Oregon Aerial Imagery Index Data Standard

Version 1.08

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1.0 Introduction

The Oregon Aerial Imagery Index Data Standard is a five part geospatial metadata index representing aerial or satellite image project areas, photo flight lines, photo centers, image extents, and polygons of the nearest image within a project. Additionally the standard can accommodate oblique imagery locations in a 6th vector point layer.

1.1 Mission and Goals of Standard

The purpose Oregon Aerial Imagery Index Data Standard is to create a standard for use by agencies and other organizations in Oregon to readily share spatial metadata about aerial or satellite near vertical imagery projects and photographs. The resulting layers could then be used to help create orthoimagery products or to enable the distribution of digital copies of the photographs over a network or the Internet.

There are several intended uses for the spatial layers that comprise the Oregon Aerial Imagery Index Data.
- Index aerial photo projects
- Index satellite image projects
- Index orthoimagery projects
- Infrared line scanning projects
- LiDAR projects, especially intensity images
- Oblique aerial, terrestrial, or satellite imagery

1.2 Relationship to Existing Standards

The Oregon Aerial Imagery Index Data Standard is a supplement to the Oregon Orthoimagery Standard, with is based on the Federal Geographic Data Committee (FCGC) Content Standards for Digital Orthoimagery (FGDC-STD-008-1999).

1.3 Description of Standard

The database contains information about various aspects of aerial photography projects and will consist of five related spatial layers and one project table.

1.3.1 Aerial Image Project Areas

19970329 Elliott CIR
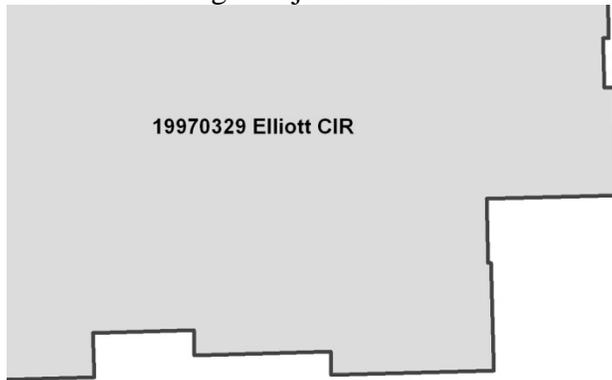
The Aerial Image Project Areas layer consists of polygons depicting project boundaries. This layer is useful for data exploration on a statewide or regional basis. This layer is the only mandatory element for this standard.

1.3.2 Photo Flight Lines

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The Photo Flight Lines layer consists of the approximate flight lines with the vertexes at each photo center. This layer is useful in displaying the flight pattern and determining adjacent photo locations. This layer is optional for this standard.

1.3.3 Photo Centers

14 - 13

13 - 13

15 - 13

12 - 13

16 - 5

13 - 9

14 - 9

15 - 9

16 - 1

12 - 9

13 - 5

14 - 5

12 - 5

15 - 5

13 - 1

14 - 1

12 - 1

15 - 1

The Photo Centers layer consists of point locations of the center of each photo exposure. This layer can be used to search and display photo locations and in creation of flight index maps. This layer is optional for this standard, but would be critical for analog photo projects.

1.3.4 Image Extents
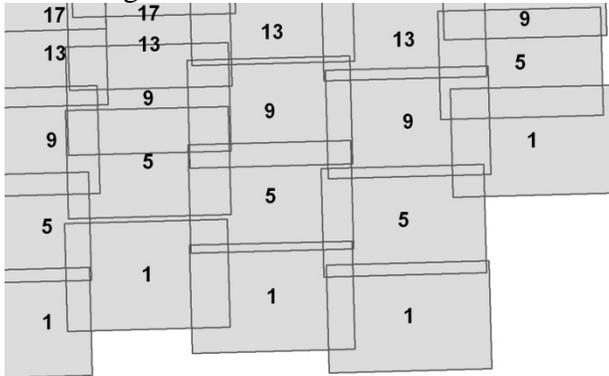
The Image Extents layer consists of overlapping polygons representing the approximate extent of each photo exposure. For continuous collection sensors the polygons will represent the swath of an individual flight line. It should be noted that projects may have gaps in coverage over a geographic area and these polygons may not show those gaps. This layer can be used for display of the actual area captured in the image. This layer is optional for this standard.

1.3.5 Nearest Image Polygon
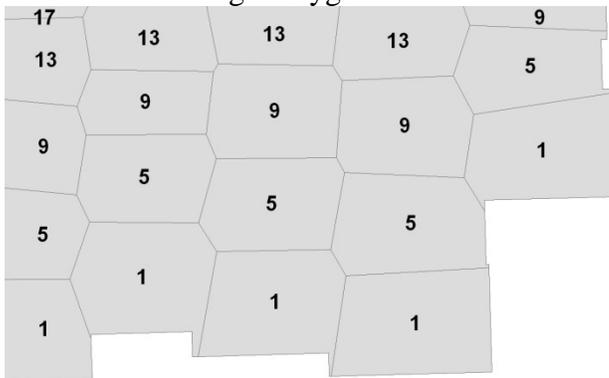
The Nearest Image Polygon layer consists of adjacent polygons within a project area representing the closest image location. In the case of gaps in image coverage this layer will still represent the nearest image, not necessarily the actual photo area for a mosaic. This layer is useful for an on-line index to hyper-link to non-georeferenced images. This layer can be constructed from the Photo Centers layer by creating Thiessen or Voronoi polygons. This layer is optional for this standard.

1.3.6 Oblique Image Sensor Location Points
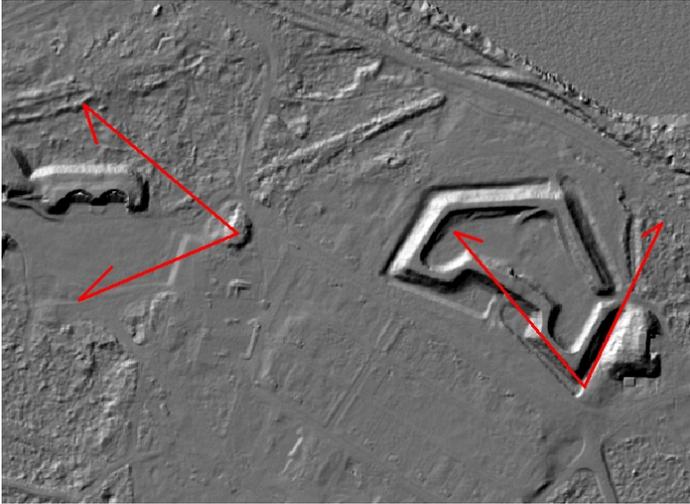
The Oblique Image Sensor Location Points layer is an independent but related layer used to document the geographic location of the camera or sensor location of oblique imagery. This layer is optional for this standard.

1.3.7 Project Information (non-spatial)

The Project Information table is a flat database table that contains critical information about the photo project, the image specifications, the vendor, and the managing organization. This table may be linked to the five spatial layers through the use of the photo project number. If in the implementation of a given acquisition project more than one sensor is utilized a separate Project Information table and Photo Project Area Polygon layer shall be created. This table is mandatory for this standard.

1.4 Applicability and Intended Use of Standard

The Oregon Aerial Imagery Index Data Standard is intended to serve as a geospatial metadata tool for organizations to share location information about aerial photo collections.

1.5 Standard Development Procedures

The Oregon Aerial Imagery Index Data Standard is developed by the Oregon Orthoimagery Framework Implementation Team with input from interested parties. Outreach efforts to professional societies, the photogrammetry industry, and aerial photography vendors will be conducted.

1.6 Maintenance of Standard

This standard will be updated by the Oregon Orthoimagery Framework Implementation Team when issues arise from members or from interested parties.

2.0 Body of the Standard

2.1 Scope and Content of the Standard

The scope of the Oregon Aerial Imagery Index Data Standard is intended for organizations in Oregon that maintain aerial photo indexes and share that data with other entities. The standard is intended for near vertical imagery including satellite imagery.

2.2 Need for the Standard

The standard is needed to ensure the efficient and accurate communication about the location and temporal information of vertical aerial imagery data sets that could be shared between organizations.

2.3 Participation in Standards Development

The process for this standard included research into data maintained by organizations outside of Oregon, and examination of data elements in use by entities in Oregon.

2.4 Integration with Other Standards

The Oregon Aerial Imagery Index Data Standard complements other Oregon Framework layers, but is not dependent on other layers for coincident geometry. This standard is a portion of the Orthoimagery Standard and provides locational metadata to enhance orthoimagery produced following that standard.

2.5 Technical and Operation Context

2.5.1 Data Environment

The data environment for this standard is a mix of vector data types; polygons, points, lines, overlapping polygons, and a related table.

2.5.2 Reference Systems

The geographic framework for all current reference systems is the North American Geographic Coordinate System of 1983 (NAD83) or the similar World Geodetic System of 1984 (WGS-84). Latitude positions in degrees north of the Equator and Longitude positions in degrees west of the Greenwich Prime Meridian describe any location on the Earth. Reference systems using meters or feet from a defined point use the GCS. The coordinate reference systems typically used in Oregon are the Universal Transverse Mercator (UTM) the Oregon State Plane system and the Oregon Geographic Information Council (OGIC) standard Oregon Lambert coordinate system. The UTM zones are zone 10, which comprises all land in Oregon to the west of 120 degrees west longitude, and zone 11, which comprises all land to the east of 120 degrees west longitude. The State Plane North and State Plane South zones are divided along the county boundaries near 44

degrees north latitude. The Oregon Lambert coordinate system is known as European Petroleum Survey Group (EPSG) # 2992.

2.5.3   Global Positioning Systems (GPS)

GPS is an appropriate tool to collect location information as aerial images are captured. However, for documentation of historical image photo centers other location tools are more appropriate. Historically, photo centers were plotted on a map by hand to create a project index. The scale of the base map used determines the positional accuracy of the plotted points.

2.5.4   Integration of Themes

Data produced following the Oregon Aerial Imagery Index Standard will support and enhance the use and delivery of orthoimagery as well as non ortho corrected imagery. Within the standard the flight line vertexes are snapped to the photo center points.

2.5.5   Encoding
N/A

2.5.6   Resolution

The resolution of the data will correspond to the resolution of the base map used for indexing, or the accuracy of the locational values derived from GPS at the time of image capture.

2.5.7   Accuracy

The accuracy of the features that represent the location of aerial images is contained as an attribute in the individual data layers. Accuracy is determined by the method of creation of the photo centers. Plotted centers are within 400 feet based on 100k map and centers determined by GPS are within 50' or less of their actual ground locations.

2.5.8   Edge Matching

The requirements and nature of aerial photography is that images overlap, therefore the features that represent the location of those images also overlap. There is no need to edge match features produced following the Oregon Aerial Imagery Index Data Standard.

2.5.9   Feature Identification Code

The Oregon Aerial Imagery Index Standard will use the Federal Geographic Data Committee guidelines for agency identification; 2 digit Federal Information Processing Standard (FIPS) code, 3 digit agency or organization code (e.g. "41DSL"). This code will be the first digits of the unique project identification code. Each agency may design a project number scheme based on their business needs, provided that the first five digits are consistent and different from other organizations.

2.5.10 Attributes

The attributes are organized into six related geospatial layers and one database table. This standard is designed to accommodate scanning of historical or archival film imagery as well as to provide spatial metadata about future imagery collection projects. Like all metadata records more information adds additional value to the data being documented. All features are recommended for all projects both future and historical, but may not be known in many cases of historical projects. Therefore only a few data elements are mandatory with the remainder being optional.

2.5.10.1   Aerial Image Project Area Polygons
Mandatory layer. Key data elements in this layer are, a) project identifier, and b) year.

2.5.10.2   Photo Flight Lines
Optional layer. The vertexes in this layer are snapped to the Photo center point layer. Key data elements in this layer are, a) project identifier, b) flight date, and c) line number.

2.5.10.3   Photo Centers Points
Optional layer. Key data elements in this layer are, a) project identifier, b) flight date, c) line number, and d) photo number.

2.5.10.4   Image Extent Polygons
Optional layer. Also known as photo or image footprints. Key data elements in this layer are, a) project identifier, b) flight date, c) line number, and d) photo number.

2.5.10.5   Nearest Image Polygons
Optional layer. This layer nests inside of the Photo project area layer. Key data elements in this layer are, a) project identifier, b) flight date, c) line number, and d) photo number.

2.5.10.6   Oblique Imagery Sensor Location
Optional layer. Independent of other spatial layers. Used to locate the location of the camera or sensor for oblique aerial or terrestrial imagery. Key data elements for this table are, a) project identifier, b) image date, c) sensor direction, d) field of view, and e) range distance.

2.5.10.7   Project information table
Mandatory table. Key data elements for this table are, a) project identifier, b) project contact information, c) the year the project began, and d) sensor information.

2.5.11 Transactional Updating

The update process for the data produced following this standard is the responsibility of each organization that develops and maintains this data.

2.5.12 Records Management

The adherence to the use of the unique ID for each photo project will require cooperation between organizations.

2.5.13 Metadata

The standard follows the Framework Metadata Standard for geospatial data.

3.0 Data Characteristics

3.1   Spatial Data Elements

3.1.1 Photo Project Area Polygons, mandatory data layer

Item Name	Type & Size	Mandatory	Description
project_id	Text 50	Yes	A unique Identifier assigned by the contracting agency. Used to link to the project information table.
capture_year	Text 4	Yes	The starting year the imagery was collected, *yyyy*

3.1.2 Photo Flight Lines, optional data layer

Item Name	Type & Size	Mandatory	Description
project_id	Text 50	Yes	A unique identifier assigned by the contracting agency. Used to link to the project information table.
flight_date_start	Text 8	No	The calendar date the flight line began, *yyyymmdd*
flight_date_end	Text 8	No	The calendar date the flight line ended, *yyyymmdd*
flight_line_id	Text 5	Yes	The flight line number, may contain letters
fly_height_average	Int 8	No	The average flying height above ground
fly_height_units	Text 10	No	The units of the fly_height_average field
flight_azimuth	Number 5	No	The average flight line azimuth direction, North = 0, East = 90, South = 180, West = 270 (not magnetic)
side_overlap	Int 3	No	The average percentage overlap between lines
end_overlap	Int 3	No	The average percentage overlap within lines

3.1.3 Photo Center Points, optional data layer

Item Name	Type & Size	Mandatory	Description
project_id	Text 50	Yes	A unique identifier assigned by the contracting agency. Used to link to the project information table.
entity_id	Text 50	Yes	A unique identifier assigned by the contracting agency for each image. Example: DDAPPPPPRRRRFFFFF DD = Data set designator , A = Agency , P = Project , R = Roll, F = Frame
flight_line_id	Text 5	Yes	The flight line identifier, may contain letters
photo_id	Text 5	Yes	The exposure or frame identifier within a roll or line
image_date	Int 8	Yes	The calendar date the image was captured, *yyyymmdd*
exposure_time	Int 8	No	The local time the image was collected
pitch_value	Number 3	No	The pitch angle from vertical (phi) of the sensor (0-180 degrees)
roll_value	Number 3	No	The angle from vertical (omega) of the sensor (0-180 degrees)
yaw_value	Number 3	No	The yaw angle from flight line (kappa) of the sensor (0-180 degrees)
centerline_direction	Number 3	No	The angle of the centerline of the image (0-360 degrees)
film_roll_name	Text 10	No	The roll identifier used by the repository organization
latitude	Text 15	No	The latitude of the sensor when the image was collected
latitude_accuracy	Number 9	No	The estimated accuracy of the latitude value
longitude	Text 15	No	The longitude of the sensor when the image was collected
longitude_accuracy	Number 9	No	The estimated accuracy of the longitude value
location_determination	Text 50	No	The method used to determine latitude and longitude
height	Int 6	No	The height of the sensor when the image was captured
latitude_NW	Text 15	No	The latitude of the northwest corner of the image
longitude_NW	Text 15	No	The longitude of the northwest corner of the image
latitude_NE	Text 15	No	The latitude of the northeast corner of the image
longitude_NE	Text 15	No	The longitude of the northeast corner of the image
latitude_SW	Text 15	No	The latitude of the southwest corner of the image
longitude_SW	Text 15	No	The longitude of the southwest corner of the image

latitude_SE	Text 15	No	The latitude of the southeast corner of the image
longitude_SE	Text 15	No	The longitude of the southeast corner of the image
scale	Int 12	No	The approximate scale of the image, expressed as a whole number
height_units	Text 10	No	The units used to record height
height_accuracy	Number 9	No	The estimated accuracy of the height value, RMSE in height_units
height_method	Text 50	No	The method used to determine height
image_quality	Int 1	No	A numeric rating of the overall image quality of the frame 9 to 8 = Good to Excellent, 7 to 5 = Fair, 4 to 2 = Poor, 0 to 1 = Very poor, NULL = No quality assigned
cloud_cover	Int 1	No	A code for the approximate percentage of the frame that is obscured by cloud or fog cover. The code is a single digit representing tens of percent. 0 = 0 to 9 percent cloud cover 1 = 10 to 19 percent cloud cover 2 = 20 to 29 percent cloud cover 3 = 30 to 39 percent cloud cover 4 = 40 to 49 percent cloud cover 5 = 50 to 59 percent cloud cover 6 = 60 to 69 percent cloud cover 7 = 70 to 79 percent cloud cover 8 = 80 to 89 percent cloud cover 9 = 90 to 100 percent cloud cover
snow_cover	Int 1	No	A code for the approximate percentage of snow cover on the ground in the image
smoke_haze	Int 1	No	A code value for image degradation due to smoke or haze. 0 = none, 5 = severe
photo_link	Text 250	No	A hyperlink to the image location on a network or Internet
solar_angle	Number 3	No	The solar zenith angle in decimal degrees calculated for the date and location of image acquisition
sun_azimuth	Number 5	No	The sun azimuth measured clockwise from north in decimal degrees calculated for the date, time, and location of image acquisition

3.1.4 Photo Image Extent Polygons, optional data layer

Item Name	Type & Size	Mandatory	Description
project_id	Text 50	Yes	A unique identifier assigned by the contracting agency. Used to link to the project information table.
image_date	Int 8	Yes	The calendar date the image was collected, *yyyymmdd*
flight_line_num	Text 5	Yes	The flight line number, may contain letters
photo_number	Int 3	Yes	The exposure or frame number
film_roll_name	Text	No	The roll identifier used by the repository organization

3.1.5 Nearest Image Polygons, optional data layer

Item Name	Type & Size	Mandatory	Description
project_id	Text 50	Yes	A unique identifier assigned by the contracting agency. Used to link to the project information table.
image_date	Int 8	Yes	The calendar date the image was collected, *yyyymmdd*
flight_line_id	Text 5	Yes	The flight line identifier, may contain letters
photo_id	Text 5	Yes	The exposure or frame identifier
film_roll_name	Text	No	The roll identifier used by the repository organization
photo_link	Text 250	No	A hyperlink to the image location on a network or Internet

3.1.6 Oblique Imagery Sensor Location, optional data layer

Item Name	Type & Size	Mandatory	Description
project_id	Text 50	Yes	A unique identifier assigned by the contracting agency. Used to link to the spatial index layers.
image_date	Text 8	No	The calendar date the image was collected, *yyyymmdd*
photo_id	Text 5	Yes	The exposure or frame identifier
sensor_direction	Text 10	No	The direction the sensor was pointed, azimuth
direction_source	Text 50	No	The source of the sensor_direction value
vertical_angle	Int 3	No	The vertical angle the sensor was pointed when the image was collected
vertical_angle_source	Text 50	No	The source of the vertical_angle value
field_of_view	Int 3	No	The angular field of view
range_distance	Int 9	No	The distance of the maximum range of view
range_distance_units	Text 8	No	The units used to measure range_distance

sensor_elevation	Int 9	No	The elevation of the sensor when the image was collected
elevation_source	Int 50	No	The methodology to determine sensor_elevation

3.2   Non Spatial Data Elements

3.2.1 Project Information Table, mandatory table

Item Name	Type & Size	Mand atory	Description
project_id	Text 50	Yes	A unique identifier assigned by the contracting agency. Used to link to the spatial index layers.
capture_year	Text 4	Yes	The starting year the imagery was collected, *yyyy*
project_contact	Text 100	Yes	The contact information regarding the project
contact_phone	Text 15	No	The telephone number for the project contact
capture_date_start	Text 8	No	The calendar date the project was started, *yyyymmdd*
capture_date_end	Text 8	No	The calendar date the flight was completed, *yyyymmdd*
project_name	Text 100	No	The name of the photo or image project
event	Text 20	No	A name to describe the event the data was flown to cover. Such as hurricane, flood, etc.
recording_technique	Text 30	No	The recording technique used in acquiring the image frame. Vertical cartographic, Vertical reconnaissance, Low oblique, High Oblique
height_AGL	Int 8	No	The average height above ground for the project
height_units	Text 8	No	The units used to record height_AGL
nominal_flight_directi on	Text 15	No	The general direction of flight lines North/South, East/West, irregular.
sensor	Text 250	No	A link to the sensor or camera specifications
sensor_serial	Text 100	No	The serial number of the sensor or camera
lens_serial	Text 50	No	The serial number of the lens used
focal_length	Text 50	No	The focal length of the sensor or camera
lens_calibration_report	Text 250	No	A link to the calibration report of the lens
vendor	Text 250	No	The company or organization that collected the imagery
purchaser	Text 250	No	The organization that acquired the imagery
repository	Text 250	No	The organization that stores the film or master copy of the imagery
medium	Text 20	No	Film negative, Film positive, Film diapositive, Raster

roll_numbers	Text 150	No	The film roll number(s)
emulsion	Text 10	No	The type of film, Color, B&W, CIR, film brand
sensor_type	Text 20	No	RGB, 4-Band, 7-Band, Hyperspectral
format	Text 20	No	The physical dimensions of the negative for analog images, or the number of rows and columns for digital images.
film_length_width	Text 15	No	The length and width of image frame contained on the roll of film, expressed in millimeters. Conversion: 1 inch = 25.4 mm
scan_date	Text 8	No	The date the film was scanned to digital format *yyyymmdd*
resolution	Int 6	No	The ground pixel size of the scanned images
resolution_units	Text 10	No	The units used to record ground resolution
nominal_scale	Int 12	No	The target or average scale of the images collected
number_lines	Int 6	No	The number of flight lines in the project
number_images	Int 6	No	The number of images contained in the project
datum_horizontal	Text 20	No	The horizontal datum used in identification of photo centers

References

FGDC Content Standard for Digital Orthoimagery
http://www.fgdc.gov/standards/projects/FGDC-standards-projects/orthoimagery/orth_299.pdf

FGDC Content Standards for Digital Orthoimagery (FGDC-STD-008-1999)
http://www.fgdc.gov/standards/projects/FGDC-standards-projects/framework-data-standard/GI_FrameworkDataStandard_Part2_DigitalOrthoimagery.pdf

FGDC Content Standard for Remote Sensing Swath Data (FGDC-STD-009-1999)
http://www.fgdc.gov/standards/projects/FGDC-standards-projects/swath_data/FGDC-STD-009-1999.doc

FGDC Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy. (FGDC-STD-007.3-1998)
http://www.fgdc.gov/standards/projects/FGDC-standards-projects/accuracy/part3/chapter3

Specifications for Aerial Photography Database Files, Ministry of Agriculture and Lands, British Columbia.
http://ilmbwww.gov.bc.ca/bmgs/airphoto/specs/DATABASE_SPECS_05022008.pdf