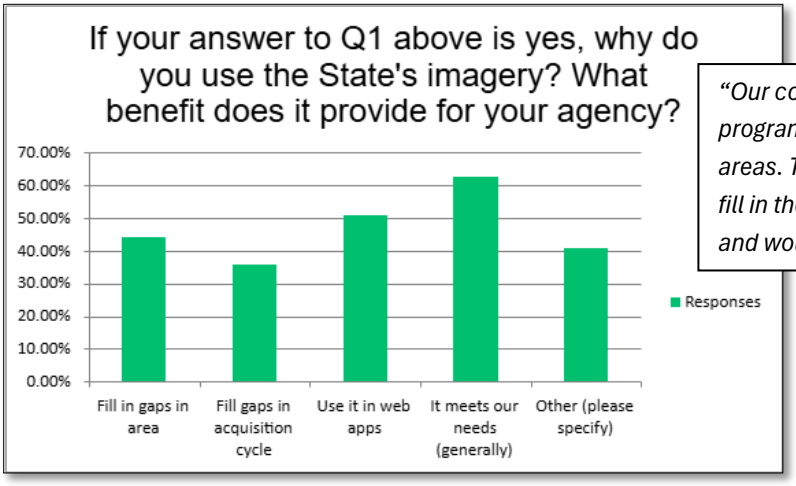
A survey was created and distributed by The State of Oregon to agencies and local governments. The survey aimed to help assess imagery interest, need and value across the state and within specific regions. The survey responses in PDF and workbook form are attached as digital appendices (Appendix A).

The survey consisted of 38 total questions and received 75 responses. Some notable findings from the survey are:

- 80% of respondents use the statewide orthoimagery created by OSIP.



- Only 2% of respondents said orthoimagery was *not* a priority for their agency
- 60% of imagery users said the imagery generally met their needs
    - Reasons for use include filling area gaps, acquisition cycle gaps, and use in web applications



"Our county has a robust imagery program for our more populated areas. The statewide program can fill in the areas we don't capture and would be at a different date."

- Major motivators for participating in the statewide aerial imagery program include cost, resolution, frequency of collection, accuracy, and purchasing ease
    - Concerns include timeliness of data delivery, duplication of area coverage (especially in urban areas) but at a lower quality

"The timeliness of data delivery is high priority for our members, including the raw data."

- 55% of the respondents said their agencies purchase orthoimagery
- Only 21% of respondents said orthoimagery purchasing was funded through dedicated budget line-items, others relied on soft money or project-based funds
- 22% of respondents did not have funds to purchase orthoimagery

"We do not have funding to purchase our own flight acquisition, so we only use the State imagery."

- 70% of respondents stated that they use oblique imagery
- Nearly 80% of respondents said there were indirect financial benefits from using aerial imagery such as saving staff time, travel costs, research costs

"Reduced field time for planning, more accurate information, and more defensible decisions."

"Saves staff time and cost for field visits."

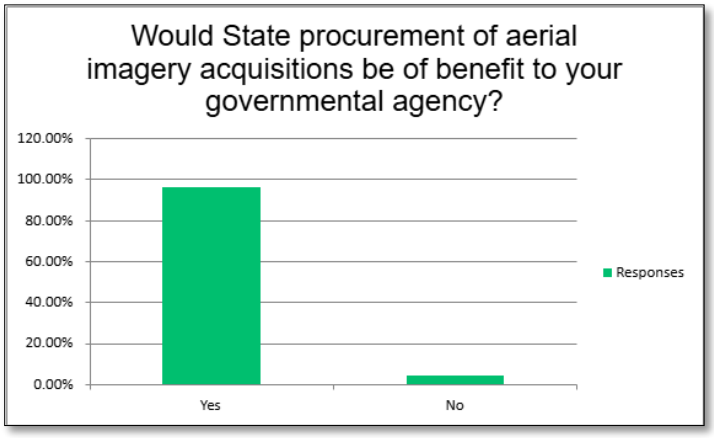
- 45% of users stated that there were direct dollar benefits from aerial imagery, primarily in property assessment but also forest revenue, land use planning, and relief funding after natural disasters

"Landslide mapping over time. Orthophotos are critical for this. Both back in time (ie before 1995) and into the future."

"Imagery has helped Marion County justify relief funding after natural disasters."

- Oblique imagery is necessary to 20% of respondents but an additional 45% said they would use it if available

- Over 95% of respondents said state procurement of aerial imagery would be beneficial to their government agency



Overall, the survey shows that OSIP orthoimagery is highly useful. It doesn't perfectly meet many needs, but even when it doesn't meet users' needs it often gives them a starting point. For example, one respondent described how OSIP orthoimagery helped them evaluate permit or license applications, leading them to decide whether to seek either more detailed imagery (higher resolution and oblique images), or to perform field research, or both.

The common baseline provided by OSIP orthoimagery aids communication within respondents' organizations and between them. Prior to OSIP, the NAIP imagery served this purpose. Since 2016, OSIP has been the common base freely available to everyone. Hypothetically, if the OSIP program failed and the federal NAIP program was terminated or moved to very long update cycles, Oregon would not have an up-to-date statewide aerial imagery basemap.

Oblique imagery is of great interest to stakeholders. Two-thirds of respondents stated they would use oblique imagery if it was available. About one-third of these users said that oblique imagery was essential to their work. These were mostly property assessment professionals. The International Association of Assessing Officials (IAAO) has published standards for using aerial imagery (orthoimagery and oblique images) for assessment. Orthoimagery and oblique imagery with 12" resolution is acceptable under IAAO standards. Use of imagery has become standard practice for most property tax offices in the United States. These offices much prefer 3" to 6" ground separation distance (GSD, also called resolution) orthoimagery and 3" to 6" oblique images as best practices, according to the survey responses.

Another important use of oblique imagery provided by survey respondents was in public safety response and planning. This includes law enforcement and fire. For example, one cannot estimate or measure the height of a wall or fence on an orthoimage, if it can be seen at all. It also includes disaster recovery, where oblique imagery can better reveal the effects of disaster on property and natural resources.

A third finding from the survey is that respondents would find the streamlining of the process of acquiring and managing aerial imagery extremely valuable. The benefit of a state-run program is that it unburdens local governments and state agencies acting independently. Those burdens include the necessity of finding local or specific agency funding, going through procurement and contracting, ensuring quality control is performed on the delivered imagery, and two to three years later arguing why updated imagery is needed. This is a substantial effort; the Washington State imagery study (2024) documented one county imagery program manager putting in 10% of full-time effort every year to budget, contract, and coordinate his county's aerial imagery.

Annual Imagery Expenditures – State and Local Governments

The stakeholder survey asked about current purchases of orthoimagery and oblique imagery. Table 1 is a summary of this information. Not all stakeholders responded with aerial imagery purchase information, nor did the survey get responses from all counties and municipalities. The answers provided were turned into annualized estimates of funds spent on imagery, yielding a *minimal* estimation of 1.2 million dollars being expended for oblique imagery and orthoimagery. This does not include the $800,000 per year cost of the most recent statewide orthoimagery acquisition. There are almost certainly other public dollar purchases of aerial imagery that are absent from this estimate because less than half of the county governments only a few municipal governments are responded to the survey.

This survey certainly did not gather all aerial imagery expenditures. Excluding the figures for counties shown in Table 1 for the moment, we know anecdotally that many cities and towns purchase aerial imagery in addition to Astoria and Eugene. More than just two state agencies use aerial imagery in addition to OSIP data. Table 1 shows only the single private sector response that stated imagery was purchased; again, there are certainly many larger landowners who buy aerial imagery (e.g., timber companies, utilities, mining companies).

An earlier survey of Oregon's county assessors (2024) performed by EIS found that 45% of county assessors (about 16 counties) regularly used oblique imagery. Counties must purchase this imagery since it is not part of OSIP. The survey performed by this study had

nine county responses and an annual total expenditure of $592,000 (Table 1). By extension, counties are spending about $1,050,000 per year on imagery.

A reasonable estimation is that public agencies alone spend about $2,000,000 per year on aerial imagery, including oblique imagery. This is aside from the cost of the OSIP program which, for 2024, is about $800,000 per year. In sum, about 2.8 million public dollars are likely spent on aerial imagery annually.

Table 1. Annual expenditures on aerial imagery in Oregon based on stakeholder survey responses.

Organization Type	Organization Name	Annual Imagery Costs	Imagery Cycle	Oblique cost	
Cities	**Astoria**	$20,000	Annual		
Cities	**Eugene**	$15,000	Annual	Included	
				Total City Spend	**$35,000**
County	**Douglas County**	$22,000	Annual	Included	
County	**Clackamas County**	$283,000	Annual	Included	
County	**Benton County**	$16,667	3 year		
County	**Yamhill County**	$75,000	Annual	Included	
County	**Wasco County**	$100,000	2 year	Included	
County	**Deschutes County**	$10,000	3 year		
County	**Jackson County**	$5,000	Annual	$40,000	
County	**Polk county**	$10,000	As Needed		
County	**Lincoln County**	$30,000	2 year		
				Total County Spend	**$591,667**
COG	**Lane Council of Governments**	$94,000	2 year	Included	
Regional	**Metro + Regional Aerial Photo Consortium**	$150,000	Annual		
Metro	**GIG 12-PDX Metro**			$46,667	
				Total Regional Spend	**$290,667**
State	**Oregon Parks and Rec Dept**	$30,000	2 year	$7,500	
State	**Oregon Dept. of Geology and Mineral Industries**	$17,500	Annual		
				Total State Spend	**$55,000**
Federal	**USDI Bureau of Land Management**	$150,000	2 year		
Private	**Geology and Forestry**	$40,000	2 year	$50,000	
				Total Federal and Private Spend	**$240,000**

Total Known Annual Imagery Costs **$1,212,334**

Meetings

Connecting directly through meetings with stakeholders allows for a more thorough, and more candid, understanding of historical and current funding pathways. Large group, small groups and one-on-one meetings were leveraged for the purpose of extracting use cases, funding experiences, practices, cycles, and obstacles. The information and knowledge that the stakeholders have on Oregon's State funding is invaluable and can immediately shape or negate a statewide imagery effort.

The primary stakeholders in the Oregon imagery funding strategy are EIS, Imagery FIT, and OSIP. These stakeholders represent an intimate history with funding cycles associated with past and current statewide imagery acquisitions.

A stakeholder workshop meeting was held on January 28, 2025. There were 24 attendees in addition to the 3 Sanborn presenters (Appendix B). The workshop covered the history of Oregon's aerial imagery acquisitions, programs in other states, and solicited ideas from participants about an ideal statewide program for their agency or organization (Appendix C).

One workshop activity asked participants to describe the business justification for funding aerial imagery. Many participants stated that imagery:

- Enhances staff efficiency
- Is cost-effective, being cheaper and faster than sending staff to the field
- Allows more to be done with fewer resources, especially in areas like tax assessment
- Is essential for public services, facilitating permit approval, asset locating, change detection

> *"Can't accomplish work without imagery and/or it is cost prohibitive to do the work using alternative means (e.g. extra staff time or travel required to send*

A second activity asked participants for both motivators and barriers to participating in an imagery acquisition program, either individually or as a coalition member. Barriers cited included:

- Higher cost
- Lengthy turnaround times, fragmented capture dates, outdated imagery
- Misalignments of budget cycles and acquisition cycles making it unclear how and when to request funds to buy imagery, especially in coalition situations

- Technical insufficiency of aerial imagery products: poor resolution, image characteristics like radial displacement, or inability to integrate with other important software systems
- Lack of public availability

> *"Budget cycles not aligning, contracting (i.e. funding transfer) timing or issues, higher cost, specifications not aligning (especially GSD and horizontal accuracy)"*

However, there were many motivating factors cited that would lead stakeholders to participate in and support a long-term statewide program:

- Lower costs
- Consistent data across the state
- Better resolution than the current 12" orthoimagery (3" or 6")
- Availability of high-resolution or other product tasking (buy-up options)
- An oblique option
- Good integration with other platforms (assessment systems, other major applications and map tools)
- Public availability

> *"A stable known funding source would make budgeting easier. A consistent product for change analysis."*

A third activity asked for opinions on the best ways for Oregon to build and fund a long-term sustainable aerial imagery program. Answers included:

- Legislative funding
- Buy-up options on a base contract with stable funding
- Ensure public access to products
- Consider relying on NAIP for federal land to reduce costs
- Be compatible with common software platforms and information systems
- Try to serve the needs of local government, even if just through buy-up options
- Wide availability and public availability through streaming services and other appropriate options that do not involve licensing
- Modular contracting vehicles with affordable (or supplied) base products for smaller jurisdictions and appropriate buy-up options for higher resolution imagery,

> *"For our diverse local governments, we need a modular program. If the state cannot provide a high-quality product for all without some financial support from local government there should be an affordable base product for the smaller jurisdictions. The buy up option seems great, including the option for obliques. Some thought should be given to how to integrate the imagery into the various platforms used by different users."*

additional features such as oblique images, and optional services like change detection

The workshop showed that stakeholders are strongly interested in an improved, stable, statewide aerial imagery program. Most workshop participants advocated for state legislative funding as the means to create stability. They emphasized that the program should be designed so that it benefits all levels of government and non-government organizations and individuals. To succeed, the program has to offer better technical products than the current program either as part of the baseline portfolio or through buy-up options, preferably the former. Lastly, it should be easy to participate in the program whether that involves contributing to it financially or acquiring buy-up products through it.

State Programs and Literature Review

Many states have statewide aerial imagery programs of some sort. This study examined several of these programs, looking at the technical products created, funding, and how imagery is purchased. One common feature of most states is that their programs are funded, or planned to be funded, over multiple cycles of aerial imagery collection. In other words, these states have multi-year contracts with their aerial imagery vendors rather than the episodic single contracts Oregon has used.

NAIP imagery is a baseline dataset used in many states…

Table 2 shows technical and financial characteristics from 6 comparator states. There are four general patterns of funding source, imagery licensing, and cost recovery from imagery users:

1. Legislative Funding → Licensed Imagery → Usage Fee-Based Cost Recovery (Texas)
2. Legislative Funding → Licensed Imagery → No Cost Recovery (Statewide: Utah; Settled areas: Wyoming)
3. Legislative Funding → Public Ownership → No Cost Recovery (Indiana, Kentucky, Oregon)
4. Coalition Funding → Licensed Imagery → No Cost Recovery (Washington)

Funding for aerial imagery is often from legislative appropriation. Washington's coalition funding approach has succeeded, but according to a recent study of aerial imagery in Washington, has been challenging to administer.

Several states use imagery under a license from the vendor. The licensing terms vary but mostly limit use of the highest-quality imagery provided by the vendor to only public

agencies. Indiana, Kentucky, and Oregon on the other hand have public ownership of the imagery they purchase; they make it freely available. Utah's higher resolution orthoimagery is only available to public agencies but a lower resolution version is freely available.

Only Texas has a fee-based cost recovery. Legislative funding started the program, and Texas has succeeded in sustaining and improving their aerial imagery program through a tiered fee system. In Washington, fees are essentially paid up front by being a member of the coalition.

An important feature of several programs is their ability to measure use of the aerial imagery that the state provides. Utah, Texas, and Kentucky use cloud-based software tools that track each image file served by their systems. This allows for very granular analysis of the areas of the state where imagery is most used, how frequently it is used, and who is using it. This information is used to make calculated improvements to their imagery programs.

Table 2. Summary of existing State Imagery Programs, including funding sources and costs to sustain.

	Washington	Utah	Texas	Indiana	Wyoming	Kentucky
Ortho	**6-inch** (Streaming) **12-inch** (Archived)	**6-inch**	**6-inch**	**6-inch**	**2 Foot** **6-inch & 2-inch** (settled areas, ~12%)	**3-inch**
Oblique	**No**	**No**	**No**	**No**	**6-inch & 2-inch** (settled areas ~12%)	**3-inch**
Licensing	**Licensed** (Hexagon)	**Licensed** (Hexagon, older Google)	**Licensed** (Hexagon)	**State-owned**	**Licensed** (Eagleview subscription with affiliate access)	**State-owned**
Frequency	**Every 2-years** (Dependent on NAIP)	**Every 3-years** (Hexagon; Google archived)	**Every 2-years**	**Every 4-years** (1/3 each year, buy-up year)	**Every 2-years**	**Every 2-years** (proposed)
Annual Cost	**~$400,000**	**$400,000** (seeking +$150k due to cost increase for inflation)	**$1,450,000**	**$666,666**	**$1,000,000** Note: 12% of state by area	**$8,500,000**
Cost Breakdown	**~$800,000** Over a two-year contract Statewide 1ft imagery updated every 2 years	**$1,200,000** (over a three-year contract)	**$5,818,209.54** (Over a four- year contract period)	**$2,000,000** (Over a three-year period (FY21-FY24) (Fourth year is buy-up options)	**$2,000,000** (over a two-year cycle)	**$17,000,000** (over a two-year period)
Cost Sharing Approach	**Subscription Based Coalition Funded**	**State-funded program** (legislative funding)	**Subscription Based** (on usage, tracked monthly)	**State-funded program** (legislative funding)	**State-funded program** (legislative funding)	**State-funded program** (single 2-year cycle)
Major Funding Sources	WA State Departments, Tribal Governments, Cities & Counties	**Legislature (100%)**	DOT, 911, General Land Office, City/Local Government, University	**Legislature (100%)** (Excluding Buy-ups)	**Legislature (100%)** (via Dept. of Revenue) (Excluding Buy-ups)	**Legislature** (via specific appropriation)
Area (Square Miles)	**71,362**	**84,896**	**268,596**	**36,419**	**97,914**	**40,407**
Cost (per Square Miles)	**$11**	**$12**	**$22**	**$55**	**$218** (Includes obliques)	**$421** (Includes obliques)
Includes Administrative Costs	**No**	**No**	**No**	**No**	**No**	**No**

Wyoming has taken a unique approach to obtain imagery that differs from other states. Rather than pursue a statewide aerial imagery product, only settled areas are covered by an aerial imagery contract that produces high-resolution aerial and oblique imagery. The program is funded by Wyoming's Department of Revenue and its primary stakeholders are the county assessors in the state. Under the license agreement, other government stakeholders can gain access to the aerial imagery. They can also expand coverage areas through buy-up options of the state contract. These options include imagery upgrades to higher resolution for superior feature clarity and imagery that is post-processed with ground control points to achieve high-accuracy ground measurements. The vendor combines the buy-up imagery option with the standard NAIP imagery to create a single, seamless statewide orthoimagery dataset.

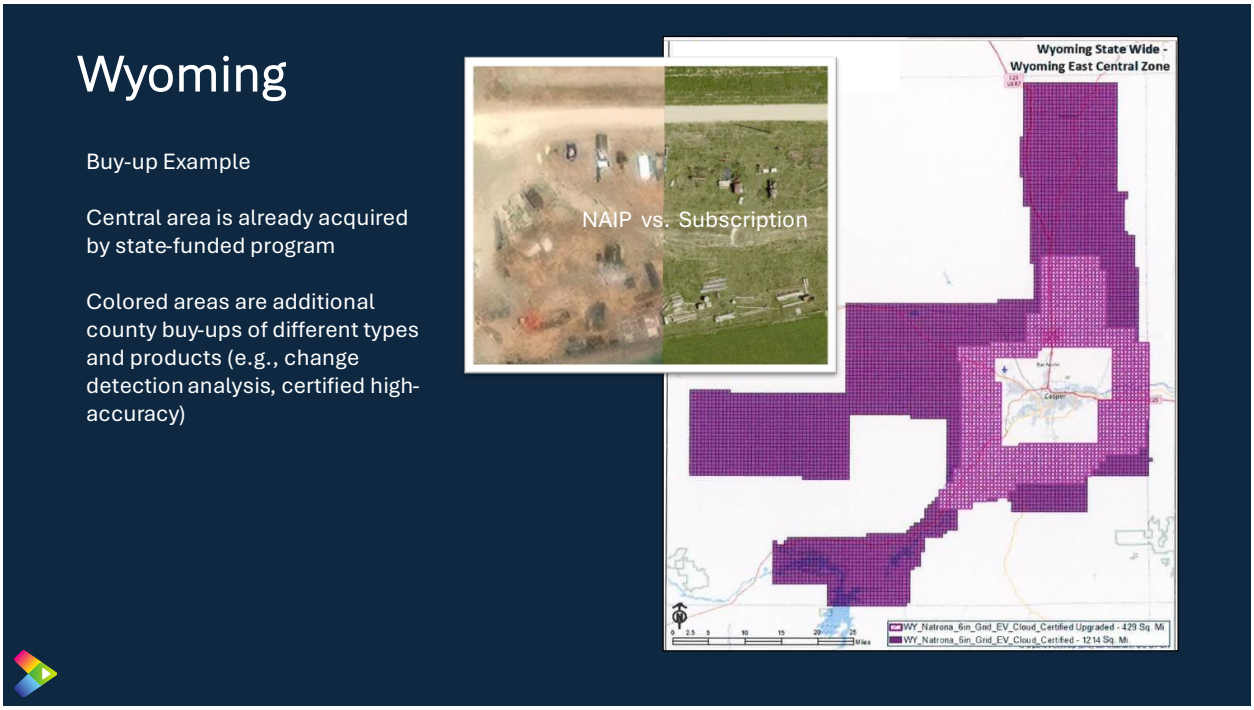


Figure 1. Wyoming buy-up example and boundary between high-resolution licensed imagery and public NAIP orthoimagery.

Kentucky, on the other hand, provided legislative funds for statewide high-resolution oblique imagery and orthoimagery. The imagery is state-owned and thus available to any user, with freely available viewer software for the oblique imagery – an important consideration since many oblique products are locked to vendor-specific tools. As in Wyoming, tax assessment needs were an important reason for including oblique imagery in a program funded at the statewide level. Unlike Wyoming, Kentucky chose to cover the entire state with oblique imagery. The state is now devising a strategy for updating the

imagery. This will probably be less expensive than the original costs since the infrastructure for the program has been created in the original tranche of funding.

Indiana does not provide oblique imagery in its state budget-funded program. The state is divided into three zones, one each year. The fourth year is a buy-up year in which local governments and state agencies can independently fund higher-resolution images, custom products, oblique imagery, and other pre-set options at rates that are negotiated into the overall state contract with the vendor.

Orthoimagery GSD's vary between the comparator states, but 6-inch GSD satisfies most user needs. Update cycles are mostly 2 years between new imagery, with Utah at 3 years, Indiana at 4 years.

Elements of the Oregon Statewide Imagery Program

The statewide imagery program has been highly successful, providing statewide aerial imagery from 1995 through the present and, since 2016, formalized as OSIP. This study's survey shows that stakeholders value OSIP's statewide orthoimagery.

OSIP has succeeded despite some obstacles. First, and foremost, funding has been uncertain. Second, even when funding has been found, it has not directly supported program management comprising several essential components: coordination, administration, quality control, technical support, and IT resources. Third, user expectations about what constitutes useful aerial imagery have changed since OSIP's inception. Each of these is discussed in separate sections because the long-term program should seek to overcome them.

Funding

As discussed in the earlier section on research performed by this study, there is no common method by which states fund their aerial imagery programs. There are essentially four patterns:

- Funding by multi-agency coalition
- Buying into other programs (e.g., NAIP)
- Recurring legislative funding through the state budget cycle without fees for use
- Fee-based usage that recoups some portion of recurring state budget outlays

To date, based on interviews with EIS staff, the Imagery FIT lead and stakeholders, OSIP's funding for each imagery acquisition contract has been uncertain. For the most recent aerial imagery acquisition, the Legislature provided most of the funding as part of the

State's biennial budget. However, budget requests are singular, having to be renewed in each budget proposal. Oregon has also tried coalition-based funding and contracting with the federal NAIP to get an enhanced higher-resolution NAIP dataset.

Coalition Funding

Oregon's statewide imagery acquisitions began by using ad hoc coalition ("pass-the-hat") funding. Coalition funding is challenging.

The first challenge is the nature of coalition funding itself. Member organizations cannot always commit to multi-year dollar outlays, so it is inherently unstable. Too, participant's technical needs may evolve faster than the statewide program specifications, leading to abandoning the coalition and purchasing separately. Another source of instability is insufficient budgeting for imagery acquisitions. There is a perception that aerial imagery is very inexpensive. The ready availability of aerial imagery on platforms such as Google Maps, Bing, or other commerce web sites that are "free" to the user leads decision-makers to think high-quality, ground-accurate, controlled collection imagery should be inexpensive.

A second challenge is the sheer effort to organize the coalition for each acquisition cycle. It takes hundreds of hours to promote the program, gather interested parties, help coalition members justify costs to their own agencies, arrange a procurement of more than a million dollars, and oversee the work of a contractor. Since OSIP is a program, not a single product purchase, almost as soon as one flight is complete, the work must begin again.

A third challenge is the timing of fund-gathering and approval to proceed with a request for proposal under state purchasing processes. During one acquisition cycle, an agency came to the Imagery FIT with funds to enhance an acquisition that was already planned and funded, though not yet contracted to a vendor. Procurement regulations prevented the extra funds being added to the acquisition. The outcome was an opportunity to have a better orthoimagery product was lost. This problem is not uncommon in other states too – agency budget calendars differ, reprogrammed funds can appear unexpectedly during a budget year, and major projects that can fund and benefit from orthoimagery can arise.

NAIP Buy-Up and Coat-Tailing

Buying into an existing program may seem an attractive, cost-effective option. One problem with buying into another program like NAIP is that OSIP's product is delivered through a process it does not control directly.

In 2022, Oregon provided approximately one million dollars to the NAIP program (U.S. Department of Agriculture) to have the NAIP aerial imagery vendor produce higher

resolution (30cm) orthoimagery than standard NAIP photography. For this specific acquisition, buy-up to higher resolution was funded by a coalition of agencies, so it also had all the attendant difficulties previously discussed. The timeline from flights to final delivery was very long (over 2 years). By then the imagery was almost no longer current and the next acquisition was already moving forward. Many stakeholders cited the slow delivery of 2022 imagery as an issue that must be avoided in future efforts.

Biennial Legislative Funding Requests

At a national level, legislative funding has been the preferred approach to funding aerial imagery programs. Many states have come to this funding method after trying coalition funding, partnering and buy-up with others, and year-to-year state budget requests.

OSIP has received budget year to budget year support from the State Legislature. The State Legislature helped fund the most recent aerial imagery collection in 2024, providing $1.55 million of the $1.65 million acquisition cost. The additional $0.1 million needed for 2024 was provided by the Oregon Geographic Information Council, also managed within EIS. The funding has come via requests in each of the biennial budget cycles – and in each there has been no guarantee that the request would be approved. This method has avoided many of the pitfalls of coalition funding but still has a high degree of year-to-year or acquisition–to-acquisition uncertainty.

Recommended Funding Approach

Overall, the recommended funding approach is to seek a *stable legislative appropriation* for the aerial imagery program. The funds needed depend on the technical details of the OSIP, but the concept is unchanged: **Transitioning OSIP into a stable program would require predictable long-term support over at least 3 biennial budget cycles (i.e., for more than 6 years).**

Stable funding through the state budget is justifiable for several reasons. First, and foremost, is that stakeholders at every level use the orthoimagery product and consider it valuable. Second, the state budget has already been paying for aerial orthoimagery either directly – as in 2024 work – or indirectly in prior orthoimagery collection cycles because state agencies have been the largest contributors to coalition-funded contracts. Third, stable funding allows for a long-term contract with an aerial imagery vendor -- an economy of scale in the aerial photography market – this saves money compared to purchasing each cycle of aerial imagery separately. Fourth, a longer-term contract minimizes the hundreds of hours of effort by state staff for each wholly new acquisition effort.

Program Management and Contracting

To date, OSIP has been managed by the part-time efforts of three state employees --- two in EIS and one in OPRD. Work on the aerial imagery program has been done as time allows for these individuals as none of them are assigned to manage the aerial imagery program as part of their regular duties. Various state agencies have supported the program by performing the essential work of quality control. EIS has provided significant administrative and technical support under their general support for geospatial coordination actions of the Oregon Geographic Information Council.

To succeed as a long-term program, OSIP needs stable, dedicated management. States with successful statewide aerial imagery programs have at least part-time program coordinators and imagery program support technicians.

Some of the duties of aerial imagery coordinators are:

- Technical and managerial oversight of aerial imagery procurements
- Vendor management – coordination of flight schedules, deliveries, and quality control actions
- Quality control management – ensures quality control occurs (even if contracted out, a best practice) and that imagery delivered has met quality standards
- Coordination with local and regional governments, state and federal agencies to ensure their needs are being met
- Coordination of optional contract elements with the vendor such as other agency buy-ups and derived products (change detection)
- Coordination of contract additions or changes
- Oversight of the technical components of serving and sharing aerial imagery with the public and other stakeholders
- Serving as the primary point of contact for technical and program inquiries
- Educating potential users and others about the value of statewide, consistent, aerial imagery

Other states budget for the network, software, and other IT resources needed to support their programs. These vary from state to state (some are vendor-hosted, for instance), but one way or another, these costs are funded as part of the overall program costs.

Recommendations for Program Management

At a minimum, OSIP needs dedicated funding support for staffing:

- An aerial imagery Program Manager

- At least 50% program technical specialist for publishing and hosting imagery collections and user support
- Hosting costs to cover hardware, software, data storage, and network needs
- Independent quality assurance and quality control of aerial imagery acquired

These are the minimum staffing needs to support the current program. If the program creates more complex products such as oblique imagery, the technical support specialist may need to be full-time.

Network, software, IT and usage monitoring resources needed for OSIP should also be explicitly supported through EIS. Otherwise, the large datasets inherent to statewide aerial imagery may not be hosted appropriately, diminishing the value of the whole program due to frustration with inadequate services.

Contracting and Purchasing

Funding, contracting, and purchasing are closely related. OSIP has not been part of EIS's current service level funding. OSIP's challenges in finding funding have had repercussions in contracting for statewide orthoimagery because the cycle-to-cycle funding has prevented a long-term vendor contract, likely making each acquisition cycle more expensive than it would have been under a long-term contract. The problem is not the contracting process itself; it is in the fact that without long-term funding one cannot create long-term contracts.

Multi-year contracts are advantageous in another way too. Vendors find large-area imagery collections complicated to bid. There are variations in weather, ground visibility, aircraft and camera scheduling, and processing time that make large near-simultaneous collection difficult. The weather, terrain, variation in ground visibility and environmental factors (smoke, dust) all make it tough to fly Oregon and produce consistent imagery. Long-term contracts allow aerial photography firms to learn with each flight cycle, so they improve their flight designs over time.

The purchasing and contracting process itself is of course governed by Oregon procurement practices. In both Oregon and in other states, an acquisition effort may attract latecomers who want to participate (and help fund) the work, typically enhancing the products that will result from it. The reasons for late participation vary: budget cycles, large land-use projects that have come to a specific point in their development where photography is useful, and new, urgent, needs. Regardless, it is beneficial to the program a as a whole if, within reason, the contracting and purchasing process allows for contract add-ins in an acquisition cycle.

Buy-ups or add-on products are typical of most statewide contracts. Vendors are not only asked to bid baseline aerial photography products but also to offer buy-up options in which stakeholders can get work flown to their specifications at lower, set, rates. Stakeholders to whom buy-ups are available are almost always other government entities including state agencies, local governments, and regional government offices. Additional products that are often included are higher-resolution orthoimagery, photogrammetrically corrected orthoimagery to support higher precision mapping, change detection analyses, oblique imagery, and in some cases, lidar data collection. Buy-up options are usually priced in tiers based on the area covered. Buy-ups are usually coordinated by the state aerial imagery program manager, but the purchaser and vendor create a separate business arrangement outside of the state contract itself. Some buy-up arrangements specify that the products created must be available for use under the same terms as the baseline products since they were created under a master state contract.

One general point to be made about the solicitation process is to have very clear requirements. This point seems obvious, but many solicitations spell out very detailed specifications without defining the functional needs those specifications are supposed to meet. Given clear statements of functional needs, aerial photography vendors can propose technical specifications that will meet those needs. It may even be beneficial to hire an aerial photography firm to help write the solicitation and perform technical review on responses to it.

Recommendations for Contracting and Purchasing

The long-term OSIP should seek the following characteristics in its contracting and purchasing:

- Solicit at least 3 acquisition cycles (currently at 2 years each cycle) as a single contract
- Solicit common buy-up option rates in tiers: higher resolution orthoimagery, corrected orthoimagery, oblique imagery, possibly lidar collection, and possibly change detection or other analytical services
- Require that imagery products be public domain or licensed without limitation to Oregon in perpetuity
- Allow for one-time enhancements to the baseline product for a given acquisition should a “latecomer” come forward with a reasonable request and funding for it
- The minimum contract specifications should be based on the chosen content requirements. However, some generally requirements should follow the most recent, 2024, contract (see OSIP/Imagery | Oregon GEOHub):

- Survey Report with control/check point information, photos, etc. plus ground control points in geographic dataset
- Aerial Triangulation Report
- Project-wide federally compliant metadata
- Digital elevation model (DEM) and digital terrain model (DTM) in compatible format, tiled by digital orthophotography quarter-quadrangle (DOQQ) boundaries
- Orthoimagery (see discussion below), horizontal accuracy per 2024 contract
- Oblique imagery: 4-way views
- Oblique imagery measurement and viewing tools
- GeoTiff format
- Coordinate system: EPSG 6557 (NAD83_2011 Oregon Statewide Int Feet)
- 4 band uncompressed orthoimagery (8 bits per channel)
- Project-wide Mosaic Datasets
    - Coordinate system: EPSG 6557 (NAD83_2011 Oregon Statewide Int Feet)
    - Coordinate system: EPSG 3857 (WGS 84 Meter)
- Seamlines geographic dataset
- State of Oregon ownership of products

OSIP Service Tiers - Content and Technical Specifications

The heart of OSIP is, of course, the current and older aerial imagery collections datasets. To date, the program has created 12" (30cm) imagery as its highest resolution (smallest GSD) products. This study's research found that while OSIP users are generally happy with the current orthoimagery because it meets some important needs, higher resolution orthoimagery and oblique imagery would be of much greater use. For example, multiple-angle oblique images paired with higher resolution orthoimagery is used by almost half of Oregon's County Assessors. A recent study of aerial imagery needs in Washington state determined the most desirable aerial imagery (as of 2024) was 3" orthoimagery and oblique images in urban area and 6" resolution imagery (both types) outside of urban areas.

Based on this study's research, OSIP should choose between three service tiers. Each tier is recommended to be funded, managed, and follow the basic technical specifications as already described. The service tiers differ in the combinations of products, resolutions, and areas covered. Because all options involve hosting and serving imagery, including

oblique imagery software tools, it is useful to think of them as service tiers, since they are not just the aerial image datasets. The three tiers are:

- Optimal Service Tier
    - Statewide
    - Updated every two years
    - Settled areas: 3” resolution (GSD) orthoimagery and 3” 4-way obliques
    - Outside settled areas: 6” resolution (GSD) orthoimagery (no obliques)
- Improved Service Tier
    - Statewide
    - Updated every two years
    - Settled areas: 6” resolution (GSD) orthoimagery and 6” 4-way obliques
    - Outside settled areas: 12” resolution (GSD) orthoimagery (no obliques)
- Current Service Tier (OSIP 2024)
    - Statewide
    - Updated every two years
    - 12” resolution (GSD) orthoimagery
    - No oblique imagery

The Current Service Tier continues the OSIP program using the 2024 specifications, products, and services. The Improved Service Tier increases orthoimagery resolution and adds oblique imagery in settled areas where engineering, infrastructure, and property assessment uses can employ it. The Optimal Service tier further increases orthoimagery and oblique imagery resolution in settled areas and increases the orthoimagery resolution outside of settled areas.

The value of each service tier really is determined by what can be accomplished with the imagery. Table 3 shows common use cases for aerial imagery, oblique and orthoimagery, and the range of image requirements needed for use cases. It is idealized because there are more factors to consider such as air clarity, sun angles ground cover (especially leaf-on). Regardless, while more resolution, clarity, and less obscured ground is always considered to be better, one can make some generalizations about the value of each potential OSIP Service Tier.

The Optimal Service Tier has by far the greatest value to aerial imagery users. As Table 3 shows, it fully supports key needs – especially public safety, emergency management, and disaster recovery efforts. Local governments can use the Optimal Service Tier in place of contracts with aerial vendors, alleviating the attendant administrative and technical burden it places on public sector staff.

Table 3. Common functional needs, benefits of aerial photography use, and imagery characteristics needed. Optimal: 6" Orthoimagery and 3" to 6" Oblique (settled areas) Improved: 6" Orthoimagery statewide; 6" to ` 12" oblique (settled areas); Minimum (Current): 12" Orthoimagery statewide. Key: Fully meets requirements: white tick mark in green square; Minimally meets requirements: black tick mark; Does not meet requirements: red cross mark.

Functions, Sectors, Benefits, and Requirements				Aerial Imagery Program Options		
Functional need	**Government sector (others)**	**Benefits**	**Imagery types needed**	**Optimal**	**Improved**	**Current**
Air quality monitoring	State, local, tribal, special purpose district	Timely public hazard notification & education	1' to 3' ortho	✅	✅	✅
Assessing property value	Local, tribal	Improved assessment equity; More efficient inspections; improved safety	3-6" ortho / obliques	✅	✓	✗
Disaster recovery	State, local, tribal, special purpose district (insurers, property owners)	Assess damage and focus mitigation efforts, speed conveying resources to affected communities and individuals	6" - 12" ortho / obliques	✅	✓	✗
Economic development	State, local, tribal, special purpose district	Improved property targeting matching specific development criteria; Improved property management	3-6" ortho / obliques	✅	✓	✗
Emergency management	State, local, tribal, special purpose district	Improved hazardous materials and wildfire risk assessment and preparedness; More efficient disaster response; Improved post disaster assessment and mitigation	3-6" ortho / obliques	✅	✓	✗
Forestry and forest management	State, local, tribal (timber industry, private land managers, grazing)	Improved timber harvest assessments, forest health assessments, & wildfire risk assessments; Improved post wildfire recovery management	6" - 12" ortho	✅	✅	✓

Law enforcement	State, local, tribal	Improved crime mapping, public notification, emergency services routing, 911 location verification	6” - 12” ortho	✓	✓	✓
Long-term planning	State, local, tribal, special purpose district	Improved comprehensive planning, economic development, public discourse	6” - 12” ortho	✓	✓	✓
Near-term planning	State, local, tribal, special purpose district	Improved planning and public discourse	6” - 12” ortho / obliques	✓	✓	✓
Public health	State, local, tribal, special purpose district	Improved disease mapping; improved public outreach	6” - 12” ortho	✓	✓	✓
Public safety (fire and police actions)	Local, tribal	Ability to see incident context (safe entry modes, nearby hazards); Common operating picture for incident command	6” - 12” ortho / obliques	✓	✓	✗
Site selection	State, local, tribal, special purpose district	Improved site prospecting and planning	6-12” ortho / obliques	✓	✓	✗
Transportation infrastructure	State, local, tribal, special purpose district	Improved traffic management; Improved infrastructure mapping & facility management; improved safety assessment	3-6” ortho / obliques	✓	✗	✗
Utility infrastructure (power, water, sewer)	Local, tribal, special purpose district	Time-savings in fieldwork, efficiency in management, safety through reduced field time	3-6” ortho / obliques	✓	✗	✗

In contrast, the Current Service Tier is much less useful. It will not replace local government imagery purchases, especially the many purchases that include oblique images. As noted in the survey responses and workshop participant comments, 12" orthoimagery gives a common baseline and is helpful for general mapping purposes and larger area spatial studies: forestry, general site selection, long-term and large area planning and land use, and large-area disaster recovery.

The Improved Service Tier is a compromise between the Current and Optimal Service Tiers. It includes oblique images and orthoimagery that minimally meets property assessor standards but is not ideal given current best practices. It meets the most common minimal needs in urban and other settled areas (Table 3)

Table 3 shows that oblique imagery is widely used in government and business functions. 6" 4-way (4 images from any given viewpoint) are the most common products in the United States for the past 5 years. As with orthoimagery, vendors are offering ever-finer resolutions (including 1"). Oblique imagery is now a three-dimensional mapping-grade data source, unlike when it first appeared and was just a way to "see something from the side." Because oblique imagery can be very well-controlled in three-dimensions, measurements can be made from them that are impossible with orthoimagery: heights of objects and areas of sloping surfaces can be determined, for instance.

Oblique imagery has many uses, some of which are especially significant for local governments and state agencies that perform property valuations. The International Association of Assessment Officials (IAAO) guidelines state that property assessments may be performed with recent (usually within 3 years) high-resolution good quality orthoimagery and oblique imagery in place of visiting a property. This has saved assessors an immense amount of time nationally. Some other significant uses are in emergency response and planning. As one emergency dispatcher stated: "it lets us see over fences and under trees so we can send officers where they need to be safely".

Settled areas are proposed for coverage with higher resolution imagery in the Optimal and Improved Service Tiers. "Settled areas" is not a legal entity – it is those areas of the state where settlement (and thus structures) are clustered, even if at low densities. OPRD performed an analysis in which they calculated structure density per square kilometer. In this study we examined the structure density map and created very generous boundaries around the higher structure density areas. These covered an area of about 16,250 square miles, about 16% of the state by area. This is the *maximum* area for Optimal and Improved oblique and higher resolution orthoimagery. A *minimum* area might be the state's Urban Growth (UG) boundaries. The 217 polygons comprising UG boundaries cover 1354 square miles, about 1.4% of the state by area. Coverage by the Service Tiers can range from:

- Current Service Tier
    - Statewide (98,880 square miles) – 100%
- Optimal Service Tier and Improved Service Tier
    - Settled Areas Size Range
        - Urban Growth Boundaries 1,354 square miles – 1.4%
        - Structure density (this study) 16,250 square miles – 16%
    - Outside of Settled Areas
        - Outside of Urban Growth Boundaries 97,526 square miles – 98.6%
        - Outside of structure density polygons 82630 square miles – 84%

The Optimal and Improved Service Tiers create consistent imagery for all settled areas (however defined) within Oregon. Oregon has seen a huge increase in rural settlement over the past twenty years. Local governments in largely rural counties lack funds to buy the oblique and high resolution orthoimagery that larger and more wealthy urban areas and counties already acquire through contracted vendors. By including at least 6" imagery in the Improved Service Tier (and even better 3" in the Optimal Service Tier), Oregon gives all settled areas the same basic, highly useful, aerial photography resources regardless of local funding availability for imagery.

Table 4 provides an additional comparison between the three service tiers. This table shows the benefits each service tier provides, rather than the uses the service tiers support shown in Table 3. For example, all three service tiers will be public products that do not require purchasing licenses to use them. The Optimal Service Tier provides the most benefits, the Current Service Tier provides the least.

Table 4. Benefits of Service Tier options. Key: Fully provides benefit: white tick mark in green square; Minimally provides benefit: black tick mark; Does not provide benefit: red cross mark.

Benefit	Description	Optimal	Improved	Current
Settled Areas	Aerial imagery coverage within settled areas	3” GSD orthoimagery; 3” GSD oblique images	6” GSD orthoimagery; 6” GSD oblique images	12” GSD orthoimagery, no oblique images
Outside of Settled Areas	Aerial imagery coverage outside settled areas	6” GSD orthoimagery	12” GSD orthoimagery	12” GSD orthoimagery
Standard Basemap Capabilities	Public domain product can be freely shared; all users see same imagery facilitating coordination and decision-making	✅	✅	✅
Contributes to Oregon Data Framework (cf. ORS276A.500(5))	Provides a current framework layer as called for in statute	✅	✅	✅
Horizontal, vertical, slope area and height measurements	Oblique imagery viewing tools that allow more than just plan view length or area	✅	✅	❌
Meets International Association of Assessing Officials Standards	Meets guidelines in IAA) documents	✅	✅	❌
Meets Common Assessing Official Practices in U.S.	Follows current best practices of many assessors and adjusters	✅	❌	❌
Quality control costs are covered in program	Cost of quality control for imagery products is built into program costs	✅	✅	❌

Coordination and technical support costs are covered in program	Explicit funding for staff time and resources to support program	✅	✅	❌
Meets many government use cases and common business needs	See Table 3	✅	✓	✓
Minimize administrative costs through streamlined Procurement (Local and State Agencies)	Master contract vehicle with buy-up capabilities that are pre-set and require little administrative effort	✅	✅	❌
Can replace some current local government expenditures	Depending on program details, local governments could use State program imagery and contracting instead of separate contracts with vendors	✅	✅	❌
Dedicated Program Support	Improved comprehensive planning, economic development, public discourse	✅	✅	❌

OSIP Service Tiers – Cost Estimation

Table 5 shows the estimated costs for the three proposed OSIP Service Tiers as the cost per imagery collection cycle. Assuming OSIP will continue refreshing statewide imagery every 2 years, the per-year cost is half what is shown in Table 5.

Table 5. Estimated per-cycle costs for OSIP service tiers. Current Service Tier has zero costs for actions and services provided without explicit funding.

Item	Description	Optimal	Improved	Current
Settled Areas	Aerial imagery coverage within settled areas	3" GSD orthoimagery; 3" GSD oblique images	6" GSD orthoimagery; 6" GSD oblique images	12" GSD orthoimagery, no oblique images
Outside of Settled Areas	Aerial imagery coverage outside settled areas	6" GSD orthoimagery	12" GSD orthoimagery	12" GSD orthoimagery
OSIP Program Manager	1 FTE, EIS-DAS	$200,000 @ 2 years $400,000	$200,000 @ 2 years $400,000	$200,000 @ 2 years $400,000
OSIP Hosting Services Technician, User Support	At EIS-DAS, FTE percentage depends on service tier	1 FTE $150,000 @ 2 years $300,000	0.5 FTE $75,000 @ 2 years $150,000	0.5 FTE $75,000 @ 2 years $150,000
Hosting Costs (hardware, storage, software, network)	Varies depending on service tier due to varying sizes of imagery collections and size of user community	$200,000	$125,000	$50,000
Orthoimagery per service tier specification	Purchased via contract	6" GSD 82,630@ $100/sq. mi. $8,263,000 3" GSD 16,250 @$165/sq. mi. $2,681,250	12" GSD 82,630@ $25/sq. mi. $2,065,750 6" GSD 16,250 @$100/sq. mi. $1,625,000	12" GSD 98,880 @ $25/sq. mi. $2,472,000
Oblique images, per service tier specification	Purchased via contract	3" resolution 4-way 16,250 @$225 $3,656,250	6" resolution 4-way 16,250 @$150 $2,437,500	$0
Quality control of aerial imagery collection	Assumes quality control conducted by outside contractor	$250,000	$200,000	$75,000
Total per-imagery cycle	Assumes a 2-year cycle	$15,750,500	$7,003,250	$3,147,000
Annual cost	Assumes a 2-year cycle	$7,875,250	$3,501625	$1,573,500

Annual cost estimates range from 1.2 million to 7.9 million dollars. The cost spectrum is closely related to the use-value of the products in each service tier. Is the Optimal Service Tier six and a half times more valuable than the Current Service Tier? Or the Improved Service Tier providing only about half the use-value of the Optimal Service Tier but nearly three times the value of the Current Service Tier?

This study cannot answer these questions in a definitive, quantitative fashion since it did not delve deeply into fiscal details hinted at by survey respondents and workshop participants. However, some warranting arguments for the overall value of the Improved and Optimal Service Tiers can be made. First, if public agencies are spending nearly $2 million per year on imagery, as suggested in the study findings, and these tiers replace that expense, then one can deduct that two million dollars from the annual costs of the two tiers. Second, as Tables 3 and 4 show, the uses and benefits expand greatly as one goes from the Current Service Tier.

There is certainly a return on investment from aerial imagery. Disaster recovery actions involve insurers, federal, state, and local governments, and the affected public. One of the first questions asked after a disaster of any sort is “what was lost?”. Answering this question is difficult without the clarity that aerial imagery provides. Oblique imagery is especially important because it shows what something looked like from several angles, not just from a birds-eye view. In fact, it is so important that the National Oceanic and Atmospheric Administration (NOAA) has special rapid response teams that try to fly disaster areas within 24 hours of an event. Of course, the only way to assess damage is to compare post-event with pre-event imagery. To do that, one must have the pre-event imagery, of course.

A single wildfire event in September 2020 burned more than 4,000 residences causing an estimated 535 million dollars in building losses alone (https://www.oregonlive.com/business/2020/10/oregon-wildfires-burned-1-billion-in-homes-and-belongings-last-month-new-tally-finds.html). If aerial imagery was useful in recapturing the value of those homes to the homeowners in even a small way such as providing documentation of the loss to insurers, it had financial value. So, if it increased the payback to owners by 1%, that had a financial value of nearly 5.4 million dollars. While this was one of Oregon’s worst fire events, smaller disasters happen every year throughout the Pacific Northwest. Imagery is important in the response to these (e.g., https://www.eagleview.com/casestudy/eagleview-disaster-response-program-invaluable-in-spokane-wildfire-reappraisal/).

The Optimal Service Tier could return the public’s investment in it very quickly just in making disaster recovery more effective.

Improved aerial imagery has a role to play in preventing such fire events too – one can evaluate fuel load around buildings remotely and also use machine learning algorithms to identify places where public outreach can create a safer community. It is hard to calculate the savings from preventing something bad occurring, but there clearly is a financial return.

> *"... any georeferenced aerial imagery is extremely helpful. Cannot estimate the effort saved but know that the numbers would be huge. Staff making decisions use imagery in their daily work. Our agency would not be able to function without imagery."*

Another warranting argument that shifting OSIP to the Optimal Service Tier is worth the cost comes from this study. Many survey and workshop participants said they couldn't even begin to calculate the savings achieved through using aerial imagery. At this point, the Current Service Tier has probably provided as much in the way of benefit as one can get from its products – the 12" orthoimagery. Further savings of time and effort will accrue only if OSIP offers better imagery and new types of imagery.

Conclusions and Recommended Actions

This study examined how to keep it successful. The key finding is that the program needs consistent long-term funding and that this funding is probably best provided through a specific multi-budget line item in the state's budget. Another key finding of this study is that there is a considerable demand for an improved OSIP product.

The most useful, and thus valuable, improvement would come from a proposed OSIP Optimal Service Tier. A less expensive, but also less effective option is proposed as the OSIP Improved Service Tier. The estimated annual costs of these tiers is 7.9 million dollars and 3.5 million dollars, respectively. Since they would encompass about two million dollars of public money already being expended (if not more), the net public cost may be 5.9 and 1.5 million dollars, respectively. The OSIP Current Service tier meets the fewest needs. Even if this service tier is selected, it must have stable funding and dedicated, budgeted, support staff, estimated at about $400,000 per year (not shown in Table 5). The Current Service Tier will provide no new benefits and uses though, so it is the least preferred alternative.

A dedicated corps of volunteers has worked to make imagery available for Oregonians since 1995. Due to the effort of these volunteers, OSIP was established in 2016. The state has benefited many times over the program cost of the imagery program – this study has discussed only some of these benefits. Prudent investment in OSIP's future will guarantee that Oregon will continue to reap benefits that include more efficient and equitable

property assessment and inspections; reliable change detection; improved transportation and utility infrastructure mapping and management; improved near- and long-term planning; and improved speed and safety during wildfire and disaster recovery efforts.