Alaska Mapper: A Web-based Tool to Access Land Ownership and Other State-wide Geospatial Data

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INTRODUCTION

Users of the Internet are currently witnessing a revolutionary period of communication and data search capabilities. In the past several years, several research and technology corporations, like Google, Yahoo!, and Microsoft have released a number of Application Programming Interfaces (APIs) and online interactive search tools. These web applications allow users to perform a number of complex searches, with the results being displayed spatially, in an organized arrangement of layers, polygons, symbols, labels, photos, news, web links and text (Neches et al., 2001). Applications such as Google Earth (*http://earth.google.com*) Microsoft's Virtual Earth (*http://www.microsoft.com/virtualearth*) and NASA's World Wind (*http://worldwind.arc.nasa.gov*) have become the standard tools for curious users to discover the world, learn about far-away cities, and acquire information without leaving their desk chairs.

The accepted use of these online tools has been influenced by the media (Scharl, 2004). Scharl points out that although Google Earth was released in 2005, by the end of 2006 it had received 83% of the media coverage amongst all of the 3-D geospatial search tools. As a result, the power of searching and viewing thematic information in a 3-D, geospatial interface has started to draw attention away from mainstream search engines and 2-D, online map tools (Scharl and Tochtermann, 2007). Furthermore, approximately 20% of web pages currently contain distinguishable and clear geographic identifiers (Delboni et al., 2005). The number of web sites that provide these identifiers will no doubt continue to increase, as users quickly realize the potential and advantages of integrating thematic, temporal and contextual data with an interactive geospatial engine, called the geobrowser.

Alaska Mapper, developed by the Alaska Department of Natural Resources' (DNR) Land Records Information Section (LRIS), is one such geobrowser that provides access to the Alaska DNR's Land Administration System (LAS) and other statewide geospatial data (Figure 1). Much of the information displayed in Alaska Mapper is also used to easily access the State status plats, an index by township to the public land record and the department's case files (Figure 2). Although status plats have been accessible through the Alaska Land Records web site (*http://plats.landrecords.info*) since 1999, these are not interactive. With the Alaska Mapper, users can zoom to an area of interest, turn data layers on and off, make live queries to the database of records, view each layer's metadata and download selected data for use in a GIS. To access Alaska Mapper and its documentation, see *http://mapper.landrecords.info*.

SEEING ALASKA FROM A BIRD'S EYE VIEW

The LRIS Status Graphics Unit (SGU) uses a custom-built ESRI application to edit DNR's land record status data. The application, written in ArcDesktop and Visual Basic, is highly sophisticated and customized to the status plat production. The data are then transformed from the ESRI feature datasets to Oracle Spatial (*http://www.oracle.com*)

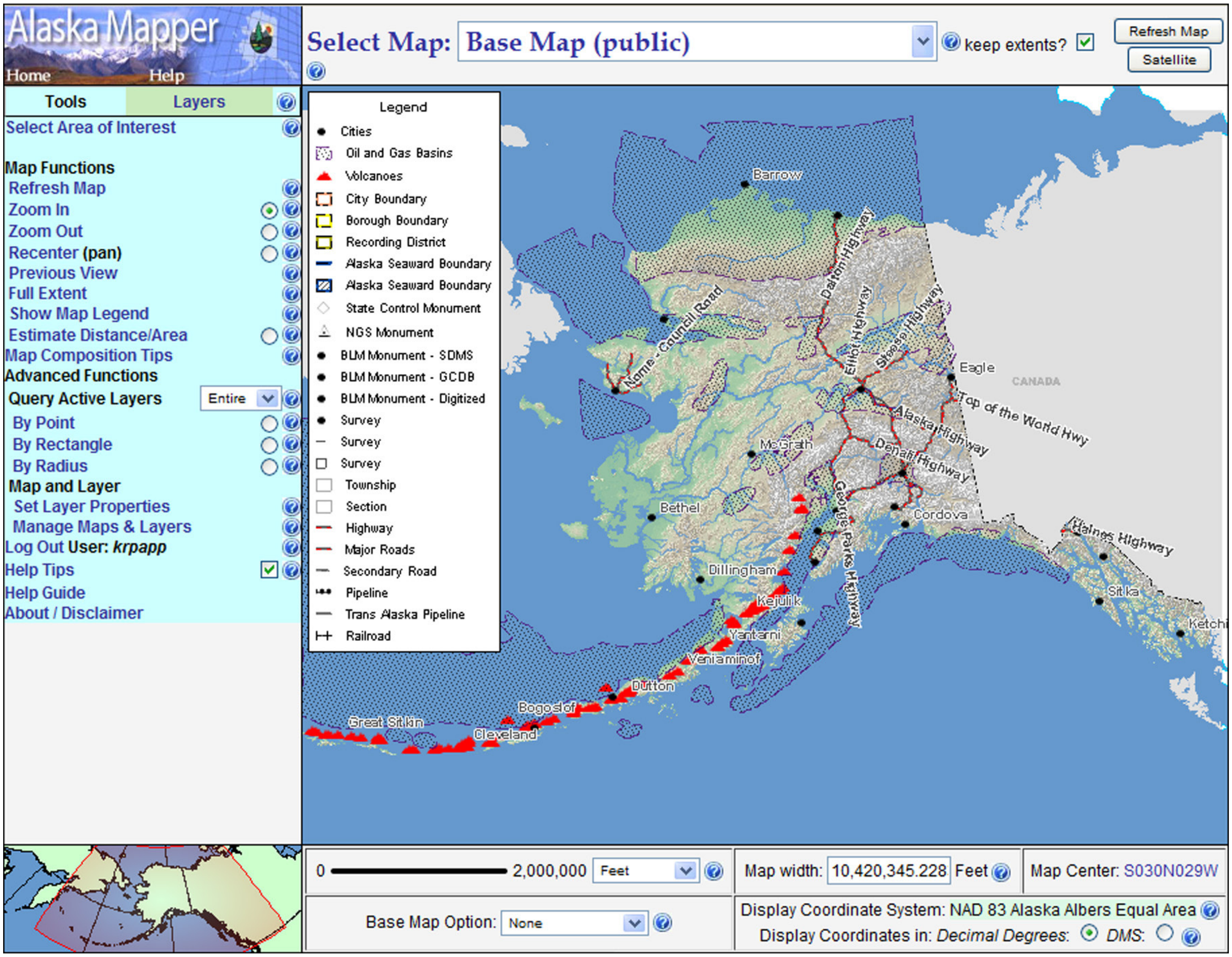

Figure 1. The Alaska Mapper geobrowser (*http://mapper.landrecords.info*), showing oil and gas fields and active volcanoes.

geometry objects using ArcSDE (*http://www.esri.com*) and then out to MapInfo TAB files from an Oracle materialized view (a cached, virtual table representing the result of a complex, database query) for the Alaska Mapper. Less complex datasets are accessed directly from an Oracle table by Alaska Mapper without being converted to TAB files. Much of this work can now be automated, which will eventually permit the data available to the public to be as current as 24 hours from the time of data-entry.

Alaska Mapper is 100% Java-based, using MapInfo's MapXtreme (*http://extranet.mapinfo.com*) for Java at its rendering core. The original intent was to use an Oracle database to directly "feed" the system, but this work flow offered substandard performance. Instead, the data are exported to MapInfo TAB files on a regular basis. The data are stored in Oracle Spatial and is registered via SDE which allows ESRI clients to manipulate it. A two node, SUN Intel x86 cluster, running Solaris and Apache, serves the application with four, active implementations of Apache Tomcat to distribute the processing load. This architecture was crucial in achieving the system's current optimal performance.

Similar to the other popular geobrowsers, Alaska Mapper was designed with navigation functions, layer management features, and query tools with which people are now quite familiar. Although innovation is at the forefront of every developer's mind, it is also desirable to maintain a similar look and feel to existing complex APIs in order to maintain usability and a certain user "comfort level" with the program (Kendall, 2005). There are advantages to being "first out the gate," however. As Shapiro and Varian (1999) point out, the original design often becomes the standard and increases the likelihood of user lock-in.

Advantages of the Alaska Mapper geobrowser include (1) integrating energy resources data, for example, with existing statewide data and infrastructure in ways that were not previously possible, (2) accessing data that is updated on a regular basis, including land status, ownership, and water rights, (3) not having to install any programs or download data to use the

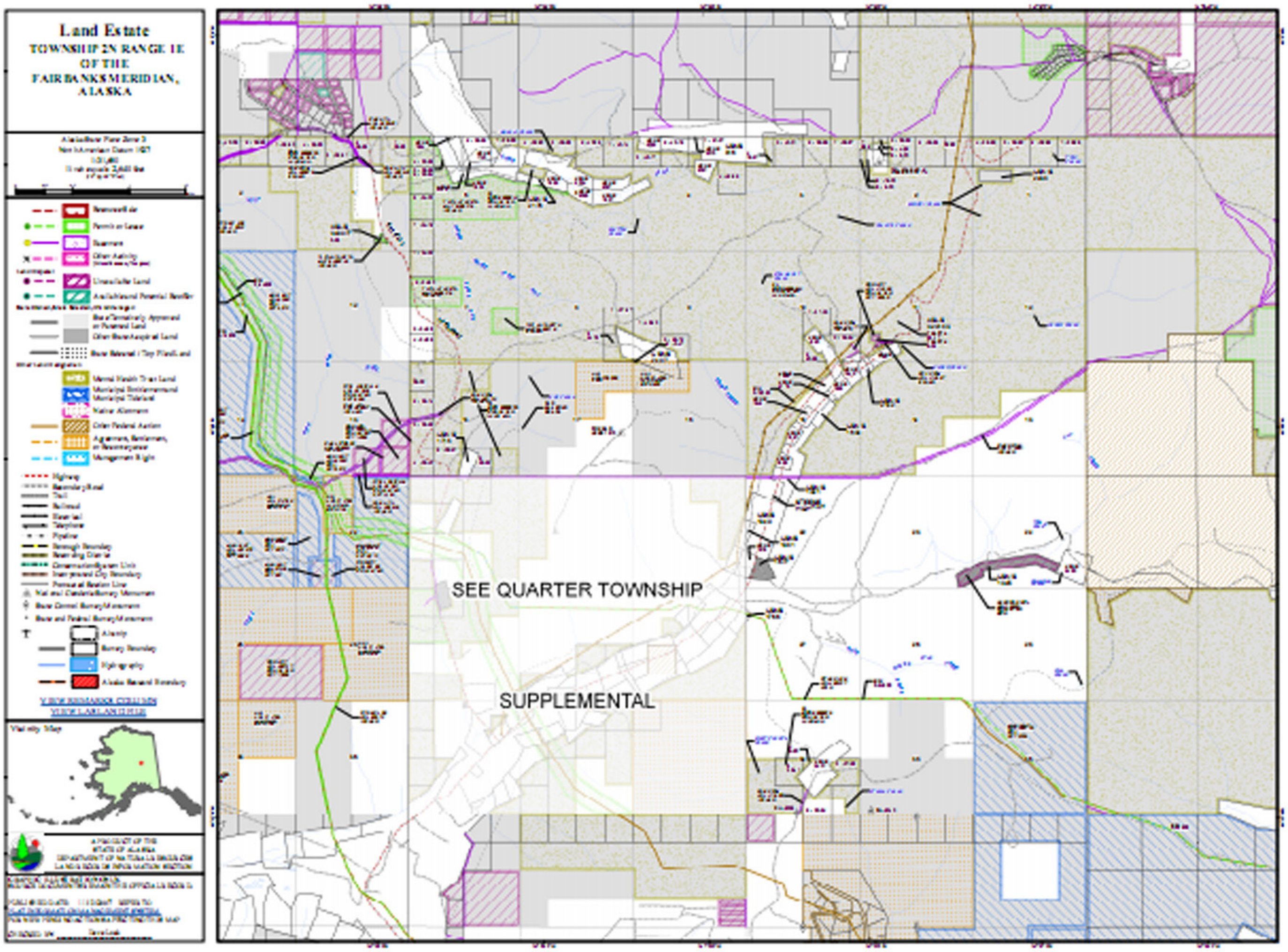

Figure 2. The status plats give a composite view of the activity on state-owned land and provide detailed information on property issues affecting state land and resources. Please see the Alaska DNR Land Records Information Section Land Records page, available at *http://plats.landrecords.info/*, for more information.

service, and (4) having the option to download the source data to use locally on your computer. It is the latter advantage of Alaska Mapper that makes the geobrowser so useful. Not only is it possible to extract all the data (see the next section) for a given dataset, but a user can also view the dataset's metadata, which answers the crucial "who, what, when, where, why, and how?" about the data. With so many users having access to the data, it is imperative to provide metadata in order to avoid misuse of the data (Browne et al., 2003) and to prevent spending valuable resources on updating legacy data many years later (McCurley, 2001).

A VIRTUAL STATE OF DATA AT YOUR FINGERTIPS

Alaska Mapper was originally designed to be the visual interface into DNR's Land Administration System, providing visual, interactive access to case-file data from status plats and links to land case file summaries, details, and abstracts. Over time, however, user needs have influenced additional features and the data capable of being displayed in the geobrowser. New features in the latest version (2.0.4, released on August 28, 2007) include (1) a new look and feel for improved operability, (2) the incorporation of satellite and ortho-images from the Geographic Information Network of Alaska (GINA), (3) the addition of tooltips, (4) user input of radius length for the "Query by Radius" tool, and (5) a core mapping software upgrade to MapInfo MapXtreme 4.8.1.

Status plats are maintained by the SGU, while DNR case file data are maintained by other DNR staff. It is important to note that since the Alaska Mapper is a representation of LAS, it's only as current and complete as the records maintained in LAS. For features that are related to LAS, the case file type and file number are displayed as feature attributes in the application. When the LAS case report submit action button is clicked, the attributes are forwarded to another web application that displays that case's complete case abstract. The advent of the Alaska Mapper, however, does not change the fact that land ownership issues are complicated and require training and experience to understand. It can only help the user answer the question, "Who owns the land?" In addition to status plats and land record information, Alaska Mapper is also capable of displaying geospatial information related to biology, Alaska culture, environmental observations, geology and geophysics, natural resources, physical features, transportation, and state infrastructure. Predefined mashups, or common groups of layers from multiple sources providing an integrated experience, have been generated by the LRIS team, such as Mineral Estate and Land Ownership maps (Table 1). The mashups are defined on the application's entry page and the user can choose a mashup from a simple drop-down list or by clicking on the mashup's name. These mashups are extremely useful for less savvy users, and for those users who want to find information quickly but may not have the time to browse through and select multiple layers to answer a common question about the data.

The Alaska Mapper login page presents users with two login account types. The public account may be used by anyone who wants to view or create maps, but does not need to save a map. Registered user accounts are currently only available to State of Alaska employees. These accounts do not provide access to additional layers; they only allow a user to save maps (including public maps) to a database that can be recalled later. Alaska DNR is considering a policy that will permit non-state employees to have registered user accounts.

Like other popular geobrowsers, users can query the layer data in Alaska Mapper using a number of familiar techniques. A query is based on a user-specified boundary, which can be a point, rectangle, radius, or even a geographic feature itself. After a query is performed, the total number of features (from each "active" layer) is displayed in the program's "Status Area." A new browser window opens to display the attributes of the features selected in the query, which are grouped by layer.

One useful feature of Alaska Mapper is the option to download an entire layer or a selection of features within a layer or layers to ESRI's shape file format. If the selected dataset contains multiple feature types (e.g., points, lines, or polygons), a shape file is present for each type. After the user initiates a download request, an email is sent to the address specified. The email contains a link to a compressed file containing all the files, including metadata, that make up the requested dataset.

CROSSING THE 180° GREAT CIRCLE

The issue of cartography will certainly arise as geobrowsers provide more complex information in the spatial, semantic, and temporal dimensions (Scharl and Tochtermann, 2007). Alaska's size (1,477,277 km²) and 54,720 km of tidal shoreline, spanning 130° W longitude, across the 180° great circle (meridian) to 172° E longitude, often creates cartographic hurdles for map makers, GIS managers and geospatial data web-portals and complicates standard queries using polygon boundaries. The sheer number of small islands, streams, rivers and lakes as well as the intricate shorelines of Southeast Alaska and the Aleutian Islands make data managers pause, as they contemplate zoom levels and cartographic decisions involving the display of base map information, data attributes and physical features.

The advent of seemingly unlimited mashups integrates datasets that were once viewed as unrelated. However, data managers now have to deal with the organization and display of hundreds of "stackable" layers, points, lines and

Table 1. Alaska Mapper's predefined mashups.

Map Name	Purpose
Ownership Map	This map displays current state land ownership and the availability of those lands for use under specific rules and regulations of the State of Alaska.
Surface Classification Map	This map displays how state land may be used as a result of an area plan or site specific classification.
Land Estate Map	This is a surface-use map that displays DNR authorizations or disposal of state uplands and tidelands to third party interests, such as individuals, businesses, municipalities, boroughs, or other state agencies.
Mineral Estate Map	This is a subsurface-use map that displays current oil and gas, mining, and other subsurface resource uses on state uplands and tidelands. This map describes state lands as open or closed to mineral entry.
Water Estate Map	This map displays the statewide location for water rights, water authorizations, reservations, and water management areas for surface and subsurface water sources.
Base Map	This map contains just the basic layers that are common to the above-mentioned maps. Common layers would include hydrography, township and section grids, state outlines, roads, pipelines, etc. It is a good map to start with when designing your own map.

polygons, all within the 1280x1024-pixel viewport of a web browser. Making the situation more complex still is the possibility that the data has a temporal dimension rather than simply a temporal attribute, such as showing the diffusion of volcanic ash particles or the duration of an earthquake swarm (Johnson, 2004). Publication of maps in digital format has forced GIS experts and cartographers to also become knowledgeable in web semantics, design, Cascading Style Sheets (CSS), and programming and database components such as Ajax (Asynchronous JavaScript and XML), MySQL and PHP (Kraak and Brown, 2001; Mitchell, 2005). Utilizing these recent combinations of components has allowed groups like the Alaska LRIS to solve complex spatial problems and provide the general public with the ability to easily interact with searchable data.

PUTTING YOUR FINGER ON A SPINNING GLOBE

It is safe to say that geobrowsers are here to stay, as the effect of geobrowsers, virtual spaces, and interacting with actual data heightens our learning experiences (Roush, 2005). As computers become the media and information centers of our homes, users will continue to expect more from the Internet, both in content and ease of use. Combining technologies, programming platforms and technical skills, such as GIS, database and web design, cartography and GPS, have proven advantages in distributing and displaying spatial data to any interested user. Moreover, the utilization of open-source software and protocols in this process promotes innovation and does not restrict data flow via proprietary formats (Shapiro and Varian, 1999). The Alaska DNR, for example, is also working with, but has not yet implemented, another means of distributing the data through open-source protocols such as Web Map Service (*http://www.opengeospatial.org/standards/wms*) and Web Feature Service (*http://www.opengeospatial.org/standards/wfs*), implemented by the OpenGIS Consortium. This would allow efficient distribution of the data and leave the choice of client to the user for viewing the data (e.g. Google Earth, Alaska Mapper, or ESRI Desktop).

The next major step for Alaska is being taken by the Statewide Digital Mapping Initiative (SDMI, *http://www.alaskamapped.org*). Because the State of Alaska does not have an adequate digital base map, the Alaska SDMI will ultimately provide an accurate, current, seamless, single source, statewide base map to be available over the Internet, through open standards, free of charge. This is a cooperative state program endorsed by the Governor and implemented by the Department of Natural Resources, Department of Military and Veteran's Affairs and the University of Alaska. The Alaska LRIS will play a major role in this initiative and, as a result, end users will have access to new and more accurate map data via Alaska Mapper.

REFERENCES

Browne, C.L., Freeman, L.K., and Graham, G.R.C., 2003, The Alaska Division of Geological & Geophysical Survey's Metadata Policy Development and Implementation, in Soller, D.R., ed., Digital Mapping Techniques 2003 – Workshop Proceedings: U.S. Geological Survey Open-File Report 03-471, p. 201-208, available at *http://pubs.usgs.gov/of/2003/of03-471/browne/index.html*.

Delboni, T.M., Borges, K.A.V., and Laender, A.H.F., 2005, Geographic Web Search Based on Positioning Expressions: *2nd International Workshop on Geographic Information Retrieval (GIR-2005),* Bremen, Germany, p. 61-64.

Johnson, Ian, 2004, Putting Time on the Map: Using TimeMap for Map Animation and Web Delivery: *GeoInformatics,* v. 7, no. 5, p. 26-29, available at *http://www.timemap.net/tm/documents/publications/200408_geoinformatics.pdf*.

Kendall, J.E., 2005, Satellite Mapping and its Potential in Ecommerce: Why We Need Directions to Follow Our New Maps: *Decision Line,* v. 36, no. 5, p. 11-14.

Kraak, Menno-Jan, and Brown, Allan, eds., 2001, Web Cartography: Developments and Prospects: London, Taylor & Francis, Inc., 224 p.

McCurley, K.S., 2001, Geospatial Mapping and Navigation of the Web, *in* Proceedings of the Tenth *International World Wide Web Conference (WWW-2001):* ACM Press, Hong Kong, May 1-5, 2001, p. 221-229, available at *http://www10.org/cdrom/start.htm*.

Mitchell, Tyler, 2005, Web Mapping Illustrated: Sebastopol, CA, O'Reilly Media, Inc., 367 p.

Neches, Robert, Yao, Ke-Thia, Ko, In-Young, Bugacov, Alejandro, Kumar, Vished, and Eleish, Ragy, 2001, GeoWorlds: Integrating GIS and Digital Libraries for Situation Understanding and Management: *New Review of Hypermedia and Multimedia,* v. 7, p. 127-152.

Roush, Wade, 2005, Killer Maps: *Technology Review,* v. 108, no. 10, p. 54-60, available at *http://www.technologyreview.com/communications/14825/?a=f*.

Scharl, Arno, 2004, Web Coverage of Renewable Energy, Chap. 4, *in* Scharl, Arno, ed., *Environmental Online Communication*: London, Springer, p. 25-34.

Scharl, Arno, and Tochtermann, Klaus, eds., 2007, The Geospatial Web: How Geobrowsers, Social Software and the Web 2.0 are Shaping the Network Society: London, Springer, 282 p.

Shapiro, Carl, and Varian, H.R., 1999, The Art of Standards War: *California Management Review,* v. 41, no. 2, p. 8-32.