

Louisiana Uses ESRI Products to Earn Millions in Petroleum Leasing

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ABSTRACT

The Louisiana Department of Natural Resources (LDNR) leases state-owned lands for petroleum exploration and production. To support this process, which generates \$375,000,000 in annual state income, the LDNR Office of Mineral Resources has developed the Strategic Online Natural Resources Information System (SONRIS) around ESRI GIS products, Oracle8 databases, and FileNet Panagon-managed document images.

The Web-based process, driven by ESRI SDE, IMS, ArcGIS, and ArcExplorer, consists of 50 feature layers, and custom tools and ArcGIS desktop projects, linked to Oracle and FileNet.

The 100 step process includes industry submission of proposed leases via CADD, creation of SDE lease nomination layers, spatial analysis by geologists, real-time GIS review of bids during lease sales, and updating ESRI, Oracle, and FileNet databases.

Processing time is reduced from weeks to days, allowing thorough review of proposed leases, better management of existing leases, staff cost effectiveness, and a huge financial return in the State's economic development.

INTRODUCTION

The Louisiana Department of Natural Resources (LDNR) is responsible for the management of oil and gas resources within the state, and management and restoration of the state's vast Gulf coastal area. The LDNR Office of Mineral Resources (OMR) is responsible for the leasing of state-owned land and water bottoms, and management of subsequent state income from lease rentals and petroleum royalties which amounts to an average of \$375,000,000 per year over the last ten years. The LDNR Office of Conservation (OC) is responsible for permitting and monitoring all oil and gas wells in the state, on state-owned or private land or water bottoms.

One of LDNR's most important management tools is the Strategic Online Natural Resources Information System (SONRIS), a Web-based combination of Oracle database technology, FileNet-managed electronic document images, and an ESRI Web-enabled geographic information system (GIS). This system delivers all of LDNR's Oracle data, several million documents and more than 100 GIS feature layers to LDNR staff and the public. LDNR created SONRIS in 1999 to upgrade the department's ability to manage computer data and link it to document images and the GIS.

LDNR implemented its first oil and gas related GIS Web site with ArcView IMS in 1998 under the guidance of the Office of Conservation. The Web site consisted of approximately 150,000 well locations, 1,700 oil and gas field center points, and USGS base maps at 1:100,000 and 1:24,000. The GIS Web site was upgraded to ArcIMS in 2001.

Currently, LDNR is maintaining three SONRIS GIS Web sites: the public site, an internal LDNR staff-only site, and a password-protected OMR site. These Web sites have a total of more than 70 feature layers including color IR photos of the entire state at one meter resolution, two satellite mosaics of the state, and three USGS map types (including historic maps). The Web sites offer standard GIS tools plus some additional functionality such as a Tool Help which takes users directly from the tool on the tool bar to the tutorial instruction about that tool. The sites offer more than 40 searches on 25 feature layers. The GIS features are hyperlinked to the LDNR SONRIS Oracle database and FileNet for imaged documents. The GIS coastal features are hyperlinked to large quantities of scientific data. The Area of Interest (AOI) Tools work with the Measure and Go-to-Coordinate Tools allowing creation and measurement of on-screen polygons both from heads-up digitizing and coordinate upload in text file format. User created polygons can also be exported in text file format. The GIS Web sites allow printing of maps on four paper sizes with or without a legend. Shape files for most feature layers can be downloaded from the Active Layer in the Map View. A Zoom-to-Scale Tool is provided for working on mapping projects in different areas of the state and printing them at the same scale. To save time making maps, the Web sites provide a GIS Tool Bar in the Map View when the right mouse button is clicked. A comprehensive tutorial is provided for new users along with LDNR HelpDesk services and regular SONRIS training workshops in several Louisiana and Texas cities.

More than 100 LDNR staff members and consultants use the SONRIS GIS daily to perform their work. Many more use it weekly or monthly to review geographic data or access Oracle data hot-linked to GIS features. Several hundred coastal and oil and gas users outside LDNR access the system to make maps or download data daily. LDNR Information Technology (IT) staff has trained over 1,000 persons in workshops in the use of the SONRIS system.

LDNR GIS ESRI Web utilization reports generated by WebTrends show greater than 26,500 hits per day representing about 350 sessions, and that over 2,600 unique users generate 176,500 maps per month representing approximately 14.6 GB of map data.

HISTORY

The first successful oil well was drilled in Louisiana in 1901. Since then more than 230,000 oil and gas wells have been permitted. If an oil or gas well is proposed on state land or water bottoms, the area must be leased from the state. There have been thousands of such leases granted by the state dating back to 1915. Currently, there are approximately 2,000 active state leases (with the number of leases changing every month after the lease sale).

Until recently, the entire complex leasing procedure was largely a manual procedure requiring a large staff and a long period of time to process the leases. Important steps in the process include 1) review of oil and gas exploration and production in and around proposed leases; 2) a historic review of active and inactive leases in the area; 3) approval of proposed leases prior to the lease sale; 4) the monthly lease sale; and 5) collection/auditing of the new leases' income and resultant royalties for the state. These and more than 100 other steps in the process required many staff members and three months to collect and analyze the necessary data prior to the monthly lease sale.

One of the most important steps is the recording of each proposed lease and each new lease in a geographic format. This was formerly done by hand on 1:40,000 hard copy maps.

The proposed leases were drawn in the approximate locations submitted by companies interested in leasing state-owned land or water bottoms. After some of the leases were sold at the lease sale, the leases not purchased were erased from the map, and the new leases redrawn. This system was very inaccurate, and often the inaccuracies led to problems among the state agencies and lease owners.

Another important step is the evaluation of special areas which relate to the leasing. There are 23 types of the special areas included in the analysis. The old procedure was for each geologist and/or engineer responsible for a proposed lease to walk around a room looking at maps pinned to the walls. From these different types of maps at different scales, the staff estimated the location of the proposed lease and took notes on which special areas related geographically to the proposed lease. This procedure was called “Walk-the-Walls”.

The evaluation of oil and gas production in and around the proposed leases was one of the most difficult of the tasks, as much of the work had to be done from paper files and archaic 1970s COBOL computer records which were difficult to access. This step required computer programmers to work with OMR and OC personnel on a daily basis to input data and produce reports with the correct information for well management and state land leasing.

LDNR LEASING PROCESS COMPUTERIZATION AND AUTOMATION

In 2002, OMR planned a complete overhaul of its entire state land and water bottom leasing procedure, intending to computerize and automate all the manual steps in the leasing process. The leasing process consists of over 100 steps and was planned in three phases. Phases 1 and 2, covering all steps up to the sale of the leases, are complete. Phase 3 is in the development phase. This discussion is a simplified version of the entire process and will concentrate on the GIS aspects, as GIS is the driver of the entire operation.

Companies proposing leases (hereafter referred to as “nominations”) must submit a CADD DXF file to OMR containing detailed nomination boundaries generated from survey plats. These nominations may be any shape or size (minimum size requirement), but are normally from several hundred to several thousand acres in size. Each DXF file is inspected and cleaned up by the OMR GIS section if necessary for conversion to ArcSDE format. Each time the nomination computer file receives new input, the automated conversion process runs automatically, updating the ArcIMS OMR password-protected GIS Web site with the new nominations (not public records). At the same time the GIS update is occurring, the nomination polygons are sent to Oracle Spatial for an automated Walk-the-Walls special area analysis report. This report is the key to the leasing process in that it evaluates all special areas, checks the boundaries of the proposed leases against existing leases, state boundaries, and inshore/offshore boundaries, etc. Notes for the lease document are generated from this procedure warning those bidding on leases that the lease may have special conditions depending on what types of special areas are involved. Nominations conflicting with other nominations or leases or other important boundaries are returned to the company to allow them to correct the problems. All of the special areas and boundaries are GIS layers so if there is a question raised by the Walk-the-Walls report, OMR staff can investigate by using the GIS Web site.

Special Area List:

- Counties
- Nominations
- Tracts
- Active Leases
- Wildlife Management Areas
- Legal Areas
- School Indemnity
- State Lands
- State Water Bottoms
- Fairway/Anchorage
- Oyster Leases/Seed Grounds
- Townships/Sections
- Shell Dredging Areas
- Scenic rivers
- Coastal Areas/Blocks
- Louisiana Three Mile Offshore Territorial Boundary
- Texas/Louisiana Border
- White Lake Preserve
- Geophysical Permits
- School Board 16th Sections
- Lease Minimums

When Walk-the-Walls has been completed, special area notes are added to the nomination computer record with Oracle Forms. For this process, IT has added a Java Applet to Oracle Forms that displays an ArcIMS map of a specific nomination on the Forms document. This allows the OMR staff to see the nomination and associated special areas to aid in checking the validity of the special area notes.

When a nomination is a state-owned river, stream, or bayou, the company must submit a nomination boundary greater than the extent of the state-owned area since it is LDNR's responsibility to determine the extent of the state-owned area. OMR's GIS section digitizes the stream or other state-owned section of the nomination from the digital orthophoto quarter quad (DOQQ) aerial photos with the ArcIMS Measure Tool and generates the total area. This acreage is compared to the acreage estimated by the company proposing the nomination for the area and adjustments are made if necessary.

Also occurring at this time is the geologist/engineering review of oil and gas production in the proposed lease and surrounding area for setting minimum rental price per acre and other considerations. The staff uses the OMR GIS Web site to select adjacent leases and wells for review. These selected leases and wells are hyperlinked from the GIS Web site directly to the Oracle database for leases and wells and to imaged lease documents.

At this point, the OMR GIS Section creates plats (formal maps) for each nomination with a customized ArcGIS Plat Tool. The plat tool features automatic labeling and scaling and a choice of raster image backgrounds and boundary layers such as sections and townships or offshore areas and blocks. This tool creates shape files for the specific area for archive purposes.

The procedures listed above consumed several weeks using manual processes. Now, the time to run these procedures has been reduced to less than a week depending on the number of proposed leases and the complexity of geologist oil and gas production analysis.

Nominations which have passed the required analyses are forwarded to the State Mineral Board for approval to be put on sale. The nominations become “tracts.” A second layer of OMR GIS data is then created for tracts. This tract layer is automatically reformatted into ArcSDE and repopulates the old tract layer of the preceding month on the OMR, the LDNR internal, and the public GIS Web sites as the layer has become public data.

During the lease sale, companies submit closed, sealed bids for the leases they desire to obtain. These bids are then opened, and the staff evaluates the bids using ArcGIS desktop software (to be Web-enabled in Phase 3). If only parts of tracts are bid upon, a new lease boundary is created at that time, although much of the proposed lease analysis data is still applicable. As soon as the leases are signed and returned to LDNR, the third leasing layer, New Leases, is created and is added to the Active Lease layer on all the GIS Web sites.

Besides providing access to the leases on the SONRIS GIS Web site, OMR offers a monthly GIS Mineral Leasing CD by subscription incorporating Active Leases and Tracts and several background layers with ArcExplorer 4.0 as the viewer. Shapefiles from this CD can be moved to desktop GIS systems for use by the subscriber.

The computerization and automation of the OMR leasing process have resulted in several improvements, all of which have enabled Louisiana to earn millions of additional revenue dollars from the leasing of state-owned land:

1. Reduction in the amount of time required to process nominations, tracts, and new leases. OMR staff has traditionally worked on nominations and tracts three months in advance. This time period will be reduced to two, or possibly one month, with automation.
2. Additional staff time to allow for better quality control of data. OMR staff is able to spend more time working with industry to improve the quality of data input to OMR.
3. Improvement in record keeping for leases and oil and gas well exploration and production. Instant access to the Oracle data and imaged documents through the GIS provides a check for data completeness and quality.
4. Improvement in historic active lease geographic positioning with GIS. OMR is using GIS to find mistakes in older lease boundaries and to correct such mistakes using ESRI products.
5. Access to archived GIS files for tracts not purchased and expired leases. OMR lease analysts can expand their ability to set lease price minimums by having access to more data than ever before.
6. Improved access to data, documents, and maps by LDNR staff, the oil and gas industry and private citizens. The Louisiana oil and gas industry is saving time, and as a result, money by being able to remotely access data which was formerly only accessible in paper files or in difficult to access databases. Improved information leads to more leasing and drilling, increased industry employment, enhanced economic development, and additional collection of oil and gas royalties by the state.

Future plans include:

1. Automation of the geology/engineering nomination/tract review process. This will allow standardization of the process and increase the speed and accuracy of the analyses.
2. Live online access to the GIS Web site, data, and documents for Mineral Board decision making. This will replace a paper map book of tracts which the Mineral Board receives at the monthly meeting.
3. The creation of a new and very complex GIS layer for unitization (well shares based on surface geographical and/or subsurface geological relationships).
4. Submittal of nominations by industry via the GIS Web site. LDNR IT personnel have developed an ArcIMS tool to allow input of coordinates in several different projections into the Web site and the creation of a nomination polygon. This function now allows potential nomination proposers to analyze their nomination with the GIS data present on the SONRIS GIS public Web site. If the nomination submittal-via-Web is approved, the coordinates will be accepted into SONRIS and the processing for the nomination will begin.

REFERENCES

Louisiana Department of Natural Resources Web Site
www.dnr.state.la.us

LDNR Strategic Online Natural Resources Information System
<http://www.sonris.com>

LDNR GIS Access/Interactive Maps Page
<http://sonris-gis.dnr.state.la.us/website/sonris/viewer.htm>

All the information for this paper was gathered from LDNR staff members and consultants. No formal references were used.

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