Phase 1 Scoping for
Oregon Orthoimagery Portal Application

PROJECT COMPLETION REPORT

May 31, 2006

In accordance with the requirements of Interagency Agreement K9436, the Institute for Natural Resources (INR) at Oregon State University and OSU Libraries (OSUL) are pleased to submit this project completion report for the Phase 1 Scoping for an Oregon Orthoimagery Portal Application. This report includes comprehensive documentation of the portal application scoping process, undertaken in anticipation of development of an imagery portal to serve digital aerial imagery for the state of Oregon. It summarizes findings of the assessment of existing software solutions and the ability of each to meet functionality needs outlined by geospatial data users in Oregon. The report also outlines next steps for the Imagery Portal project, including anticipated details to be outlined in an RFP process. Conclusions stated in the report are based specifically on this research project and, as such, may be revised in the future as new information and knowledge is obtained about possible software solutions.

EXECUTIVE SUMMARY

The Department of Administrative Services (DAS) and Oregon State University (OSU) are collaborating to develop an orthoimagery portal application to allow for the distribution of digital aerial imagery for the State of Oregon. The near-term objective of this project is to develop an Imagery Portal that serves the 2005 half-meter orthoimagery that the State has obtained from the National Agriculture Imagery Program (NAIP) and other aerial imagery datasets. The targeted primary users for the imagery portal are Federal, State, and local agencies and institutions of higher education. Secondary users include the general public.

The Imagery Portal Project includes two phases. Phase 1 is the project scoping by staff from OSU and includes an assessment of existing software solutions that meet the required and desired functionality identified for the imagery portal. Phase 2 includes procurement of a software solution and the implementation of the Imagery Portal.

Using a list of high-level functional requirements provided by the Orthoimagery Framework Implementation Team (OFIT), the OSU team refined this list to articulate required and desired functionality for the portal in the areas of 1) image provisioning, 2) providing image services, and 3) ingestion, setup and administration. The team then gathered information about software solutions that currently are available from vendors and assessed the ability of these to meet functional requirements and desirables. The scoping focused on solutions proposed by four vendors: ESRI, Intergraph, IONIC, and SANZ.

After assessing the available vendor solutions, the team evaluated the software packages relative to seven criteria: 1) Ability to provide an image provisioning web application, 2) Strength of web map service (WMS) server, 3) Licensing model, 4) Relative cost of licensing, 5) Demonstrated use of product, 6) Likelihood for on-time delivery of product, and 7) Ability of the product to integrate with navigatOR. The OSU Team found no single vendor solution that offered truly off-the-shelf functionality meeting both the image provisioning and image service needs. The Intergraph and IONIC solutions provide acceptable image services but require custom development to meet the image provisioning requirements while

SANZ provides acceptable image provisioning but is lacking in the image service area. Because ESRI's solution was based on Image Server, which has not yet been released, it theoretically is expected to meet both the image provisioning and image service needs. However, its actual ability to do so is difficult to anticipate currently. Thus, assuming that the State is willing to consider solutions that include some custom development, results of Phase I scoping are summarized as follows:

- Intergraph: meets all needs but is high cost
- IONIC: meets all needs and is low cost
- ESRI: could meet all needs but there is an extremely large potential for schedule slip
- SANZ: meets provisioning needs but does not meet image service needs plus license model is not favorable

Findings from Phase 1 scoping will be used to develop a comprehensive Request for Proposals (RFP) that clearly articulates the needs to be addressed by the software solution, the technical specifications of the portal, anticipated workflow during the portal development and implementation process, and other critical details about Phase 2 implementation of the Oregon Orthoimagery Portal Application. OSU will lead the RFP process and oversee implementation of the orthoimagery portal application within the Oregon Explorer Imagery Portal.

BACKGROUND AND OBJECTIVES

Geospatial data use is now a part of routine operations for Oregon government agencies. As a result, agencies receive many requests from organizations throughout the state for geospatial data, particularly orthoimagery and aerial photography. User needs typically go beyond simple viewing to include such features as clipping data for an area of interest, compressing these data, and shipping them to the user and seamlessly integrating with other geospatial internet applications. A Web-based Internet portal application providing access to and distribution of public domain, statewide orthoimagery would meet the majority of users' needs.

The Department of Administrative Services (DAS) and Oregon State University are collaborating to develop an orthoimagery portal application to allow for the distribution of digital aerial imagery for the State of Oregon. The near-term objective of this project is to develop an Imagery Portal that serves the 2005 half-meter orthoimagery that the State has obtained from the National Agriculture Imagery Program (NAIP) and other aerial imagery datasets. This Imagery Portal will be integrated into the Oregon Explorer Natural Resources Digital Library, which is being developed by OSUL and INR as a single web access point to learn about Oregon's natural resources and environment (see Appendix 1). Ultimately, the goal of the Oregon Explorer Imagery Portal is to distribute and display aerial imagery—including both framework imagery and all other available imagery—in Oregon and to support other applications beyond natural resources.

The Imagery Portal Project includes two phases. Phase 1 is the project scoping, which includes an assessment of existing software solutions that meet the required and desired functionality identified for the imagery portal and procurement of a software solution. Phase 2 is implementation of the Imagery Portal.

The targeted primary users for the imagery portal are Federal, State, and local agencies and institutions of higher education. Secondary users include the general public. Because of network architecture and the location of the data and the services, "tiers" of accessibility to the Imagery Portal will manifest as Oregon public employees with access to the State's high-speed network, staff of local and Federal agencies and

the general public. The intent is that the application will be developed to enable image access (viewing and downloading) by anyone.

PROCESS FOR PHASE 1 SCOPING

The intent of the Phase 1 scoping was to complete an assessment of existing software solutions that may be suitable to meet the required and desired functionality identified for the Imagery Portal. INR and OSUL convened a project team to lead the Phase 1 scoping for the Imagery Portal. Team members included:

- Renee Davis-Born, INR Faculty Research Assistant and Project Manager
- Tim Fiez, OSUL Programmer and Technical Project Manager
- Jimmy Kagan, INR Information Program Director and Project Advisor
- Janine Salwasser, OSUL Oregon Explorer Program Director and Workshop Facilitator
- Kuuipo Walsh, INR Faculty Research Assistant and GIS Analyst

Additional input was obtained from Ken Kato and Erik Steiner of the University of Oregon InfoGraphics Lab. The DAS project sponsor was Cy Smith, the Statewide GIS Coordinator for the Oregon Geospatial Enterprise Office. In addition to DAS staff, the Orthoimagery Framework Implementation Team (OFIT), and in particular OFIT Chairman Randy Sounhein from the Oregon Department of State Lands, played an important advisory role during the Phase 1 scoping. The OFIT coordinates efforts, such as standards development and data acquisition planning, in Oregon on the orthoimagery framework theme identified by the Federal Geographic Data Committee. In terms of its involvement in the Imagery Portal project, OFIT drafted the initial functional requirements and characteristics of the imagery application, which were included in the statement of work of the DAS–OSU interagency agreement.

Initial Functional Requirements

- The application will be integrated into the Oregon Explorer, and provide access to both orthoimagery and aerial photography.
- The imagery portal architecture will be designed to support future geospatial data access and distribution.
- The application will allow a user to select an area of interest (AOI), clip that area from the database, compress those images for efficient transfer, and electronically ship them to the user. Once received, users will have the option to uncompress the images. Metadata will accompany all shipments.
- The application will support multiple projections and datums.
- The application will provide access to multiple vintages of imagery.
- The application will support provision of the imagery in multiple raster formats in a manner that is transparent to the user.
- The application will be able to fully and seamlessly integrate imagery with other geospatial Web applications (OpenGIS (WMS), ESRI, Intergraph and other communication protocols).
- The application will adhere to FGDC and OGC standards.
- The application will provide 24-hour/7-day-a-week operational accessibility.
- The application will provide backup/archival support.
- The application will provide system administration privileges in a hosted server environment.
- The application will be scalable.
- The application will not limit usage at projected user loads. Multiple access will be allowed within the practical limits on the file-size operations. In addition, software of the type required to

meet the functional specifications of this project often are purchased and licensed for a specific number of concurrent users. With this type of software, users have to wait for an available license if the concurrent user load exceeds the purchased license number; however, by careful determination of projected user loads, the concurrent license number should not limit normal usage.

- The application will have initial costs associated with purchase of use licensing with the intent that there will be minimal or no annual licensing costs thereafter.

Initial Major Characteristics

Browsing. The application will have a simple viewing mode where users can browse imagery datasets as a catalog, together with one or more vector or imagery data sets overlaid. Pan and zoom tools will be available.

Searching. The search feature will support several methods of defining an AOI, including by interactive map, by database query, and by vector file. For example, vector data (such as quad indices, county boundaries, watersheds) could be used to interactively create an AOI or be queried to create an AOI.

Processing. The application will be able to:

1. Combine data from multiple tiles and data sources into a seamless dataset
2. Project data on the fly
3. Resample data to a lower resolution
4. Clip data to the AOI
5. Create a preview before final product delivery
6. Save processing selections for future reuse

Output. The application will be able to generate:

1. Custom datasets generated from a user-defined AOI
2. Copies of source imagery (e.g., one or more 1:24,000 orthophotoquads)
3. Output in multiple industry-standard raster formats, multiple projections (including Oregon Lambert), compressed and combined with metadata.

The OSU team initiated the Phase 1 scoping with a number of assumptions in place regarding the various aspects of the data, architecture, existing software, and process for developing an Imagery Portal.

- The Imagery Portal will serve the 2005 NAIP 0.5-m resolution dataset, which is seamless, statewide color aerial imagery.
- Imagery will be shared with Google Earth and Windows Live Local.
- Commercial off-the-shelf (COTS) software exists and can be licensed to State.
- The Imagery Portal will be available for use free of charge, and usage will not limited.
- Phase 2 of the Imagery Portal Project will begin with an RFP process, and the Imagery Portal is expected to be launched by the end of 2006.
- The project is being conducted under a long-term partnership between DAS and OSU intended to provide access to all geospatial Framework data through the Oregon Explorer, as outlined in Track 5 of the *Oregon GIS Utility Implementation Plan* of January 16, 2006.

Phase 1 Tasks

To accurately and adequately assess existing software solutions that have the potential to meet the functionality needs identified, the Phase 1 scoping comprised approximately 10 weeks of research by the

OSU team. Team members completed several tasks, which are listed below and culminate in the findings documented in this report.

- Obtain comprehensive information about the source datasets
- Assess how other states and jurisdictions are serving imagery
- Conduct a limited number of use case studies to determine specific user needs for representative groups
- Convene two workshops with OFIT members (see Appendix 2 for agendas and notes from the workshops)
- Obtain estimates of user demand through the use of an online survey distributed to several hundred GIS analysts around the state (see Appendix 3)
- Evaluate commercial off-the-shelf software options which meet the functionality requirements listed above, and the associated hardware, storage and network configuration necessary for each option
- Talk with users of the existing software options under consideration

For the purpose of the Phase 1 scoping, OFIT members served as representative users of the Imagery Portal and met twice with the OSU team to provide valuable feedback during the scoping process. The objective of workshop #1 (held April 13, 2006) was to communicate preliminary findings at the mid-point of the scoping and obtain feedback about the software scenarios—including detailed information about required and desired features—relative to user needs. Objectives of workshop #2 (held May 11, 2006) were to share findings from the OSU team's assessment of the existing software solutions, discuss evaluation criteria for selecting a software vendor during the Phase 2 procurement process, and present suggestions about software solutions that meet Oregon's needs, based on priorities identified by OFIT and DAS. In addition to dialogues with OFIT at the two workshops, individual members of the OSU team followed up with select OFIT members and other geospatial data users in Oregon to obtain supplemental information as needed to complete the scoping of required and desired functionality.

DESCRIPTION OF THE IMAGERY DATASETS ACQUIRED BY THE STATE OF OREGON

The three derived products of the 2005 NAIP orthoimagery (half-meter spatial resolution) are:

1. Digital Orthophoto Quadrangles (DOQs),
2. Compressed 30 x 30 minute mosaics, and
3. Unrectified scanned imagery.

Each individual full-quad DOQ covers an area measuring 7.5-minutes longitude by 7.5-minutes latitude. Full-quad DOQs will be obtained in uncompressed GeoTIFF format (no tiling, without internal pyramids) and compressed MrSID® Generation Three (MG3) format. All individual DOQs will be available in the following projections: Geographic coordinates (GCS83), Universal Transverse Mercator (UTM) NAD 83 (zone 10 or 11 depending on which zone the imagery falls in), Oregon State Plane, and Oregon Lambert.

Each individual compressed 30 x 30 minute mosaic covers an area measuring 30-minutes longitude by 30-minutes longitude. Compression for this imagery is MrSID® Generation Three (MG3) format at a compression ratio of 50:1. Each individual mosaic will be in UTM NAD 83 projection, zone 10 or 11 depending on which zone the imagery falls in.

Unrectified scanned imagery is in uncompressed GeoTIFF format and MrSID® Generation Three (MG3) format with target compression ratio of 20:1. All unrectified scanned imagery is unprojected but referenced to UTM NAD83.

The full-quad DOQs will be quality assured by the Portland Office of the U.S. Department of the Interior Bureau of Land Management. During the ingestion step of Phase 2 of the Imagery Portal Project, one copy of the DOQs will be put into the portal from which users can access the data. The portal will facilitate resampling and reprojection so that users can obtain the data they want in a desired format. For the purpose of the online Imagery Portal, the size of the 2005 NAIP imagery precludes simple downloading of the source imagery files in their entirety.

REQUIRED AND DESIRED FEATURES OF THE IMAGERY PORTAL

The OFIT committee provided a list of high-level functional requirements. These are listed in the Initial Functional Requirements section above. In preparation for the RFP process, the OSU team used this list as a starting point to determine what exact features are required and which features are desired. In addition, the team investigated what features are available from commercially available products so that an RFP can be crafted that specifies a solution that is feasible given these products.

Image Provisioning

For the Oregon Orthoimagery Portal Application, image provisioning refers to a web application that allows users to extract and download an image file for a selected area of interest and imagery source. For the 2005 NAIP imagery and most other cases, the size of the dataset will prevent users from downloading the entire data set at its native resolution. The image provisioning application provides the ability to extract subsets of the entire dataset at its native resolution or lower resolution derivatives. In addition, the portal application will project the data to the projection required by the end user and will save the data in the user's chosen file format.

In terms of sequence, the user interaction would proceed as follows:

- Search data source
- Select area of interest
- Select processing options
  - Clip to extent
  - Reproject
  - Resample
  - Mosaic
- Prepare to deliver
  - Select export format
  - Select compression if applicable
- Preview
- Deliver
  - Provide metadata

Recommendations from April 13, 2006 Workshop

During the April 13th Imagery Portal Workshop, the team asked for specific recommendations concerning required or desired functionality related to selection of area of interest, determination of clip extent, and image/file formats. The user feedback is summarized below in Tables 1–3.

Table 1. Determining Area of Interest

	Required	Desired
Draw on map	Y	
Enter coordinates	Y	
Enter address	Y	
Quad name	Y	
Township and range	Y	
HUC	Y	
Zipcode	Y	
911 centers	Y	
Highway milepost	Y	

Table 2. Defining Clip Extent

	Required	Desired
Bounding rectangle	Y	
Clip to predefined region		Y
Clip to user uploaded region		Y

Table 3. Image/File Formats

	Required	Desired
GeoTIFF -- simple	Y	
GeoTIFF – pyramids, tiles, JPEG		Y
JPEG2000	Y	
PNG		Y
JPEG		Y
MrSID		Y
IMG		Y

Oregon State University Recommendations

In addition to the user recommendations, the OSU team recommends the following characteristics be included as required in the RFP.

Search Data Source

The image portal will grow beyond serving just the 2005 NAIP imagery. Therefore, the portal application must allow users to search for and select an image source. The OSU team recommends that users be allowed to search by the following features:

- Keyword search of image metadata
- Date of acquisition
- Native resolution
- Sensor type (spectral and platform)
- Positional accuracy

Reprojection

The image portal application must use proven reprojection algorithms so that there is minimal positional accuracy loss.

Selection of Compression Factor

For the required JPEG2000 file format, the user must be able to control the compression factor.

Preview

The user must be informed of the download size and the expected delivery time for different connection speeds before they begin the download process.

Metadata

A metadata file will accompany all image downloads. The metadata must follow the FGDC Content Standard for Digital Geospatial Metadata and be provided in XML and HTML formats. All processing steps that occurred during the provisioning process should be listed in the lineage compound element.

Restrictions on Download Size and Quantity

To avoid one person overloading the image portal application, the system must limit the daily download quantity (MB of downloads) per individual. The method for limiting individual download quantity should not be based on requiring all users to register and log-in to use the image provisioning application as this would create an entry barrier that will discourage users from using the application. Only when appropriate should the system use some method to identify or remember who is requesting the imagery. In addition, the system will enforce a configurable maximum download size for a single file.

Additional Highly Desired Factors for Image Provisioning

Remembering User Settings

It is highly desired that the application provide some way to remember settings such as output format and projection between visits without requiring users to go through a registration process. For example, if the user clicked a "remember me" icon, settings would be saved between sessions.

Configurability of Area of Interest Methods

For the selection of area of interest, the OSU team would prefer that the vendor design the application so that it is easy to add/remove methods for defining the area of interest based on spatial features such as hydrologic unit codes (HUCs) and counties. For example, they could design the application to use web feature services (WFS) so that adding a new method only required creating the WFS and adding its server properties to image provisioning application.

Providing Image Services

Image services are part of the ongoing process of moving geospatial applications from single desktop solutions to distributed, networked, and service oriented computing. This approach began by moving imagery from a user's local hard drive to a network file server so a workgroup could share a common stored dataset. However, services oriented architectures have allowed this sharing of imagery to move beyond local networks to entire enterprises and to anyone with Internet access.

With image services, users connect to a service provider to access imagery as needed. The image service provides views of the imagery as requested by the user. Users no longer need a copy of the source imagery and the actual storage of the imagery becomes transparent to the user.

In this investigation of vendor solutions, the team found two primary ways of providing image services: the OpenGIS consortium's web map service (WMS) and proprietary services unique to specific vendors.

The WMS specification defines an open protocol for communication between WMS clients and WMS servers. WMS clients such as a website or a desktop GIS solution requests map views (a digital portrayal of geographic information and not the data itself) of an imagery dataset from a WMS server. WMS client and server communication occur via HTTP with servers referenced using URLs. Of those vendors for which detailed inquiries of their capabilities were made, all systems could provide WMS services (although two companies do this via proprietary image services, as discussed below). Therefore, all platforms that could consume WMS services (have WMS client capabilities) could access the statewide NAIP imagery using a services approach.

A detailed investigation of vendors found two companies—ESRI and Intergraph—providing proprietary image services. For this document, a proprietary image service is one that requires a software add-in or plug-in from the maker of the image server software to consume their services. In other words, to access a service from vendor A's image portal, you need to install a plug-in from vendor A so that your client software (GIS, CAD, etc.) can utilize the service. These vendor-specific image services can offer several advantages. First, a vendor may supply a plug-in for a client that currently does not support WMS. For example, although MicroStation V8 2004 users cannot connect to WMS's, both ESRI and Intergraph provide or plan to provide their own plug-ins for MicroStation. Secondly, because these vendor supplied plug-ins do not have to comply with a formal open specification, the communication and operation between a vendor plug-in and the vendor's image server may allow more control of the returned map images. The proprietary solutions may also be better optimized, allowing more connections to an image server than WMS-based services; however, this is probably due to the vendor's investing more development time in their proprietary solutions than the more recently developed capability.

There are several drawbacks to relying on proprietary image services. Users and/or IT staffs must install the vendor plug-ins which may increase support needs and conflict with administration and security policies. In addition, as client application software (e.g., GIS, CAD, etc.) versions change, users are dependent on the image portal vendor to make sure their plug-in works with the new software version. Finally, the technologies used by the vendor specific image services may have security implications that prevent their use by anyone outside of the State of Oregon network without specific firewall modifications. Intergraph's TerraShare plug-ins are built upon Microsoft DCOM and ESRI's plug-ins use RPC. Based on discussions with staff at the new State Data Center, the OSU team believes the firewall limitations would not prevent major users (i.e., agencies and other partners) from using the plug-in technology, but it could be difficult to allow access to single entities.

WMS Client Functionality among GIS, CAD and Remote Sensing Software

During the April 13th OFIT workshop, the group identified what software should be supported by image services meaning these applications must either act as a WMS clients or have vendor plug-ins (see Table 4). Of the commercial applications listed as requiring image services support, only MicroStation V8 2004 did not have the ability to use WMS. However, Bentley says that MicroStation V8 XM, coupled with their geospatial extension which will be released in fall 2006, will work with WMS.

The OSU team has yet to determine if the Oregon Department of Forestry's MapObjects applications can work with WMS. There are no vendor proprietary plug-ins for MapObjects-based applications.

Table 4. Applications to Support with Services

	Required	Desired	WMS Client	WMS Notes
MicroStation V8 XM	Y		Y	Geospatial Extension will be a WMS client (available Fall 2006)
MicroStation V8 2004	Y		N	
ArcGIS 8.X		Y	Y	ESRI OGC Interoperability Add-On
ArcGIS 9.X	Y		Y	Native to application
ArcView 3.X	Y		Y (plug-in)	MN DNR WMS Client for ArcView 3.x:
MapInfo 8.X		Y	Y	Professional 8.0
GeoMedia	Y		Y	
ArcExplorer		Y	Y	ArcExplorer Web
ODF MapObjects app	Y		N	MapObjects can utilize dynamic data from ArcIMS. ESRI's ArcGIS 9.1 development tools such as ArcGIS Engine and ArcGIS Server can access data from WMS servers.
Erdas Imagine		Y	N	
Autocad/Autodesk		Y	Y	MapGuide WMS Extension

Recommendation

Based on the growing number of geospatial applications that, either now or in the near future, can act as WMS clients, there is no significant need for vendor-specific services. Assuming that the State's MicroStation users will upgrade to the V8 XM with the geospatial extension, the OSU team

recommends that the Imagery Portal utilize WMS for providing image services to desktop and web-based clients.

Ingestion, Setup, and Administration

Required and Desired Functionality

While the public side of the image portal—the web provisioning application and the image services—must meet user needs, it is equally important to have functional back-end administration tools. The OSU team recommends that the RFP require the following functionality:

- A desktop or web based application to view the image files within the system
- The ability to load imagery in batches
- Tools for optimizing WMS performance such as pyramiding and tiling

The team also recommends as highly desired the following functionality:

- Logging of WMS requests
- Logging of image provisioning downloads

The OFIT-provided functional characteristics include backup/archival support and system administration privileges in a hosted server environment. In this survey of vendors, backup is best performed by standard backup software backing up the essential files/databases of the application. Most, if not all, of the potential image portal solutions will use some sort of database to hold image statistics and indexing information. These features, along with any pyramid files, should be backed up. Because all four vendor solutions do not modify the source imagery, the image files would not have to be backed up because of changes made by the portal software; however, the State would obviously want a backup of the source imagery in case of catastrophic failure of file servers or data centers.

In regards to system administration privileges, desktop applications available only to system administrators or authenticated web applications would both be acceptable.

Ingest Formats

The system must ingest the following formats:

- Geotiff
- Tiff with world files
- HDF-EOS

It is highly desirable that the system ingest ESRI GRID files.

ASSESSMENT OF AVAILABLE VENDOR SOLUTIONS

The majority of the scoping effort was focused on gathering information about software solutions that currently are available from vendors and assessing the ability of these to meet functional requirements and desirables listed above. The OSU team initiated this assessment by first researching and constructing a list of commercial, off-the-shelf software solutions that currently exist for serving imagery datasets such as those recently acquired by the State of Oregon. Next, an informal questionnaire was circulated to vendors of the identified software solutions to obtain more detailed information about the ability of the

software to address user needs (see Appendix 4). As possible and appropriate, the OSU team—and, at times, a small number of OFIT members—saw demonstrations of the software solutions. Finally, team members contacted customers of each of the currently available software solutions to discuss with them issues such as installation, functionality, performance, and maintenance of the system. In total, this body of information was used to develop the following summaries and discussion of vendor solutions.

The following section summarizes the solutions proposed by ESRI, Intergraph, IONIC, and SANZ. These summaries are based upon the questionnaires, the demonstrations and follow-up phone discussions with each vendor. To see specific answers to the questionnaire, see Appendix 5. ***Information contained in Appendix 5 is business confidential and provided for the sole use of the Imagery Portal Project team and OFIT Committee members. It is not intended for general distribution.***

In addition to the four vendors investigated in depth, the OSU team also met with and received a questionnaire response from Sanborn, an ESRI business partner that collects NAIP imagery and builds portals. In addition, team members talked to users of open source mapping software and investigated other potential software solutions through web searches and phone contacts. These investigations are discussed in the Other Vendors section.

ESRI Image Server

Solution Components

ESRI proposed a solution based on the upcoming Image Server product in combination with existing ESRI applications.

Image Provisioning System

An ESRI-provided solution would require the development of a custom web interface built upon ESRI's ArcIMS viewer, the GIS Portal Toolkit, and or ArcGIS Server. The aforementioned products can support web map-based area of interest selection. ESRI's Metadata Explorer, an ArcIMS based application, and the Portal Toolkit provide for searching of metadata and intersecting results with area of interest specifications. The application would require a custom web-based form for users to select various image extraction options and a custom component to access Image Server's clipping, reprojection, and image analysis functions. Finally, the application would require a component for the save and delivery process.

Image Server provides for multiple mosaicing methods, reprojection to all common projections and datums, multiple export formats, control of compression where applicable, various resampling algorithms, and image processing including band manipulation and generation of false color imagery.

In addition to extracting imagery through the portal web application, the Image Server product will include plug-ins that allow users to extract imagery through client applications. ESRI plans on providing plug-ins for leading GIS and CAD applications. For example, one could be using the plug-in inside ArcGIS to view the imagery and then decide download a copy of the source imagery without having to leave ArcGIS.

Image Services

Image Server can provide image services via WMS and proprietary image server plug-ins (direct connect clients). As mentioned above, ESRI plans on providing plug-ins for leading GIS and CAD applications. Set up by the service administrator, Image Server provides "on-the-fly" image processing capability so that a single copy of the imagery may support multiple image services.

When an administrator creates an image service, they can specify a processing sequence that can include image processing, radiometric enhancements, mosaicing options, and resampling methods.

Data Storage and Ingestion

The Image Server product can work with imagery stored in flat files or in ArcSDE and other relational databases. Image Server is managed through a Service Editor extension to ArcMap. Using the service editor, the administrator defines services and loads imagery. If requested during loading, Image Server can build overviews (reduced resolution views).

Licensing

ESRI server products are licensed on a CPU (or central processing unit) basis.

IONIC RedSpider Image Archive 3

Solution Components

IONIC's solution was based on their RedSpider Image Archive 3 product.

Image Provisioning System

IONIC provides a sample web client with RedSpider Image Archive 3 to demonstrate the product's capabilities. Built using the Image Archive Java application programming interface, the sample web client allows users to search for imagery by spatial extent (defined via map or coordinate entry), date, keyword, and type (an image collection/layer or individual images). Once a user finds the imagery they are interested in, they can download the entire image/layer or a rectangular region, view the image/layer in a simple mapping application, and view the image/layer metadata. If users choose to extract a rectangular region, they can define the output projection, the size of the output by specifying size in pixels or resolution per pixel, and the output file type.

The sample web client provides some of the features required for the Oregon Imagery Portal and may serve as a starting point for building a custom web interface to implement all of the features specified as required by OFIT. The primary features that would need to be added are additional ways to specify the area of interest such choosing predefined boundaries such as counties.

In terms of image manipulation to support image provisioning, Image Archive can automatically mosaic, resample, and reproject imagery and apply radiometric corrections and colormaps.

Image Services

Image Archive uses OGC WMS for providing image services. Image services are enabled and configured through a GUI Interface (ISManager) or command line tools. The command line tools provide for pyramiding and other optimization techniques for WMS's.

Data Storage and Ingestion

The ISManager and the command line tools enable batch loading of files or directories. The files are indexed and left in the native state and location. Pyramids can be created using the command line tools and must be created prior to indexing. Indexes are stored in a database (either Oracle 9i or 10g). (IONIC has a reseller agreement with Oracle to embed their database within Image Archive.)

Licensing

The Image Archive is licensed on a server/CPU basis. There are no restrictions on users other than addition of more users may require additional servers.

Intergraph TerraShare and GeoMedia Products

Solution Components

Intergraph's proposed system used a combination of the TerraShare and GeoMedia product families.

Image Provisioning System

Intergraph does not offer a COTS image extraction product. Instead, the State of Oregon would have to acquire a custom solution built upon Intergraph's GeoMedia WebMap and TerraShare. Based on the capabilities of TerraShare and GeoMedia, it is possible to create an application that would allow users to select an area of interest and to search for images based on queries of the metadata. The underlying TerraShare product supports various resampling and mosaicing options. The underlying data can be reprojected and exported to common imagery formats. TerraShare's focus is on geospatial content management so for image processing operations, users would have to rely on separate image processing tools.

An Intergraph partner has built an image extraction website with many features similar to those desired by OFIT. Although the site is public (http://www.norgeibilder.no), it delivers maps of Norway and the site text is Norwegian.

Image Services

The Intergraph solution can provide image services via two methods, one using a proprietary plug-in and the other using OGC WMS. TerraShare Raster is a plug-in component for selected GIS and CAD applications. After installation on the client machine, TerraShare Raster works from within the client application to allow users to access imagery from TerraShare server. The source imagery is reprojected and resampled (the user can control the resampling method) on the fly as the user changes views (e.g., pans, zooms). When TerraShare Server is coupled with GeoMedia WebMap, the Intergraph products can create WMS's.

Data Storage and Ingestion

The TerraShare Server module provides base data management. The TerraShare Client, a Windows Explorer plug-in, allows administrators to connect to the TerraShare Server to browse, discover, view and manage geodata and metadata stored on multiple file servers or storage devices such as a storage area network or network attached storage. Ingestion or loading of imagery is done via the TerraShare Client. Although the imagery is not copied from its physical location, the TerraShare Client can create a logical data organization so that the data appear to be in one single file store. Images can be treated as individual scenes if grouped together to form a single layer or mosaic. In addition, from the TerraShare Client, the administrator can create image overviews and other features.

Licensing

The proposed solution would require both server licenses and client access licenses for each user or device that uses the server software.

SANZ EarthWhere

Solution Components

SANZ's proposed implementation was based on their EarthWhere product.

Image Provisioning

EarthWhere provides a COTS web-based image provisioning system. This application allows users to select from a list of available imagery filtered by area of interest and metadata fields such as acquisition date, provider, and description. There are multiple options for defining area of interest including defining a point or region on a map, entering coordinates, and selecting from a gazetteer or predefined named regions. Users can also define an area of interest by uploading a shapefile.

Once the user selects an image source and an area of interest, EarthWhere provides multiple options for mosaic generation including matching the radiometric properties of the images, joining overlaps between scenes, and resampling to reduce resolution and image size. EarthWhere can reproject imagery to all common datums and projections and the Oregon Custom Lambert projection. Users can export the imagery to all common imagery formats. For those formats that support compression, users can control the quality or compression ratios.

Before the actual provisioning process, the user can preview the product and review all requested processing options. Imagery can be zip compressed for actual delivery separate from the compression that might occur as part of an image export format such as geotiff. All deliveries are accompanied by a metadata file. Users are notified by email when requested products are available for download and they can see a listing of all generated products from the web application.

In addition to extracting images through the SANZ web application, SANZ provides a plug-in for ArcMap that allows ArcMap users to do the image provisioning from within ArcMap.

Image Services

The EarthWhere product provides basic WMS capabilities. The WMS primarily provides the imagery as-is, meaning that to support different projections, large mosaics, or other derivatives of the original source imagery, the derivative product must first be created and saved and then served up using WMS. For example, to produce a WMS with a different projection, users would employ the EarthWhere provisioning tool to create a new data set and then ingest it into the EarthWhere system and make it available through a WMS.

Data Storage and Ingestion

EarthWhere does not copy or modify ingested imagery. During ingestion, EarthWhere calculates and stores relevant metadata and spatial qualities and creates overview images. There are a variety of data loading options including scripts, daemons, and a data manager monitor for file systems.

Licensing

SANZ's licensing is based on the number of user licenses and the quantity of data under control of the system. The COTS provisioning system described above requires users to log-in and each logged-in user takes one license. There can be more registered users than the number of licenses; however, the license number determines how many users can access the system at the same time. For large numbers of concurrent users, SANZ offers an enterprise license based on CPUs and quantity of data under storage.

Accessing WMS's does not count against the license pool, so the number of users that could use WMS's in client applications would be limited only by the performance of the server system.

Synthesized Comments from Discussions with Users

ESRI
The OSU Team was unable to speak with clients of ESRI's Image Server product as it has not yet been released.

IONIC
IONIC customers emphasize that IONIC's biggest strength is that many of the RedSpider software products either are certified compliant with Open Geospatial Consortium (OGC) OpenGIS specifications or are undergoing certification. Serious drawbacks include the steep learning curve on the client side implementation and the care that must be taken when configuring clients to interact with services. In summary, IONIC's RedSpider software is powerful and provides desired functionality, but implementation assumes a high level of understanding of the OGC model.

Intergraph
Intergraph customers stress that Intergraph's biggest strength is in building mosaics quickly as compared to the old way of doing business. Another important advantage is that ingesting imagery does not degrade data. Although Intergraph's TerraShare software is a polished internal application, one customer has issues dealing with firewalls to serve their data to outside agencies; however, this difficulty may not be the fault of the vendor. In general, Intergraph's TerraShare software is a proven efficient way to store, manage, and provide access to a high volume of imagery.

SANZ
SANZ customers emphasized the EarthWhere product's strength in the area of imagery provisioning and, in particular, its ability to allow power users to create products. Functionality of the product appears to be good. SANZs EarthWhere product functions best as an internal application, given difficulties experienced during both ingestion and provisioning across a distributed network. Customization has been somewhat challenging in terms of tailoring the generic EarthWhere interface to something that is geographically relevant to users, and storage needs are substantial. In summary, SANZ's EarthWhere software is proving itself in the focused area of image provisioning, while beginning to grow its WMS capabilities.

Other Vendors

The OSU team expects that there will be vendors beyond ESRI, Intergraph, IONIC, and SANZ that will respond to an RFP for the Oregon Imagery Portal. Given that some of the solutions such as those using ESRI or Intergraph technology require custom programming, companies that are business partners or certified developers may respond to build a solution built upon their partner's core technology. As mentioned above, a questionnaire response was received from Sanborn, an ESRI business partner. While the State desires commercial off-the-shelf software to avoid purchasing a singular Oregon solution, a commercial development firm may provide the option of buying a semi-custom solution. In their discussions, Sanborn mentioned that many portal projects have similar requirements such as a map window to select an area of interest so they can reuse components and tools.

Since the functional specifications provided by OFIT directed the OSU team to commercial off-the-shelf software, this in-depth investigation focused on commercial products. However, given some custom code, one could build an image portal for image provisioning and image services using all open source components. While there are many possible open source components, a combination of MapServer, a WMS server, and GDAL, a translator library for raster geospatial data formats, could provide the image services and provide the base for an image provisioning system. The strength of some open source geospatial components have led to their inclusion in commercial applications including the SANZ and IONIC products that were investigated. SANZ uses PostGIS, an open source database with geospatial data extensions, and OSSIM, an open source remote sensing library, and IONIC uses GDAL.

Finally, there are many partial solutions for the image portal that were not investigated in depth. The State's existing investments in ESRI ArcSDE and ArcIMS can be used to deliver WMS's. Two organizations within the State of Idaho are planning on using ArcSDE and ArcIMS to deliver Idaho's most recent NAIP imagery, an approximately 1TB set of files. While these entities report good performance so far, these tools provide neither image provisioning nor the image catalog functionality needed in Oregon. Safe Software produces a product called SpatialDirect which provides extract, transform, and load features for geographic data including rasters. SpatialDirect is used in GeoStor, a publicly accessible spatial data clearinghouse hosted by the Arkansas Geographic Information Office. Recently, this tool also was incorporated into the next version of ArcGIS. Finally, ER Mapper produces a product called Image Web Server 7 and LizardTech produces a product called Express Server both of which are designed for distributing large imagery datasets.

EVALUATION OF SOFTWARE SOLUTIONS RELATIVE TO USER NEEDS

Evaluation Criteria

The OSU team used seven criteria to evaluate the proposed vendor solutions. Six of the criteria are focused on initial success measures and one is focused on a long-term success measure.

Initial Success Measures

The team defined initial success as:

- Delivering a web application that provides straightforward clip-and-zip access to the NAIP imagery
- Providing a high performance image service serving NAIP imagery
- Providing both clip-and-zip and image services to everyone
- Achieving the solution within the stated budget
- Creating a stable system
- Delivering the product on-time

Relating to these measures, the following seven evaluation criteria were defined:

1) Ability to provide an image provisioning web application: Does the application provide an image provisioning application or would the State of Oregon have to acquire a custom web application for image provisioning?

2) *Strength of WMS Server:* Is the system designed as a high performance WMS server and have demonstrated high demand installations?

3) *Licensing Model:* Does the application's licensing model fit the State's plans to allow everyone to use the image portal?

4) *Relative Cost of Licensing:* Although specific cost inquiries and negotiations are reserved for the RFP process, the team did inquire about costs of installations that might be similar to what is envisioned for Oregon.

5) *Demonstrated Use of Product:* Relating to the stable criterion, is the proposed solution in use where it can be demonstrated in action and were customer responses positive?

6) *Likelihood for On-Time Delivery of Product:* Does the team anticipate that choosing a particular vendor's solution would allow an up-and-running Imagery Portal to be delivered by the required project end-date?

Long-Term Success

The sole long-term success measure was the ability of the Imagery Portal to work with the proposed navigatOR system, Oregon's GIS Utility. navigatOR is a statewide, multilevel initiative for maintaining and sharing geographic data and services. The navigatOR business plan specifies some of the same functionality as required for the portal. Specifically, both portals define a web application for provisioning of data. While the Imagery Portal is, obviously, focused on imagery, the navigatOR would encompass all spatial data. However, both portals need ways for searching for data, defining an area of interest, and selecting download options.

The final evaluation criterion, based on long-term success measures, is:

7) Ability of the Product to Integrate with navigatOR: Does the proposed solution have potential for working with the proposed statewide system for spatial data?

Incorporation of Required and Desired Features into Evaluation

To date, the primary focus of required and desired features was related to the image provisioning web application. Since ESRI and Intergraph would require a custom solution and an IONIC solution would require modification of their demonstration application, evaluating vendors based on detailed required/desired features was of limited value. With a custom solution, the OSU team would expect the vendor to provide all of the required features. Because of this, articulating required and desired features is incredibly important and essential for constructing the RFP.

Comparison of Vendors

Vendors were evaluated as (S) very strong candidate, (+) capable of meeting this criterion, (-) area of concern, and (?) not enough information. Table 5 lists the evaluation scores by vendor and criteria.

Table 5. Evaluation Matrix

(NOTE: The following evaluation criteria, shown across the top of the table, are not listed in ranked order.)

	Image Provisioning Web Application	Web Map Server (WMS)	Business Models for Licensing	Relative Cost of Licensing	Demonstrated Use of Product	Likelihood for On-Time Delivery of Product	Potential to Integrate with navigatOR
ESRI Image Server	-	?	+	+	?	-	S
Intergraph Terrashare	-	+	+	-	S	+	+
Ionic RedSpider Image Archive	+	+	+	S	S	+	+
SANZ EarthWhere	S	-	-	-	S	+	-

KEY

S = Very strong candidate

\+ = Capable of meeting this criterion

\- = Area of concern

Summary of Vendor Comparison

Ability to provide an image provisioning web application

SANZ's EarthWhere was the strongest image provisioning solution as this was the product's primary area of focus. ESRI and Intergraph were ranked as areas of concern as the State would have to acquire a custom solution. While custom solutions could do everything specified by the RFP, having to undertake a development process raises concerns related to costs, stability, and on-time delivery.

Strength of WMS Server

Intergraph and IONIC provide demonstrated high-availability WMS's, while the OSU team has strong concerns regarding SANZ's ability to serve a WMS for the 4TB NAIP seamless mosaic orthoimagery. The team rated ESRI as not yet providing enough information as the product has yet to be delivered.

Licensing Model

The CPU licensing model of ESRI and IONIC best fit the State's plan to provide access to everyone. While Intergraph does license both the CPU/server and users, the user licensing is not a hard limit such that users could be shut out from the application so it also was rated as capable. SANZ's licensing model of basing costs on users and amount of data under storage would work against providing many data to all users.

Relative Cost of Licensing

IONIC was in the lowest cost tier, ESRI was in the middle cost tier and Intergraph and SANZ were in the highest cost tier.

Demonstrated Use of Product

The OSU team rated Intergraph, IONIC, and SANZ as all capable in terms of demonstrated use of product. All three of these products are beyond their initial release and customer feedback was positive. Since ESRI's solution was based on Image Server, which has not been released, it was not scored for this category.

Likelihood for On-Time Delivery of Product

Again, the team ranked Intergraph, IONIC, and SANZ as all capable in this area. While Intergraph's solution would require a custom web application, given the company's size, customer base, and the maturity of the product, Intergraph should be able to find adequate developer resources to build the custom components on schedule. While IONIC's starter web application does not meet all required functionality, it provides a starting point which would enable fairly rapid development. ESRI's solution based on Image Server was ranked as an area of concern since the product is not released. There is an extremely strong chance that the product will not be released before the RFP award phase.

Potential to Integrate with navigatOR

The navigatOR business plan lays out an ESRI-based solution. Therefore, the OSU team rated the ESRI-based solution as very strong in this area. However, navigatOR must be capable of working with Open Geospatial Consortium (OGC) providers so the other three candidate solutions could work with navigatOR through OGC services. SANZ was ranked as an area of concern as EarthWhere's interface is so essential to its utility that it would be difficult to move it to the navigatOR system.

Thus, assuming that the State is willing to consider solutions that include some custom development, results of Phase 1 scoping are summarized as follows:

- Intergraph: meets all needs but is high cost
- IONIC: meets all needs and is low cost
- ESRI: could meet all needs but there is an extremely large potential for schedule slip
- SANZ: meets provisioning needs but does not meet image service needs plus license model not favorable

These findings also assume that the State's MicroStation users will eventually upgrade to V8 XM, which will support WMS. If the Imagery Portal must provide image services to MicroStation V8 2004 at the time it is launched, only the Intergraph and ESRI solutions could meet this type of absolute requirement through their proprietary plug-ins.

Lack of a Pure Commercial Off-The-Shelf Solution

The OSU Team found no single vendor solution that offered truly off-the-shelf functionality meeting both the image provisioning and image service needs. The Intergraph and IONIC solutions provide acceptable image services, but require custom development to meet the image provisioning requirements, while SANZ provides acceptable image provisioning but is lacking in the image service area.

If the RFP allows consideration of solutions that include custom components, ESRI, Intergraph, and IONIC should be able to produce acceptable image provisioning systems. This expectation is based on their products having the underlying functionality needed for the provisioning, with the current concern being that they lack a web interface for this. The team expects it would be difficult for SANZ to increase their web service capabilities within the timeframe of the Imagery Portal project given that the web service capability is more of a core system application.

Based on input received during the second user workshop with OFIT members, the OSU team concluded that some amount of customization by vendors appears to be acceptable to users. The RFP should allow for solutions that include custom components, but should emphasize—via a scoring criterion—the solutions based on off-the-shelf solutions will be favored. This approach would help ensure that a high-quality product that meets all mandatory requirements, along with several desirable requirements is provided in a timely fashion. In addition, it encourages partnerships between vendors so that the proposed solutions might include a mix of commercial products.

NEXT STEPS FOR THE IMAGERY PORTAL PROJECT

Upon submission of this report to DAS, a procurement process will be initiated to acquire software that will serve as the cornerstone of the Oregon Explorer Imagery Portal. Findings from Phase 1 scoping will be used to develop a comprehensive RFP that clearly articulates the needs to be addressed by the software solution, the technical specifications of the portal, anticipated workflow during the portal development and implementation process, and other critical details about Phase 2. OSU, including the OSU Imagery Portal Project team and staff from the OSU Procurement Office, will lead this process. Review by and

participation of staff from DAS and the State Procurement Office is essential. In addition, OFIT members will serve in an advisory role by providing a review of the detailed functionality, specifications, and constraints regarding the acceptable degree of customization in the RFP to ensure that these are well defined and that the end product will meet the needs of users. The procurement process will result in acquisition of licensing for the selected software solution.

Developing the RFP for an Imagery Portal Software Solution

At the second workshop, the OSU team asked OFIT members to help determine which criteria were of greatest importance so that this information can be incorporated into the RFP. Based on weighting of the seven evaluation criteria by OFIT members, it is clear that the image provisioning and web services functionality within the Imagery Portal are equally important, and that on-time delivery of the product is critical.

The RFP should include a detailed list of required and desired functionality for the image provisioning application. These feature lists are especially important as some vendors may need to modify existing applications or create a custom application to provide an image provisioning application with the required functionality. The RFP should include evaluation criteria to assess how well vendors implement the required and desired features. For the required features, the scoring should reflect the method and utility of the implementation of the required features, as these features must be present. For the desired features, the scoring should reflect how many desired features are provided as well as how they are provided.

Since the Open Geospatial Consortium WMS specification determines the WMS requests and responses, evaluation of the WMS requirement of the RFP should focus on performance of the WMS servers. Poor WMS performance (i.e., slow response times) will severely weaken the Imagery Portal's expected utility. Given this, the RFP must include criteria to ensure the final system will meet user expectations. These measures could include some metric of proof by vendors that the proposed systems can adequately serve the 2005 NAIP or by specification of minimum response times in the RFP.

To guide the performance metrics, the OSU team will provide an estimate of user demand (requests per hour) based on 1) numbers of state GIS users as listed in the GIS utility business case and 2) a recent web-based survey of GIS all across the state. Because the overall system, software, servers, and storage, will determine performance and costs, the RFP should require vendors to provide a system architecture description to meet the estimated user load. Currently, the storage location remains a topic under discussion, with DAS and the OSU team exploring various storage scenarios for the data, software application and web servers. The RFP should ask vendors to comment on the suitability of probable storage scenarios.

Finally, the RFP should ask vendors to provide a detailed development and installation plan with milestones. The RFP should include a scoring criterion that reflects how well the development and installation plan will lead to on-time delivery.

The categories of expenses and associated estimated costs for Phase 2 of the Imagery Portal project are:

Category	Details	Estimated cost
Hardware	3 servers for the software application and processing	$25,000
Storage	6 TB of storage	$25,000–35,000
Vendor contract	Software, consulting, and other technical support during design, installation, and implementation	$80,000–95,000
Staff	Installation/configuration, ingestion, customization, testing, web design, and project management	$33,000–38,000

Phase 2 Tasks

After completion of the RFP process and acquisition of a software solution for the Oregon Orthoimagery Portal, Phase 2 tasks will include:

- Resolve any hardware, storage or network configuration issues that may exist, depending on the software selected
- Modify the acquired software and any essential hardware as necessary
- Load the NAIP and other essential framework imagery into the repository
- Develop a testing prototype orthoimagery and aerial photography data repository as the initial collection in the Imagery Portal
- Test the implemented prototype with DAS and OFIT users
- Refine the prototype and implement the Imagery Portal, which is anticipated to be launched by the end of 2006

Measuring Success

Success of the Imagery Portal will be assessed over various time horizons. An initial measure of success will be taken upon the site's launch by determining how many of the evaluation criteria are, in fact, met by the portal and how well these are met. Within the first year of the Imagery Portal's existence, success can be determined by such measures as the addition of more statewide raster datasets, refinement of the portal functionality to provide searching across datasets, availability of image services for all datasets in the portal, ability of State staff to support the portal application, and interest by new and different partners in adding non-institutional datasets to the Imagery Portal. Over the long term, success of the Imagery Portal can be gauged by its ability to be customized to meet evolving and emerging needs and be equally functional for local datasets that will be added in coming years. The Imagery Portal also will contribute to the ability of Oregon Explorer to serve other imagery, geographic framework data, and vector datasets in the future. Finally, future integration of the portal with navigatOR, Oregon's GIS Utility, is an important metric for consideration at a later date. Imagery is one of the many geospatial datasets that eventually will be made available through this broader GIS Utility.

APPENDIX 1. Overview of the Oregon Explorer Natural Resources Digital Library

The Problem. The *Oregon State of the Environment Report 2000* concluded that Oregon's existing environmental data collection and management system must be improved to effectively measure ecological conditions, trends or risks. Citizens, businesses, agencies and scholars spend countless hours trying to find the information they need for decision making and research. Data gathering may be duplicated simply because past studies and data cannot be found. Too often the maps and data systems of one agency cannot be integrated with those of other agencies.

The Solution. Oregon Explorer will provide a single access point on the web to Oregon natural resources information, integrating information from many sources by creating a community of users. The primary intended audience is citizens and decision makers actively involved in natural resource use, policy and planning. While tailored for the informed public, businesses, government agencies and academic researchers will be able to easily access the information they need. The Oregon Explorer will quickly direct users to information if they know what they want. Users who are not sure what they want will be able to explore and discover the information that is available. All users will be able to access decision support tools allowing them to analyze their own problems. When completed, Oregon Explorer will empower communities to actively engage in creating and sharing the knowledge needed to solve today's resource management problems.

The Partners. The Institute for Natural Resources and the Oregon State University Libraries launched the Oregon Explorer. The initial pilot project focused on the Willamette Basin and was completed with funding from Meyer Memorial Trust. A second prototype, for the North Coast Basin, was developed with assistance from the InfoGraphics Laboratory at the University of Oregon and the Oregon Department of Administrative Services with funding from the Oregon Watershed Enhancement Board. The Oregon Institute of Technology library is now working with the team to expand its Klamath Basin Digital Library. Building the Oregon Explorer with librarians assures user accessibility as a top priority, while providing essential archiving and data management functions.

The Prototype. The two pilot projects illustrate what the Oregon Explorer will look like: http://www.willametteexplorer.info and http://www.northcoastexplorer.info. The home pages for both of these sites are illustrated below. The Oregon Explorer home page displays three maps showing water basins, counties and ecoregions. The left margin links users to specific subject pages (e.g. soils, fish, forests, invasive species, fire, endangered species, water quality). The home page also includes sophisticated search capability, providing immediate access to documents, reports, maps and other information. The search is based on the A9 search mechanism – a prototype developed by Amazon.com and Google allowing more focused searches of a wide variety of materials, of the Internet, the Pacific Northwest University Libraries and linked federal, state and local agency sites.

Next Steps. To realize this vision, funding is needed to build the Oregon Explorer home page, complete water basin portals for the rest of the state, and to build and populate portals on counties, ecoregions and specific subjects. A data repository and search functions also need to be built. When completed, on-going operation and maintenance support will be required. Funds are now being sought to meet these needs.

APPENDIX 2. Agendas and Notes from Workshops with OFIT Members

Imagery Portal Workshop
Thursday, April 13, 2006 from 1:00 pm to 3:00 pm
DSL Salem building—Mill Creek room
775 Summer Street. NE

Workshop Purpose: discuss the scope of the OSU planning work and the progress to date, as well as address any issues that have emerged from preliminary conversations with the various vendors (SANZ, Intergraph, ESRI, Sanborne and others).

Facilitator: Janine Salwasser, OSU Libraries

A G E N D A

1. Introductions
   1:00–1:10 p.m.

2. Context of OSU role and Oregon Explorer – Janine Salwasser, OSUL
   1:10–1:20 p.m.

3. Purpose and outcomes of Phase I scoping – Renee Davis-Born, INR
   1:20–1:40 p.m.
   a. Addressing immediate needs (i.e., NAIP) versus future needs (e.g., other framework data, vector data, etc.)
   b. Targeted users
   c. Clarifications on the scope of work
   d. Relation to Phase 2 implementation

4. Matching user needs with vendor capabilities (review and discussion) – Tim Fiez, OSUL
   1:40–2:00 p.m.

5. Break
   2:00–2:10 p.m.

6. Matching user needs with vendor capabilities (continued) – Tim Fiez, OSUL
   2:10–2:50 p.m.

7. Next steps and scheduling of next workshop – Janine Salwasser, OSUL
   2:50–3:00 p.m.

Attachments:
OSU Scope of Work
Vendor Questionnaire

Imagery Portal Workshop
Department of State Lands, Salem, Oregon
April 13, 2006

Workshop Purpose: discuss the scope of the OSU planning work and the progress to date, as well as address any issues that have emerged from preliminary conversations with the various vendors (SANZ, Intergraph, ESRI, Sanborne and others).

Present: Randy Sounhein, DSL (Chair); Emmor Nile, ODF; Cy Smith, DAS/GEO; Bob Pinotti, Polk County; Corey Plank, BLM; Susan Nelson, BLM; Jim Baker, FSA; Theresa Valentine, USFS; Chad Brady, ODOT; Nancy Tubbs, USGS; Ken Hill, DOR; Tanya Haddad, DLCD; Diana Walker, ODA; Ken Kato, UO; Eric Steiner, UO; Steve Lucker, DOR; Gary Lettman, ODF; Renee Davis-Born, OSU; Jimmy Kagan, OSU; Tim Fiez, OSU; Kuuipo Walsh, OSU (workshop note taker); and Janine Salwasser, OSU (workshop facilitator).

Hand Outs: Agenda, Vendor Questionnaire, Exhibit A (Statement of Work).

Scoping Assumptions:
- 2005 half meter NAIP imagery served
- Storage at DAS, State Data Center
- Imagery shared with Google Earth and Windows Live Local
- COTS exists and can be licensed to State
- Free of charge use; usage not limited
- Phase 2 RFP process (product by end of 2006)
- DAS – OSU partnership for framework data access

Comments:
- May be unrealistic to expect that there won't be maintenance/ongoing licensing costs
- How to address user loads
- What is the concept of "serving"?
- Cy is the point person for Google Earth (no one else should contact Google Earth independently)
- Two targeted levels: 1) state/fed/local agencies; 2) general public
- Consider distributed storage

Web services (see matrix below):
- DOR - MicroStation at the county level; ArcGIS
- USFS: ArcGIS 8 is desired, ArcGIS 9 is required
- A lot of older ArcView users – required support
- Ask DOGAMI if MapInfo is required support (contact Paul Staub)
- Assessors use ArcExplorer (desired) to look at properties from air
- ODF map object users – required
- Erdas Imagine users: DSL, USFS. USFS live copy instead.
- Autodesk used by local government (11) (desired)
- FSA – 25 offices – 1000 producers – clip pieces (ave. 100 acres) of producers' farms. (server side – provides consistency)
- Want to avoid log-ins (in response to question about user downloads)
- Make sure any limits on downloads/day doesn't restrict "fair" use by an organization. Need ability for override of file-size limits by administrator under extenuating circumstances.

- USGS site (http://nationalmap.gov/) does track who is downloading: name, address, email (1.6 GB per visit)
- Plan for SPAM and how to minimize
- Is there cost difference between server and client side image processing? Server side processing ensures consistency in terms of products and time efficiency if users are not stumbling through many choices presented with client-side processing.

Area of Interests (AOI) (see matrix below):

- Need gazetteer backend, otherwise all required
- Add zip code
- Add townships

Clip Extent (see matrix below):

- Clip – upload predefined region – desired

Image/File Formats (see matrix below):

- DOR – GeoTIFF (required) and MrSid (desired)
- USFS – Imagine (.img) desired
- Ability to save user preferences is very desired, but not required

Imagery beyond NAIP:

- Historical imagery to view change over time
    - For example, USGS photo finder: thumbnails of '96,' 02 (jpegs), photo index, functional, quick
- 2000-01 DLQ
- 30 m Landsat
- Scanned 9x9 negatives and serve as positive (not georeferenced except for index)
- 2 meter Aerial imagery – true color (FSA) agriculture areas for 2006 and 2007
- Urban area high resolution

Applications to Support with Services

	Required	Desired
MicroStation 8.X	Y	
ArcGIS 8.X		Y
ArcGIS 9.X	Y	
ArcView 3.X	Y	
MapInfo 8.X		Y
GeoMedia	Y	
ArcExplorer		Y
ODF MapObjects app	Y	
Erdas Imagine		Y
Autocad/Autodesk		Y

Determining Area of Interest

	Required	Desired
Draw on map	Y	
Enter coordinates	Y	
Enter address	Y	
Quad name	Y	
Township and range	Y	
HUC	Y	
Zipcode	Y	
911 centers	Y	
Highway milepost	Y	

Defining Clip Extent

	Required	Desired
Bounding rectangle	Y	
Clip to predefined region		Y
Clip to user uploaded region		Y

Image/File Formats

	Required	Desired
GeoTIFF -- simple	Y	
GeoTIFF – pyramids,tiles, JPEG		Y
JPEG2000	Y	
PNG		Y
JPEG		Y
MrSID		Y
IMG		Y

Imagery Portal Workshop
Thursday, May 11, 2006 from 1:00 pm to 3:00 pm
Conference Room B, DAS West
155 Cottage Street, Salem

Workshop Purpose: discuss the outcomes of the phase 1 scoping process for development of an imagery portal and the next steps for implementation.

Facilitator: Janine Salwasser, OSU Libraries

A G E N D A

8. Introductions
   1:00–1:10 p.m.

9. Findings of Phase I scoping – Tim Fiez, OSU Libraries
   Decision point: Weighting of evaluation criteria (dot exercise)
   1:10–2:00 p.m.

10. Break
    2:00–2:10 p.m.

11. Recommendations from Phase 1 scoping – Tim Fiez, OSU Libraries
    2:10–2:30 p.m.

12. Implementation steps – Renee Davis-Born, INR
    Discussion item: How does OFIT envision work-flow process for imagery contributions in the future?
    2:30–2:50 p.m.

13. Wrap-up – Janine Salwasser, OSUL
    2:50–3:00 p.m.

Attachments:
Draft Report for Phase I Scoping Process for Development of the Imagery Portal (to be circulated by the morning of 5/10)

Imagery Portal Workshop #2
Department of Administrative Services, Executive Building
Salem, Oregon
May 11, 2006

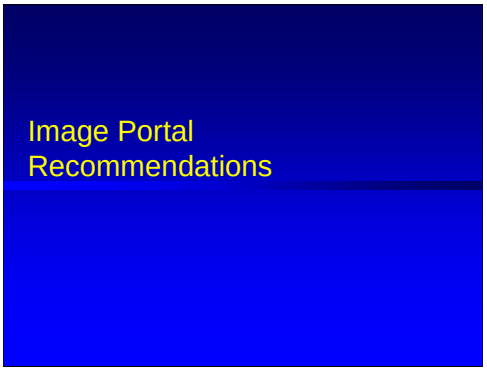
Workshop Purpose: discuss the outcomes of the phase 1 scoping process for development of an imagery portal and the next steps for implementation.

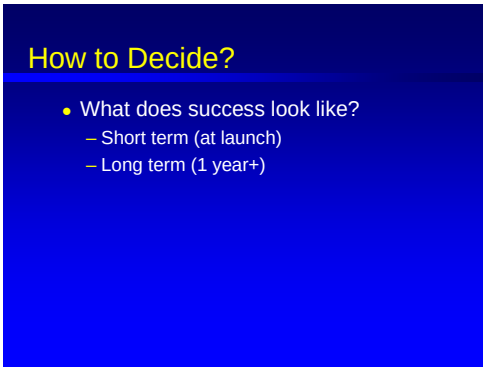
Present: Randy Sounhein, DSL (Chair); Cy Smith, DAS/GEO; Ed Zigoy, BLM; Theresa Valentine, USFS; Chad Brady, ODOT; Dennis Scofield, ODOT; Nancy Tubbs, USGS; Tanya Haddad, DLCD; Diana Walker, ODA; Mike Engelmann, UO; Erik Steiner, UO; Steve Lucker, DOR; Andrew Herstrom, ODF; Renee Davis-Born, OSU; Jimmy Kagan, OSU; Tim Fiez, OSU; Kuuipo Walsh, OSU; and Janine Salwasser, OSU (workshop facilitator).

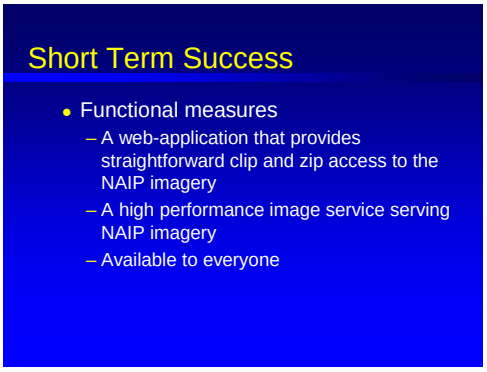
Hand Outs: Agenda, Draft Report for Phase I Scoping Process for Development of the Imagery Portal, Slides of Tim's PowerPoint presentation (meeting copy).

Findings and Recommendations of Phase I scoping:
Janine highlighted that the purpose of the Phase I Scoping was not to select a vendor, but rather to assess what products are currently available that might fit the needs targeted by the Imagery Portal and to identify priorities for the Imagery Portal's functionality that will be articulated in the RFP for a software solution.

Tim Fiez presented a PPT presentation outlining the findings from the Phase I scoping process.







Long Term Success

- Functional Measures
  - Image portal integrated with NavigatOR
    - » Imagery one of many geospatial datasets and services available through the broader geospatial portal

Ability to provide COTS image provisioning

- Does the application provide a COTS image provisioning application or would the state of Oregon have to acquire a custom web application for image provisioning?

1. Image Provisioning Web Application

	Image Provisioning Web Application
ESRI Image Server	-
Intergraph Terrashare	-
Ionic RedSpider Image Archive	+
SANZ EarthWhere	S

KEY

S	=	Very strong candidate
+	=	Capable of meeting this criterion
-	=	Area of concern

"COTS" and Web Image Provisioning

- Does the vendor provide an out of the box web portal that meets Oregon's requirements?
- All vendors provide interfaces and/or services than can be called from a web application
  - Inner workings are COTS
  - Web interface is custom

Strength of WMS Server

- Is the system designed as a high performance WMS server and have demonstrated high demand installations?

2. Strength of WMS Server

	Web Map Server (WMS)
ESRI Image Server	?
Intergraph Terrashare	+
Ionic RedSpider Image Archive	+
SANZ EarthWhere	-

KEY

s	=	Very strong candidate
+	=	Capable of meeting this criterion
-	=	Area of concern

Supporting Applications with WMS

	Required	Desired	WMS Client	WMS Notes
MicroStation V8 XM	Y		Y	Geospatial Extension will be a WMS client (available Fall 2006)
MicroStation V8 2004	Y		N	
ArcGIS 8.X		Y	Y	ESRI OGC Interoperability Add-On
ArcGIS 9.X	Y		Y	Native to application
ArcView 3.X	Y		Y	MN DNR WMS Client for ArcView 3.x:
MapInfo 8.X		Y	Y	Professional 8.0
GeoMedia	Y		Y	Native to application
ArcExplorer		Y	Y	ArcExplorer Web
ODF MapObjects app	Y		?	
Erdas Imagine		Y	?	
Autocad/Autodesk		Y	Y	MapGuide WMS Extension

1. ESRI and Intergraph plug-ins (non-WMS) are the only options for MicroStation V8 2004
2. WMS would be the only option for MapObjects applications

Licensing Model

- Does the application's licensing model fit the state's plans to allow everyone to use the image portal?

3. Licensing Model

	Business Models for Licensing
ESRI Image Server	+
Intergraph Terrashare	+
Ionic RedSpider Image Archive	+
SANZ EarthWhere	-

KEY
s = Very strong candidate
\+ = Capable of meeting this criterion
\- = Area of concern

Relative Cost of Licensing

- Although specific cost inquiries and negotiations are reserved for the RFP process, we did inquire about costs of installations that might be similar to what is envisioned for Oregon.

4. Relative Cost

	Relative Cost of Licensing
ESRI Image Server	+
Intergraph Terrashare	-
Ionic RedSpider Image Archive	s
SANZ EarthWhere	-

KEY
s = Lowest cost
\+ = Medium cost
\- = Highest cost

Demonstrated Use of Product

- Relating to the stable criterion, is the proposed solution in use where we can see it in action and were customer responses positive?

5. Demonstrated Use

	Demonstrated Use of Product
ESRI Image Server	?
Intergraph Terrashare	s
Ionic RedSpider Image Archive	s
SANZ EarthWhere	s

KEY
s = Very strong candidate
\+ = Capable of meeting this criterion
\- = Area of concern

Likelihood for On-Time Delivery of Product

- Do we anticipate choosing the vendor's solution would allow us to deliver an up and running image portal by the required project end-date (Dec. 2006) ?

6. On-Time Completion

	Likelihood for On-Time Delivery of Product
ESRI Image Server	-
Intergraph Terrashare	+
Ionic RedSpider Image Archive	+
SANZ EarthWhere	+

KEY
s = Very strong candidate
\+ = Capable of meeting this criterion
\- = Area of concern

Ability of the Product to Integrate with NavigatOR

- Does the proposed solution have potential for working with the proposed statewide system for spatial data?

Oregon GIS Utility Conceptual Design

- Web-based GIS and metadata search, access, display, mapping, and simple analysis
- Multi-format Data Access, Import and Export: Data stored in a variety of formats will need to be accessed and imported and exported.

7. NavigatOR Integration

	Potential to Integrate with NavigatOR
ESRI Image Server	s
Intergraph Terrashare	+
Ionic RedSpider Image Archive	+
SANZ EarthWhere	-

KEY

s = Very strong candidate
\+ = Capable of meeting this criterion
\- = Area of concern

Summary

	Image Provision-ing Web Application	Web Map Server (WMS)	License Model	Relative Cost	Demon-strated Use	On-Time Delivery	NavigatOR Integration
ESRI Image Server	-	?	+	+	?	-	s
Intergraph Terrashare	-	+	+	-	s	+	+
Ionic RedSpider Image Archive	+	+	+	s	s	+	+
SANZ EarthWhere	s	-	-	-	s	+	-

Image Provisioning Customization

- Provides a larger vendor pool
- Be specific in RFP
  - Exact steps/options
  - Wireframes
- Tight control over development process

Comments regarding Findings:

- Many of the functional requirements initially outlined by OFIT are addressed within the 1) Image Provisioning Web Application and 2) WMS Server criteria
- The lack of a completely COTS solution to meet the required needs is important to highlight. Specifically, there is no one "plug and play" software solution that fully meets the image provisioning and web services needs outlined for the Imagery Portal.
- Several OFIT members were confused by the mention of COTS in the first criteria, Image Provisioning, in the draft report. The terminology for this criterion should be changed to "Image Provisioning Web Application," removing all references to COTS.

Comments about additional criteria and responses from OSU team:

- Concerns about time/resources needed to ingest data – *None of the vendors appears to have a significantly faster or slower timeframe from ingestion.*
- Response time to receive requested output – *Much of this will hinge on the network design between OSU and the State Data Center. As needed, information about this issue will be built into RFP.*
- Concern about ability to monitor system – *All of the vendors appear to have methods for doing this.*

Decision Point: Weighting of evaluation criteria

The OSU team assumed that all criteria were not equal in priority, but did not have the information from the OFIT team to know which criteria were of greatest importance. To get at this information, OFIT members were asked to weight the evaluation criteria through the use of a dot exercise. Each organization represented at the meeting was given three dots and asked to place the "red dot" on their highest priority criteria (worth 3 pts); a "green dot" on their second highest priority (worth 2 pts) and a

"yellow dot" on their third highest priority (worth 1 pt). Results of the weighting at the workshop are as follows:

Criteria	Highest priority votes	2nd highest priority votes	3rd highest priority votes	Total points
Image Provisioning Web App	4	3	2	20
WMS	4	2	1	17
License Model	1	2	1	8
Cost		1	1	3
Demonstrated Use	1		3	6
On-Time Delivery	1	4	3	14
navigatOR Integration	1		1	4

OFIT organizations who were not represented at the workshop will be invited to submit their votes by a representative member to Randy Sounhein by Monday, May 22. The final compiled results will be used to inform the RFP process and evaluation. All criteria will be evaluated in the RFP process, even those of lesser priority.

The results of the weighting exercise at the workshop suggest that the image provisioning and web services functionality within the Imagery Portal are equally important to users. Because of this, the last PPT slide, which highlights the need for some customization is critical, given that the scoping process concluded no single vendor can fully meet both needs with a COTS solution.

It will be important to define what is meant by "customization". The group does not want a completely customized solution (largely due to time and money constraints), but some customization to meet the required functionality is acceptable.

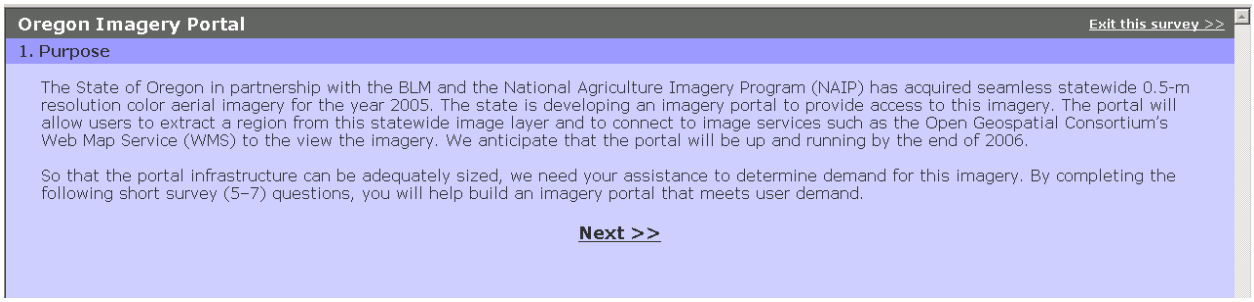
Implementation steps:

- RFP process being led by OSU with input from DAS and OFIT
- OFIT members will review Statement of Work of RFP to make sure constraints are well-stated and details of the functionality are well defined
- Contractor is expected to be on board by mid-September 2006.
- The implementation process is expected to begin in mid-September and be completed by the end of 2006.
- The Imagery Portal will have its own domain name, but will also be accessible via the Oregon Explorer.

Other tasks:

- Resolution is needed regarding ODOT's MicroStation use and ODF's MapObject use as they relate to WMS-supporting applications
- Follow-up with vendors' customers may be needed for additional information about customization costs

APPENDIX 3. Oregon Imagery Portal Online Survey



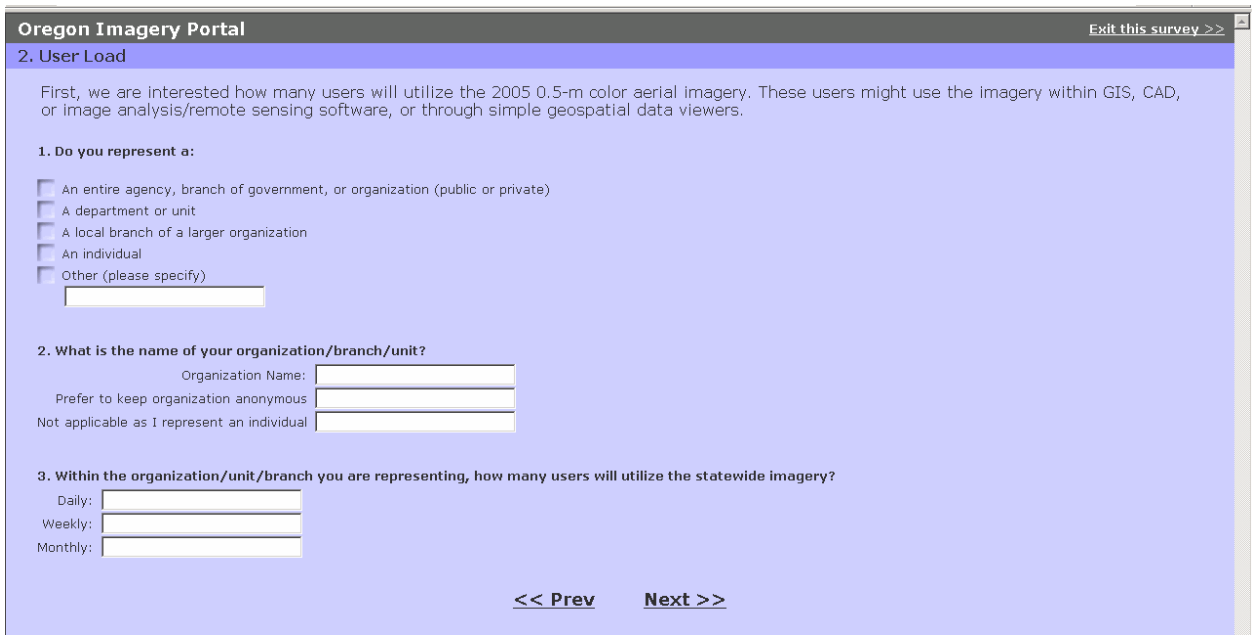
Oregon Imagery Portal Exit this survey >>

1. Purpose

The State of Oregon in partnership with the BLM and the National Agriculture Imagery Program (NAIP) has acquired seamless statewide 0.5-m resolution color aerial imagery for the year 2005. The state is developing an imagery portal to provide access to this imagery. The portal will allow users to extract a region from this statewide image layer and to connect to image services such as the Open Geospatial Consortium's Web Map Service (WMS) to the view the imagery. We anticipate that the portal will be up and running by the end of 2006.

So that the portal infrastructure can be adequately sized, we need your assistance to determine demand for this imagery. By completing the following short survey (5–7) questions, you will help build an imagery portal that meets user demand.

Next >>



Oregon Imagery Portal Exit this survey >>

2. User Load

First, we are interested how many users will utilize the 2005 0.5-m color aerial imagery. These users might use the imagery within GIS, CAD, or image analysis/remote sensing software, or through simple geospatial data viewers.

1. Do you represent a:

- An entire agency, branch of government, or organization (public or private)
- A department or unit
- A local branch of a larger organization
- An individual
- Other (please specify)

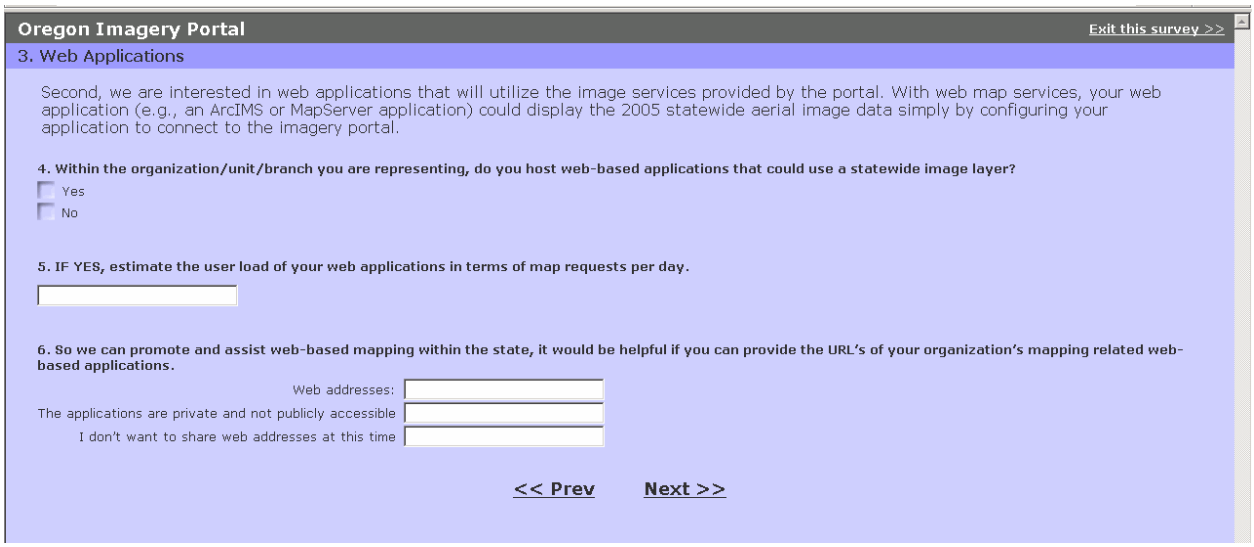
2. What is the name of your organization/branch/unit?

Organization Name:
Prefer to keep organization anonymous
Not applicable as I represent an individual

3. Within the organization/unit/branch you are representing, how many users will utilize the statewide imagery?

Daily:
Weekly:
Monthly:

<< Prev Next >>



Oregon Imagery Portal Exit this survey >>

3. Web Applications

Second, we are interested in web applications that will utilize the image services provided by the portal. With web map services, your web application (e.g., an ArcIMS or MapServer application) could display the 2005 statewide aerial image data simply by configuring your application to connect to the imagery portal.

4. Within the organization/unit/branch you are representing, do you host web-based applications that could use a statewide image layer?

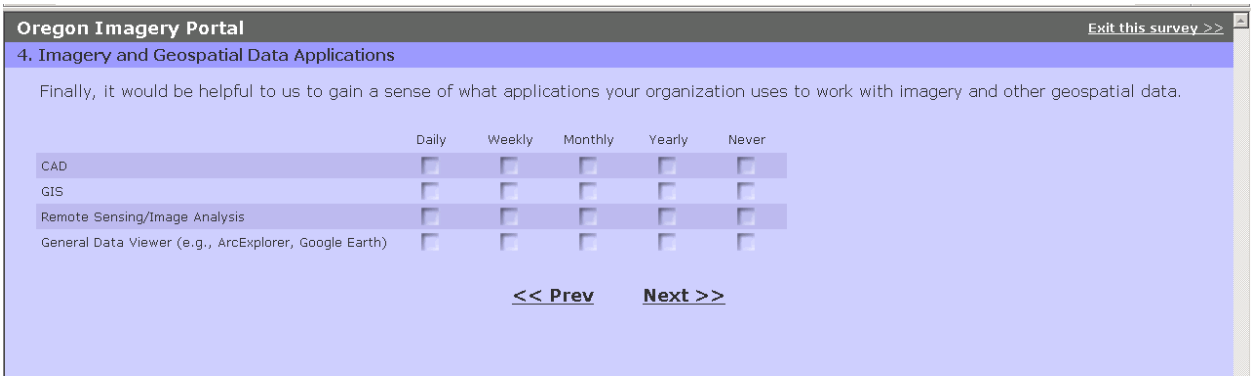
- Yes
- No

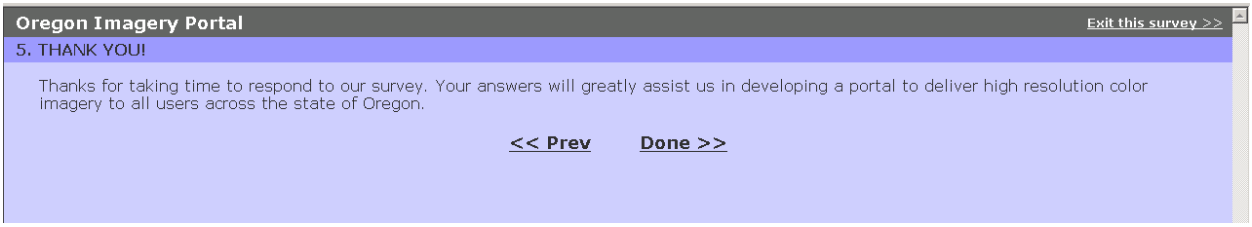
5. IF YES, estimate the user load of your web applications in terms of map requests per day.

6. So we can promote and assist web-based mapping within the state, it would be helpful if you can provide the URL's of your organization's mapping related web-based applications.

Web addresses:
The applications are private and not publicly accessible
I don't want to share web addresses at this time

<< Prev Next >>


Oregon Imagery Portal
Exit this survey >>
4. Imagery and Geospatial Data Applications
Finally, it would be helpful to us to gain a sense of what applications your organization uses to work with imagery and other geospatial data.
Daily
Weekly
Monthly
Yearly
Never
CAD
GIS
Remote Sensing/Image Analysis
General Data Viewer (e.g., ArcExplorer, Google Earth)
<< Prev
Next >>


Oregon Imagery Portal
Exit this survey >>
5. THANK YOU!
Thanks for taking time to respond to our survey. Your answers will greatly assist us in developing a portal to deliver high resolution color imagery to all users across the state of Oregon.
<< Prev
Done >>

APPENDIX 4. Informal Questionnaire for Software Vendors

A Software System to Create an Aerial Image Portal for the State of Oregon

SECTIONS IN THIS DOCUMENT

Background and Scope

The state of Oregon is acquiring 0.5 meter resolution color aerial imagery of the entire state. These images amount to 4.1 TB of data. To provide access and distribute this imagery, the state is partnering with Oregon State University to create a web-based Internet imagery portal application.

The targeted users for the imagery portal are state agency employees who have access to the State's high speed network. Secondary users include staff from other government agencies, including federal and local governments. However, the application will be developed to enable image access (viewing and downloading) by anyone.

While the immediate task is to provide access to the newly acquired imagery, the state plans on expanding the web portal to include distribution of previously acquired imagery and non-image vector and raster data at some point in the future.

Please regard this document as an informal questionnaire to allow us to better understand the current state of the art in commercial application support for delivering large image data sets to end users. Actual procurement will be through a formal process.

Commercial Off-the-Shelf

The state of Oregon is seeking a commercial off-the-shelf (COTS) solution for the imagery portal application. In your answers to the questions below, please denote the products of yours that you would use. If, to fully implement some of the application features described below, you would have to create a custom interface, wrapper, connector or some other code, please explicitly note that the feature would require custom code.

Image Provisioning System

Requirement: allow a user to select an area of interest (AOI), clip that area from the database, compress those images for efficient transfer, and electronically ship them to the user.

The Image provisioning may occur via a web interface or inside of another client such as a GIS or remote sensing software application.

Web-Based Approach

1. Provide a catalog-like listing of available data
    a. Does the catalog listing show only data available for the selected area of interest?
    b. Can the user search for data layers such as keyword searches of the layer metadata?

2. Define an area of interest
    a. List specific ways a user can define an area of interest
    b. Can users search for named places or addresses realizing that the geocoding data/service may come from outside your software?
    c. If your application provides a map window for defining area of interest, can this selection map show vector data such as roads and towns in addition to the data they are downloading?
    d. Can users save an area of interest?

3. Mosaic generation
    a. List the capability of your system to generate an image mosaic if the user's area of interest spans multiple scenes.
        1. Although the NAIP imagery that the state is acquiring is preprocessed to generate a seamless mosaic, archival imagery may only be rectified. Describe features of your product that support mosaic generation such as radiometric balancing or processing.
        2. How are images joined if there is overlap among scenes and does the user have control over this?

4. Projections and datums
    a. List data projections and datums your system can ingest
        1. Is there a preferred input projection/datum?
    b. List which projections and datums your application can convert data to?
        1. Your system must support the Oregon Custom Lambert projection. See http://egov.oregon.gov/DAS/IRMD/GEO/coordination/projections/projections.shtml for further information.

c. Does your system choose the reprojection algorithm or is the user given options?
d. Does your system validate user choices for appropriateness such as a user wanting to use UTM Zone 11 for Western Oregon data or choosing a UTM projection for data that crosses zones 10 and 11?
e. Are users' projection preferences saved or remembered?

5. Export formats
    a. List the output formats your software supports.
    b. Can you export specific bands of multiband imagery?
    c. If you support formats that include compression, does the user have control over the degree of compression?
        1. What information do you provide the user so they can balance degree of compression versus resulting image quality?
    d. Are users' export preferences saved or remembered?

6. Image processing/raster manipulation
    a. Does your application support resampling (resolution reduction)?
        1. Can the user select the method of resampling?
    b. Does the application support any image processing or remote sensing techniques such as band ratioing or edge detection?
    c. Can you do raster algebra operations between data layers/data bands and export these derivative products?
    d. Can the user generate false color imagery from sensor data that includes data beyond the visible spectrum?

7. Preview and confirm features
    a. Can the user preview their selection?
    b. Can the user review the selected processing options such as projection, output format, size of download and other characteristics?

8. Processing user selections
    a. How does your system process multiple users/jobs?
        1. Do you use threading or other means so a quick small request does not have to wait behind the processing of several very large requests?
    b. Can system administrators set bounds on size of selections? For example, can system administrators limit downloads to 5GB or less?
    c. Can users be limited to a maximum download quantity for day or other time increment?
    d. If users exceed a threshold such as trying to download 1TB of data, how does your system respond to the user?
        1. Are users given alternatives such as decreasing resolution, choosing a smaller area or using a web mapping service?

9. Data delivery
    a. Explain how your application delivers the final product to the user. For example, do you provide a web page link coupled with an email to the user that their job is done if long transactions are required?
    b. What compression options are available to minimize user downloads? These are in addition or separate from choosing a compressed format for the imagery (i.e. JPEG 2000) they are downloading.

c. If you provide compression options for data delivery, are these self extracting or are users required to install some sort of extraction software?

10. Metadata accompanying the data: metadata must accompany all data downloads
    a. What metadata formats does your system support (i.e. xml, html, PDF etc.)
    b. Is your metadata output compliant with the FGDC Content Standard for Digital Geospatial Metadata?
    c. How is metadata entered into the system?
    d. Can your system create a metadata document unique to each download or do users receive a metadata file that pertains to the entire data layer? If you support the former, explain how you create the download specific metadata document and what elements are custom to each download.

GIS and other Client Support

Describe plug-ins/add-ins that allow users to do the image provisioning inside GIS/Remote Sensing and other software

1. List what client applications you support
2. Are these plug-ins/add-ins freely available? Are they restricted to licensed users?
3. If the features of the client add-ins differ from the web-based interfaces relating to items 1 through 9 above, please explain these differences.

Mapping Services

Requirement: The application will enable other geospatial applications to seamlessly integrate imagery from the portal via geospatial web protocols such as the OpenGIS Web Map Service (WMS), ESRI's ArcIMS service or other communication protocols.

1. Describe your product's ability to deliver imagery to other geospatial applications (e.g. ArcGIS desktop or an ArcIMS web-mapping application).
2. Explain how your application can be configured to provide these image services in multiple projections and datums.
3. Provide benchmark results showing response time per transaction and total transactions per hour.

Note: We can provide imagery samples if needed to answer these questions.

Enterprise Architecture, Scalability and Failover Support

Describe and illustrate an installation of your product suitable for the State of Oregon Imagery Portal. An estimate of user load and initial data loading will be available soon.

Address the following:

1. What is the separation of processes among servers if your suggested application splits components across multiple servers?

2. Given the large amounts of storage required for this application, there is a desire to store the imagery within a State Data Center while Oregon State University manages the interface components of the Imagery Portal. Therefore, in your architecture presentation, illustrate and describe where process/servers can be separated and the bandwidth requirements and firewall access for communication between these machines.
3. Provide suggested hardware specifications (CPU's, RAM, etc.).
4. What is required to increase the amount of data under control of the system? For example, the amount of imagery increases from 5 TB to 10 TB.
5. What is required to support an increase in users/requests/transactions?
6. List specific features that enable scaling and failover support. For example, your application supports multiple servers and provides load balancing.
7. If your application can be configured in some sort of clustered configuration with a machine available solely for fail-over purposes (not actively processing requests until another machine fails), explain how this affects licensing costs.

Data Storage

Given that the state will be acquiring multiple terabytes of imagery, data storage costs are significant.

1. Describe your products data storage architecture.
    a. How is the ingested imagery stored? For example, is it in flat files, a database or some combination?
    b. What additional data are created during the image ingestions and how do they affect the storage needs. For example, image pyramids are created and image statistics are computed and the total storage needs are 2 times the ingested image size.

System Requirements

1. List support operating systems
2. List software dependencies such databases or software libraries.
3. List web application requirements such as JSP, .NET or PHP.

System Administration

1. Describe the system administration features of your software beyond the user management users which are addressed in the following section.
    a. Are these tools web-based or some sort desktop application that can connect to remote clients?
    b. Do they require terminal/login access to the server running your application?

User Management

1. Explain the user management features in your application.
    a. Can you restrict access via login?
    b. What type of interface (web, application) do you provide to enable user management manage users?
    c. Adding, deleting, and other user management features.

d. Controlling access to available data (i.e. can some data be restricted to specific users or user groups).

Licensing Model

1. Describe how your software is licensed
    a. Is there licensing on the server side such a per cpu licenses?
        i. If you use a per cpu license, do you have to buy additional licenses if you have a fail-over machine?
        ii. What are the server side license costs?
    b. Is there licensing based upon the quantity of data under control of your software?
        i. Explain how the data under storage affects costs
    c. Is your software licensed by number of users (concurrent users or some sort of client licensing scheme)?
        i. Explain how your concurrent licensing scheme is applied to web-based anonymous users?
        ii. If you use client access licenses instead of concurrent users, explain what this means for a large number of decentralized and possible anonymous users.
        iii. Can you have multiple license pools? For example, can you reserve a set of licenses for logged-in users and have another set available to anyone on a first come first serve basis?
    d. Explain any licensing costs or issues related to the delivery of mapping services.
    e. Explain if you use some other licensing scheme.

Support, Maintenance, and Upgrades

1. Are there yearly license or maintenance fees to use your product?
    a. Can you continue to use the product if the license fees are not paid?
    b. Do the yearly fees include some type of support and upgrades?
        i. What support services are available and what are their costs?
    c. Are maintenance contracts separate from licensing fees?

Data Ingestion Process

1. The state of Oregon will receive over 1900 digital ortho-quadrangles with an average size of 2.2GB each. Describe your recommended process for loading such imagery.
    a. Provide any benchmark data you may have if you estimate the time required for the ingestion process.

2. Describes product features that enable batch unattended loading of large amounts of data.
3. Describe how administrators monitor the loading process.

Note: We can provide imagery samples if needed to answer these questions.

Archival and Backup Support

1. Describe archival support features in your product.

2. Describe what data would need to be restored in the case of total system failure.
    a. Specifically address what would need to be backed up so that the ingestion process would not have to be repeated.
    b. Explain what data are dynamic and needing frequent backups and what data are static and would not need frequent backups.

Customization

1. Pertaining to your web-based tools, describe how and how much end users can modify the look of these tools so they can be integrated with existing web sites.
2. Does your product provide an application programming interface? If so, describe.
3. Does your product provide an open interface? For example, does your product provide web mapping services, ArcIMS services or other web service or HTTP-based ways to receive and respond to requests?

Portal Catalog Discovery

Describe protocols or services that your application provides to allow clients to discover services and data available from the image portal? For example, does your application support Z39.50, Open Geospatial Consortium Catalogue Services, the Open Archive Initiative Protocol for Metadata Harvesting (OAI-PMH), or ArcIMS metadata services?

Support for Non-Image Data

The state of Oregon may at some point in time want to offer the provisioning (define area of interest, extract and deliver) and web mapping services for non-image data such as vector and non-image raster data.

1. List your application's support for the process listed under Image Provisioning above but applied to vector and non-image raster datasets.
2. List your application's support for the process listed under Mapping Services above but applied to vector and non-image raster datasets.

APPENDIX 5. Comparison Matrix of Vendor Solution

IMPORTANT: Information contained herein is business confidential. It was provided for the sole use of the Imagery Portal Project team and OFIT Committee members and is not intended for general distribution.

NOTE: All of the following vendors except Sanborn offer a COTS product manufactured by their company. Sanborn is an ESRI business partner and submitted a response based upon ESRI technology.

(THIS AREA DELIBERATELY LEFT BLANK.)