Roadmap

• Overview of mapping in Alaska
• How the Statewide Digital Mapping Initiative fits in,
  – Background and history
  – Goals and objectives
  – Current status and accomplishments
  – Plans forward
Unique Challenges

- Limited collection season
- Challenging weather conditions
- Large area, small population (1 person/mi$^2$)
- Vast remote areas (limited access to resources such as refueling stations, etc.)
Mapping in Alaska: the last century

1902-1917 USGS reconnaissance mapping

1947-1983 Statewide 1:63,360 maps

1978-1986 Aerial High Altitude Photography Mapping

2006-2012 Statewide Digital Mapping Initiative

1902 1947 1978 2006
Alaska High-Altitude Aerial Photography Program

- 1978-1986
- $2.7M multi-agency funding ($6.4M in 2012 dollars)
- 1:60,000 color infrared
- 90%+ statewide coverage
- Not orthorectified systematically
Primary goals:

1. **Acquire new and better maps** for Alaska, and
2. **Make existing map products more easily available.**
SDMI Member Agencies

ALASKA Department of Commerce, Community, and Economic Development

Alaska Department of Military & Veterans Affairs

University of Alaska
Many Traditions One Alaska

Alaska Department of Natural Resources

Alaska Department of Fish and Game

Alaska Department of Environmental Conservation

Alaska Department of Transportation & Public Facilities

STATE of ALASKA
SDMI spending

• Workshops and whitepapers
• Web mapping services of existing imagery and USGS topographic maps
• Mid-resolution elevation data through federal partnership pilot project
• Kenai peninsula LiDAR
• Statewide orthoimagery coverage
Statewide Digital Mapping Initiative Investments

- Imagery Acquisition: 31%
- Elevation Acquisition: 35%
- Data services: 20%
- Admin. costs: 3%
- Planning, including user workshops and whitepapers: 10%
ORTHO-IMAGERY ACQUISITION

August 2010 – June 2014
State contract #10-10-062
Requirements Gathering

- 2008 User Survey
- Imagery Workshop held March 2-3, 2009
- Whitepaper June 2009
- Available at www.alaskamapped.org
Participants

- **State Agencies**: 35%
- **Federal Agencies**: 25%
- **Private Sector**: 17%
- **Local Gov’t**: 8%
- **Academia**: 4%
- **Utilities**: 3%
- **Military**: 3%
- **Not-Profits**: 2%
- **Other**: 2%
- **Native Corporations**: 1%
Tier 1
Broad Scale Features
- Climate Change
- General Hydrographic Features
- Vegetation Land cover
- Geologic Unit Mapping
- General Wetlands Mappings
- Mining
- Underlay for Parcel / Property Boundaries
- Underlay for Land use & Natural Area Boundaries

Tier 2
Moderate Scale Features
- General Urban & Rural Cover
- Discrete Hydrographic Features (riverbanks/ponds)
- Extraction of Land use & Natural Area Boundaries
- Mapping Protected Areas & Trails
- Agricultural Mapping & Monitoring
- Tree Canopies
- Discrete Wetlands Boundaries
- Extraction of Parcel / Property Boundaries
- Pipeline Mapping
- Parking lots & impervious surface
- Military Base Mapping
- Major Road Intersections / Road Centerlines
- Commercial & Household Building Footprints
- Utilities (hydrants, electric power poles etc.)
# Uses

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Example Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transportation</strong></td>
<td>Roads (general)</td>
</tr>
<tr>
<td>DOT&amp;PF, Aviation (management),</td>
<td>Centerlines, Airports</td>
</tr>
<tr>
<td>FHWA, utilities</td>
<td></td>
</tr>
<tr>
<td><strong>Land Management</strong></td>
<td>Parcels</td>
</tr>
<tr>
<td>BLM, NPS, ADNR, DCCED, Native corporations/organizations</td>
<td>Land ownership boundaries</td>
</tr>
<tr>
<td></td>
<td>Mining claims</td>
</tr>
<tr>
<td></td>
<td>Oil and Gas Leases</td>
</tr>
<tr>
<td><strong>Land Cover</strong></td>
<td>Land cover, e.g. LANDFIRE, NWI</td>
</tr>
<tr>
<td>USFWS, NPS, BLM, USFS, Private Industry</td>
<td>Wetlands, discrete wetlands, e.g. COE</td>
</tr>
<tr>
<td><strong>Environmental mapping/analysis</strong></td>
<td>Land cover</td>
</tr>
<tr>
<td>Academia, Conservation groups,</td>
<td>Hydrography, e.g. coastlines, stream banks,</td>
</tr>
<tr>
<td>USFWS, USFS, NPS</td>
<td>water bodies</td>
</tr>
<tr>
<td><strong>Public Safety</strong></td>
<td>Roads, airports, ice cover, hydrography/water-</td>
</tr>
<tr>
<td>FAA, DMVA</td>
<td>bodies, manmade features, general land cover</td>
</tr>
<tr>
<td><strong>Natural Resource Inventories</strong></td>
<td>Forest/timber, geologic units, mining exploration</td>
</tr>
<tr>
<td>USGS, ADNR, USFS, Native</td>
<td>features, renewable energy sites, hydrographic</td>
</tr>
<tr>
<td>Corporations &amp; Organizations,</td>
<td>(stream networks), water resources,</td>
</tr>
<tr>
<td>Private Industry</td>
<td></td>
</tr>
</tbody>
</table>
Requirements

• Statewide coverage
• 5 meter pixel resolution or better
• Ability to collect the state in 3-5 years or less, leaf-on, snow free and <10% cloud cover
• Multispectral optical, including infrared
• Ortho-image map products of 1:24,000 national map accuracy standards or better
• Image products available on web for distribution and use
• Licensing public (1st choice) or at minimum available to public agencies and academia (2nd choice)
Imagery Contract in 2010

- Contract awarded August 2010 to Aerometric
- Completion date June 2014
- Combined State funds with $1.8M BOEMRE CIAP (Coastal Impact and Assessment Project) funds for a total of $3.45M
Product Specifications

- 15% maximum incidence angle
- 10% cloud cover or less

SPOT 5 bands:

- XS1 (Green: 0.50 – 0.59 µm, 10 meter resolution)
- XS2 (Red: 0.61 – 0.68 µm, 10m resolution)
- XS3 (Near infrared: 0.78 – 0.89 µm, 10 meter resolution)
- MIR SWIR (short wave infrared: 1.58 – 1.75 µm, 20 meter resolution resampled to 10 meters)
- Panchromatic band (0.48 – 0.71 µm, 2.5 meter resolution)
Deliverables

• **Source imagery**, including FGDC compliant metadata containing information on spectral bands, rational polynomial coefficients (RPC), and all additional sensor information necessary for processing

• **Seamless orthoimagery tiles** delivered as 8-bit, natural color or pseudo natural color composite, pan sharpened, uncompressed GeoTiffs. Also mosaic blend lines, panchromatic mosaic, and metadata. All tiles will be delivered in Alaskan Albers NAD83 EPSG code 3338.

• **Color infrared orthoimagery tiles** delivered as 8-bit, color infrared composite, pan sharpened, uncompressed GeoTiffs

• **Product horizontal and vertical control** documenting all control points used for orthorectification, including information about and metadata for any DEM used for ortho rectification.
2010 QA/QC report

• Radiometric quality
  – cloud and cloud shadow, haze, blending along cut lines, contrast, saturation, artifacts, blurring, ghosting, color, and location based errors

• Geometric offset
  – Offset along cutlines of linear features such as roads or rivers

• Geometric accuracy
## Geometric Accuracy

<table>
<thead>
<tr>
<th>Block_ID</th>
<th>No. Points</th>
<th>RMS in X (m)</th>
<th>RMS in Y (m)</th>
<th>RMS (m)</th>
<th>CE90 (m)</th>
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</thead>
<tbody>
<tr>
<td>CM1</td>
<td>23</td>
<td>4.01474</td>
<td>3.18580</td>
<td>5.12518</td>
<td>7.78</td>
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<tr>
<td>CM3_Pilot</td>
<td>39</td>
<td>1.92024</td>
<td>1.44665</td>
<td>2.40419</td>
<td>3.65</td>
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<tr>
<td>CM3_South</td>
<td>16</td>
<td>2.25656</td>
<td>2.41112</td>
<td>3.30236</td>
<td>5.01</td>
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<tr>
<td>JU1_East</td>
<td>9</td>
<td>2.22469</td>
<td>3.71440</td>
<td>4.32957</td>
<td>6.56</td>
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<tr>
<td>JU1_West</td>
<td>12</td>
<td>2.67875</td>
<td>4.07422</td>
<td>4.87595</td>
<td>4.06</td>
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<tr>
<td>NM1</td>
<td>23</td>
<td>3.60820</td>
<td>2.50492</td>
<td>4.39246</td>
<td>7.40</td>
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<tr>
<td>NM2</td>
<td>45</td>
<td>1.64688</td>
<td>2.30841</td>
<td>2.83567</td>
<td>4.30</td>
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<tr>
<td>NM2_East</td>
<td>9</td>
<td>1.63304</td>
<td>2.64374</td>
<td>3.10745</td>
<td>4.71</td>
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<tr>
<td>SM1</td>
<td>27</td>
<td>2.38353</td>
<td>2.27322</td>
<td>3.29381</td>
<td>4.99</td>
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<tr>
<td>SM2_East</td>
<td>15</td>
<td>2.42490</td>
<td>2.82015</td>
<td>3.71933</td>
<td>5.64</td>
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<tr>
<td>SM2_West</td>
<td>19</td>
<td>2.29724</td>
<td>2.55574</td>
<td>3.88594</td>
<td>5.90</td>
</tr>
</tbody>
</table>
Select Scene – Add to Cart – Download
Plans forward

- 2011 license uplift amendment placed allowing USGS to use the imagery products in their US TOPO project
- Refresh program
- Coastal improvements
Land Ownership in Alaska

- **Bureau of Land Management, 22.30%**
- **Fish and Wildlife Service, 19.49%**
- **Forest Service, 6.04%**
- **National Park Service, 14.88%**
- **Native Patent or IC, 10.60%**
- **Military, 0.55%**
- **State, 25.86%**
- **Private, 0.28%**
Cost of Refresh, 3 Year Cycle
Percentages Based on Land Ownership

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>Federal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>$400,000.00</td>
<td>$600,000.00</td>
</tr>
<tr>
<td>Year 2</td>
<td>$300,000.00</td>
<td>$500,000.00</td>
</tr>
<tr>
<td>Year 3</td>
<td>$200,000.00</td>
<td>$400,000.00</td>
</tr>
</tbody>
</table>
THANK YOU! QUESTIONS?

Anne M. Johnson, GIS Coordinator
Alaska Department of Natural Resources | Division of Mining, Land & Water
anne.m.johnson@alaska.gov
2009 & 2010 Data – Ortho + DEM

SDMI Statewide 2009 & 2010 Collections

<table>
<thead>
<tr>
<th>Collection Type</th>
<th>Area (km²)</th>
<th>% of State Buffer Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-overlapping SPOT5 Orthos</td>
<td>603,452</td>
<td>38.64</td>
</tr>
<tr>
<td>FUGRO IFSAR DEM</td>
<td>77,684</td>
<td>4.97</td>
</tr>
<tr>
<td>InterMap IFSAR DEM</td>
<td>78,568</td>
<td>5.03</td>
</tr>
<tr>
<td>Alaska State Boundary 1km Buffer</td>
<td>1,561,622</td>
<td></td>
</tr>
</tbody>
</table>
Strategic Goals

• Strategic Goal 1: Establish a sustainable participatory governance structure to effectively and efficiently coordinate and communicate geospatial efforts

• Strategic Goal 2: Ensure statewide spatial data and technology are available to as many potential users as possible and are developed, managed, and coordinated according to best practices

• Strategic Goal 3: Expand and improve the use and awareness of geospatial technologies through increased collaborative educational opportunities and outreach

• Strategic Goal 4: Identify and secure sustainable funding sources used to support ongoing statewide geospatial programs
<table>
<thead>
<tr>
<th>NSGIC Characteristic</th>
<th>Alaska Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A full time paid coordinator with authority to implement the state’s strategic and</td>
<td>Not implemented</td>
<td>No single coordinator exists for statewide geospatial efforts. The state does not have any formal leadership of geospatial activities to support the implementation of this Strategic Plan and a forthcoming companion Business Plan.</td>
</tr>
<tr>
<td>business plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A clearly defined authority exists for statewide coordination of geospatial</td>
<td>Not implemented</td>
<td>No formal authority exists to coordinate statewide geospatial efforts in Alaska. Although the Statewide Digital Mapping Initiative (SDMI) has coordinated efforts for statewide data collection, this body does not have formal authority to prioritize, execute, and manage statewide geospatial initiatives.</td>
</tr>
<tr>
<td>technologies and data production</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A statewide coordination office has a formal relationship with the state’s CIO</td>
<td>Not implemented</td>
<td>Alaska does not have a statewide coordination office or a Chief Information Officer. The state does have an Enterprise Technology Services (ETS) department, but this department does not have governance responsibilities for all of the state’s technology initiatives. No formal relationship exists between the ETS department and statewide geospatial efforts (including SDMI).</td>
</tr>
<tr>
<td>(or similar office)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A champion (political or executive decision maker) is aware and involved in the</td>
<td>Not implemented</td>
<td>Several members of the executive, legislative, and administrative branches of state government are aware of the coordination planning that has been initiated, but no champion has been identified to continually support the coordination effort.</td>
</tr>
<tr>
<td>process of coordination</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsibilities for developing the NSDI and a state clearinghouse are assigned</td>
<td>Not Implemented</td>
<td>The SDMI has taken responsibility for developing orthoimagery and elevation data, but there is no formal mandated assignment of these responsibilities.</td>
</tr>
<tr>
<td>The ability to work and coordinate with local governments, academia, and the private</td>
<td>Not Implemented</td>
<td>There are many examples of successful coordination between private and public sector organizations, but there are no formal mechanisms (including contract vehicles, standard operating procedures, etc.) within state government that can be continually utilized to support these collaboration efforts.</td>
</tr>
<tr>
<td>sector</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustainable funding sources exist to meet projected needs</td>
<td>Not implemented</td>
<td>No sustainable funding sources exist specifically for statewide geospatial needs. Funding is generally allocated for single initiatives or as part of related programs.</td>
</tr>
<tr>
<td>Coordinators have the authority to enter into contracts and become capable of</td>
<td>Implemented</td>
<td>Government agencies have the authority to contract with other organizations and can transfer funds. This authority and the resulting contracts are generally executed on an agency and/or project specific basis.</td>
</tr>
<tr>
<td>receiving and expending funds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Federal government works through the statewide coordinating entity</td>
<td>Not Implemented</td>
<td>No statewide coordinating entity exists. Although the Federal government has supported statewide and regional efforts, and has partnered with individual agencies, this coordination is not universal.</td>
</tr>
</tbody>
</table>
Status of Framework Data

**Geodetic Control:** exists, but not at the accuracy or density required for state mapping. Elevation heights in error up to 2m due to poor geoid model.

**Orthoimagery:** Satellite and aerial imagery with statewide 2.5m resolution imagery by 2014. 39% of state collected to date. No refresh program in place, or coordinated means of collecting higher resolution imagery.

**Elevation:** NED is only available DEM for much of the state. 2010 IfSAR collect covered 10% of the state with 20m contour interval data. An additional 10% of the state is covered by Intermap IfSAR but at a lower resolution. LiDAR has been collected in certain areas, including Kenai and most recently the MatSu borough.

**Transportation:** Exists via various sources including DOT highway centerlines, local roads datasets, DNR and USFS datasets. No single, integrated roads dataset for the state.

**Hydrography:** Most hydrology datasets in use are derivations of the National Hydrology Dataset. There has been limited integration with moving updates from modified NHD layers back into the main dataset.

**Cadastral:** Efforts are underway to integrate federal, state, local and tribal parcel datasets and to develop procedures for updating the dataset over time. No statewide parcel layer currently exists.

**Governmental Units:** Generally derived from Census TIGER data, also state and local datasets for other administrative boundaries such as election districts.
The blue line is the stream coverage from USGS maps. It only shows one stream and is in error by over 800' in some locations.

Why an statewide orthorectified satellite imagery base is important.
Vegetation types within a stream buffer can’t be calculated if the stream is in the wrong location.
Federal, state, and local governments and a multitude of private users need a good orthoimagery base product in order to use and update their coverages. Application development has been in vain until this problem is corrected.

Note the 100 foot difference between the road coverage and road location on the image.