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TITLE: PREPARATION OF NORTHERN MID-CONTINENT PETROLEUM ATLAS

Cooperative Agreement No.: DE-FG22-95BC14817

Contractor Name and Address: The University of Kansas Center for Research Inc.

Date of Report: November 4, 1996

Award Date: August 24, 1995

Government Award for Current Fiscal Year: \$ 250,000

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Reporting Period: July 1, 1996 -- September 30, 1996

Objectives

Project will develop a prototype for a digital and hard-copy atlas of petroleum fields and reservoirs in the northern Mid-continent region. A limited number of reservoirs in Kansas are to be included in the prototype project, but the goal is to expand beyond the prototype atlas to include significant reservoirs representing the major plays in Kansas, Nebraska, South Dakota, North Dakota, the Williston basin portion of Montana, the Denver-Julesburg basin of eastern Colorado and southeastern Colorado.

Primary products of the prototype atlas will be on-line accessible digital data bases covering two selected petroleum plays in Kansas. The regional databases will be supplemented with geological field studies of selected fields in each play. Digital

imagery, digital mapping, relational data queries, and geographical information systems will be integral to the field studies and regional data sets. Data sets will have relational links to provide opportunity for history-matching, feasibility, and risk analysis tests on contemplated exploration and development projects. The flexible "web-like" design of the atlas provides ready access to data, and technology at a variety of scales from regional, to field, to lease, and finally to the individual bore. The digital structure of the atlas permits the operator to access comprehensive reservoir data and customize the interpretative products (e.g., maps and cross-sections) to their needs. The atlas will be accessible in digital form on-line and through CD-ROM using a World-Wide-Web browser as the graphical user interface.

Regional data sets and field studies will be free-standing entities that will be made available on-line through the Internet to users as they are completed. Technology transfer activities will commence in the early part of this project, providing data information sets to operators prior to the full digital atlas compilation.

Summary of Technical Progress

"Pages" and data schema for the atlas overview and field studies have been developed and are accessible through the world-wide-web. The atlas structure includes access to geologic, geophysical and production information at levels from the national, to the regional, to the field to the individual well. Several approaches have been developed that provide efficient and flexible screening and search procedures. The prototype of the digital atlas is accessible through the Kansas Geological Survey Petroleum Research Section (PRS) HomePage (The Universal Resource Locator [URL] is <http://www.kgs.ukans.edu/PRS/PRS.html>). The Digital Petroleum Atlas (DPA) HomePage is available directly at <http://www.kgs.ukans.edu/DPA/dpaHome.html>. Technology transfer is underway through presentations at national and regional meetings and through the use of monthly electronic updates and the on-line availability of the DPA products. Project information and Quarterly Progress Reports are linked to the Digital Petroleum Atlas HomePage.

On-line Prototype

The prototype digital atlas has been designed, tested and constructed. A new navigation bar at the top simplifies the standard page structure. Included in the bar is a new button that accesses a site map. The map outlines the structure of the entire Atlas, and is active so if you click on one of the rectangles you will jump to that section of the Atlas (Figure 1). The site map should help in navigation through the Atlas and provide the user a feel for its general structure. The URL for the site map is <http://www.kgs.ukans.edu/DPA/dpaMap.html>. At present the prototype covers four counties (Grant, Ness, Stanton and Stevens) and four fields (Arroyo, Big Bow, Gentzler and Schaben). The status of each of the counties and fields included in the Atlas can be accessed on-line (Figure 2). The URL for the status chart is

<http://www.kgs.ukans.edu/DPA/Reports/statusChart.html>. The prototype also covers play and field information for Kansas and the Mid-continent. The present prototype design consists of the following components: "

DPA HomePage: <http://www.kgs.ukans.edu/DPA/dpaHome.html>

The DPA HomePage includes links to project information, such as progress and topical reports, and to discussions of plays, basins and geological provinces at the national, regional and Kansas levels. Active links are provided to DPA information at the Bartlesville Project Office. Information at the national and province level is from the US Geological Survey 1995 National Assessment of United States Oil and Gas Resources (available on CD-ROM from the U.S.G.S. as Digital Data Series DDS-30, Release 2). The U. S. G. S. material has been supplemented and in some cases replaced by regional and play material covering the Kansas basins. Additional maps of regions and geologic provinces, overview discussions, historical data and Quicktime movies of the exploration history at national, province, basin, and play levels have been linked. All information is linked through graphical user interfaces.

Examples can be found at

National Level: <http://www.kgs.ukans.edu/DPA/frontEnd/regions1.html>

Province Level: (Mid-continent Province)

<http://www.kgs.ukans.edu/DPA/frontEnd/Region/midcontinent.html>

Basin Level: (Anadarko Basin)

<http://www.kgs.ukans.edu/DPA/frontEnd/Anadarko/anadarko.html>

Play Level: (Morrow Play)

<http://www.kgs.ukans.edu/DPA/frontEnd/Anadarko/Morrow/morrow.html>

Also included on the DPA HomePage is an expandable listing of producing regions, basins and plays (<http://www.kgs.ukans.edu/DPA/frontEnd/Plays/regionList1.html>). Clicking on the plus will show more detailed information while clicking on the minus will show less detailed information about the selected region, province or play.

Access to the Kansas DPA HomePage is through the National DPA HomePage.

Kansas HomePage: <http://www.kgs.ukans.edu/DPA/dpaKansas.html>

Kansas specific play information has been expanded down to the county level and there is increased integration of play, field and geographic location. Access to this information is through the Oil and Gas Province Map of Kansas that has been designed as a graphical user interface. The Kansas Oil and Gas Province Map is located on the Kansas Atlas page or can be accessed directly with the URL <http://www.kgs.ukans.edu/DPA/Plays/ksProv.html>. As an example, the area of the Anadarko Basin is active and a click on that area will lead to a list of plays. (Example Morrow Sandstone Oil and Gas (<http://www.kgs.ukans.edu/DPA/Plays/Anadarko/morrow.html>)). Each play provides a map showing distribution of the play and various charts of accumulation size versus time. Click on any county on the play distribution map and you will get a list of plays within the county with +’s and -’s. Click on the + in front of Morrowan and you should get an expandable listing of fields under that play and in that county. Clicking on the plus will provide links to more detailed information while clicking on the minus will show less detailed information about the selected play. We will be working on increasing the integration of play, field and geographic location within the Atlas.

Parameter Searches:

The parameter search remains unchanged, but additional data has been added to the databases. Fields and wells can be searched by geographic location, name (API number or field name) and in the case of fields by a flexible search routine that incorporates production and geologic parameters. Searching fields by parameters can be accessed at <http://www.kgs.ukans.edu/DPA/Forms/GeneralInfo.html>.

County Maps:

Regional maps show the field outlines and provide access to selected geologic and geophysical maps. Click on the name of the field to go to pages about that field. Access through a GUI stratigraphic column to show structure or isopach maps. Stratigraphic columns were improved and additional horizons added.

Field Title Page:

Outline of producing leases; location of discovery well(s), condensed field statistics, and access to field production data. Additional information was added to all the fields covered by the Atlas. Data additions include log analyses of individual wells using PFEFFER (<http://www.kgs.ukans.edu/PRS/software/pfeffer1.html>), scans of original completion reports (ACO1's), well and lease production, and other well and field data. The status of field level information for each field is shown in Figure 2. The URL for the status chart is <http://www.kgs.ukans.edu/DPA/Reports/statusChart.html>)

Regional Setting:

The regional setting page provides a geologic and production perspective at a regional scale. Nearing completion are play discussions that are fully integrated with the other DPA information.

General Information:

Basic geologic, geophysical, fluid, engineering, completion, and production data at the field scale.

Geological Information:

Access to geologic field maps and cross-sections through a type log graphical user interface. Clicking on selected horizon provides access to multiple maps at different levels.

Geophysical Information:

At present, geophysical data for Arroyo Field in Stanton County is available.

Reservoir Information

This page contains access to petrophysical plots and to core descriptions <http://www.kgs.ukans.edu:80/DPA/Arroyo/Reservoir/arroyoRese1.html>. The page will contain additional reservoir engineering and geologic information.

Well Information

These pages provide access to information on a single wellbore. Access is through an interactive map (click on the well symbol) and through a forms-based search. Data includes raster image of original completion report, digital "scout ticket" data, production data in graphical and digital formats, and digital log data. Prototype pages have been developed for presentation of core data (such as core photos, porosity and permeability data, descriptions, and thin-sections). Additional wells and information have been added for all fields and the field information is nearly complete.

Technology Transfer

The prototype Digital Petroleum Atlas remains one of the most visited pages on the Kansas Geological Survey web site (Current usage statistics can be accessed at the bottom of the Petroleum Research Section HomePage or at http://www.kgs.ukans.edu/PRS/usage/past_stats.html). Usage continues increase to over 6,000 access "hits" per week (Figure 3). Presentations at the Kansas Independent Oil and Gas Association (KIOGA) on August 26 and at an educational seminar for the Kansas Petroleum Council on September 18 were well received. Additional presentations are scheduled for the Annual Meeting of the Geological Society of America on October 28 (Abstract attached), the IOGCC Annual Meeting on December 9 and the Powder River Basin Section of SPE on May 14, 1997. A paper to be published in COMPUTERS AND GEOSCIENCE uses the Digital Petroleum Atlas as an example of new forms of on-line publication. A copy of the manuscript is available on-line at http://www.kgs.ukans.edu/PRS/publication/OFR96_37/abstract.html.

Comments have been received from oil and gas operators that indicate that the product is meeting a need. Included is a selection of email comments from operators (names and affiliations removed).

"The digital petroleum atlas is one of the few worthwhile petroleum sites on the internet. You are demonstrating what can be done with the Web. We need more states to start doing what you are doing. Until we see more products like this the small independent will not be on the internet."

"I think the Kansas O&G database is great and wish the project much success. I wanted to know when monthly well and field data would be available. Also will injection data also reside in the database eventually? Have you thought about writing Java applets that would plot data various ways and do decline analysis."

"I really like the direction you're taking with the Digital Petroleum Atlas. This is the kind of information I've been hoping for from KGS and PTTC. Can't wait for you to start on other counties (like Lane and Ness for example hint, hint). Keep up the great work."

“This service is very useful and saves a great deal of time.”

“You have done an excellent job! Love the feature, keep up the good work.”

Color Key Kansas Section of DPA General Section of DPA Other parts of KGS Web Site

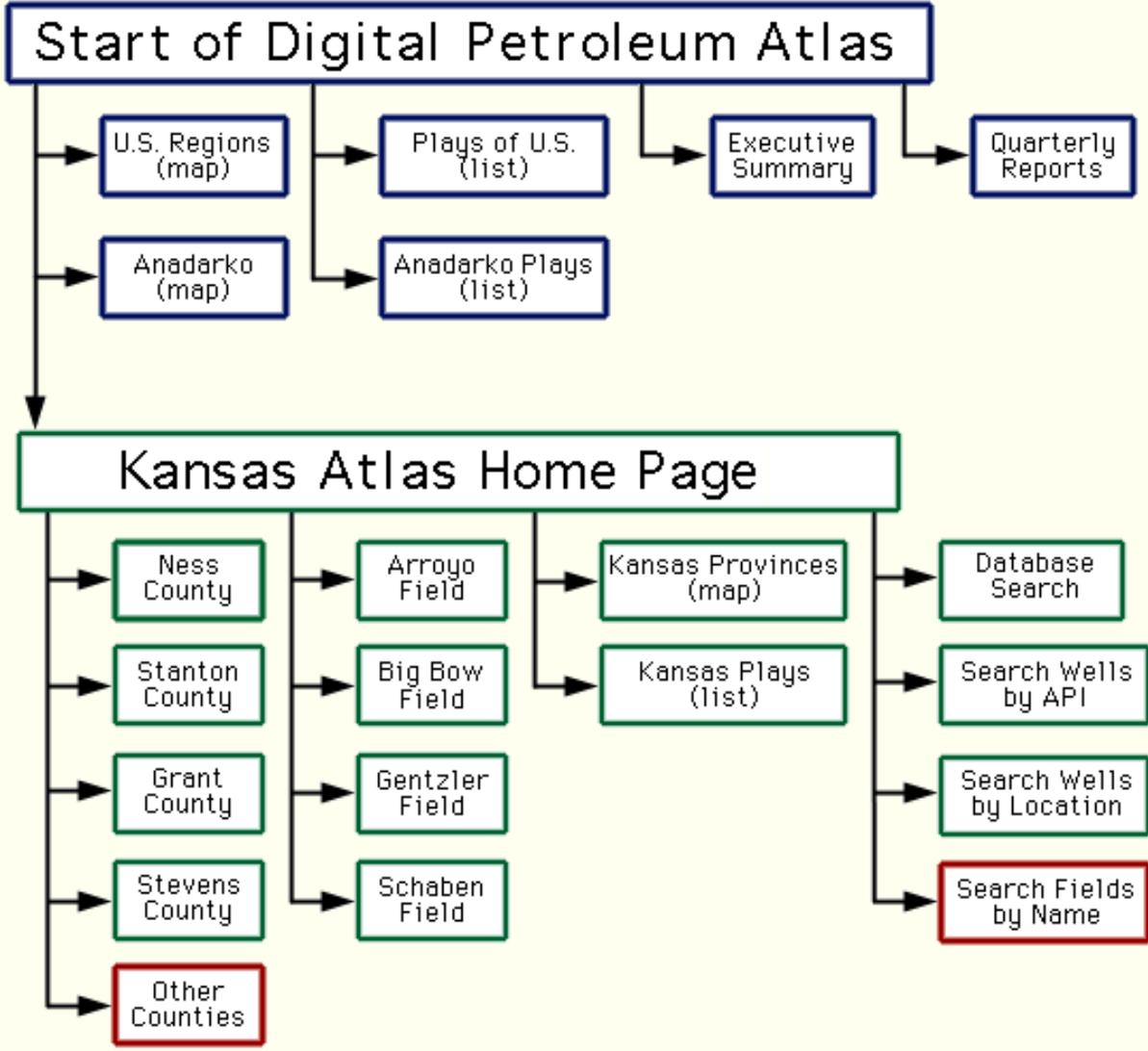


Figure 1.-- Digital Petroleum Atlas--Site Map. Map provides an overview of the Digital Petroleum Atlas structure and can be used to navigate to specific areas of the atlas. Map is a graphical user interface that can link user to specific areas of the DPA. Map is accessible from tool bar at the top of all DPA pages. The direct URL is <http://www.kgs.ukans.edu/DPA/dpaMap.html>.

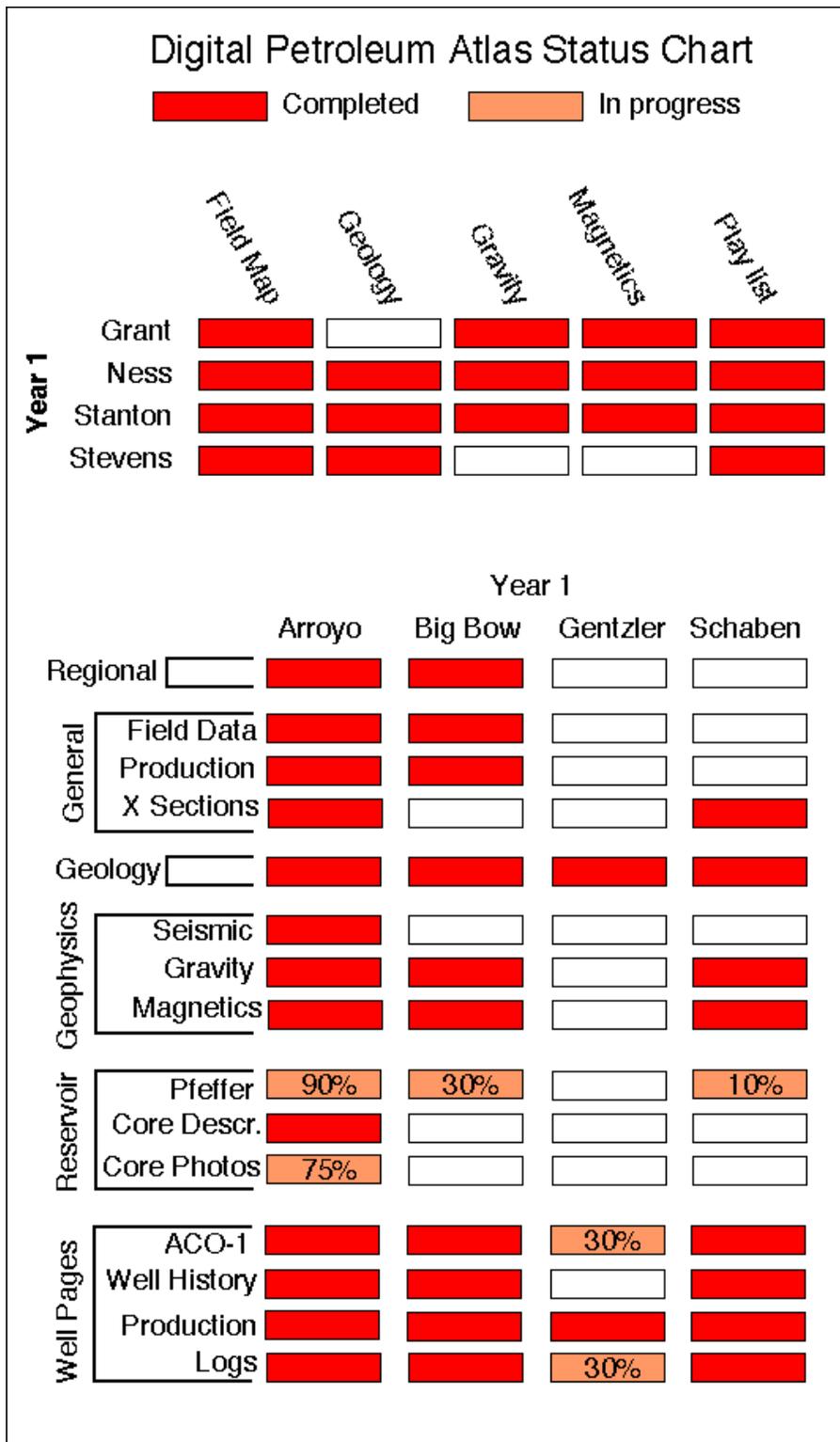


Figure 2.-- Chart showing the status of each of the counties and fields included in the Digital Petroleum Atlas. Chart can be accessed on-line at <http://www.kgs.ukans.edu/DPA/Reports/statusChart.html>

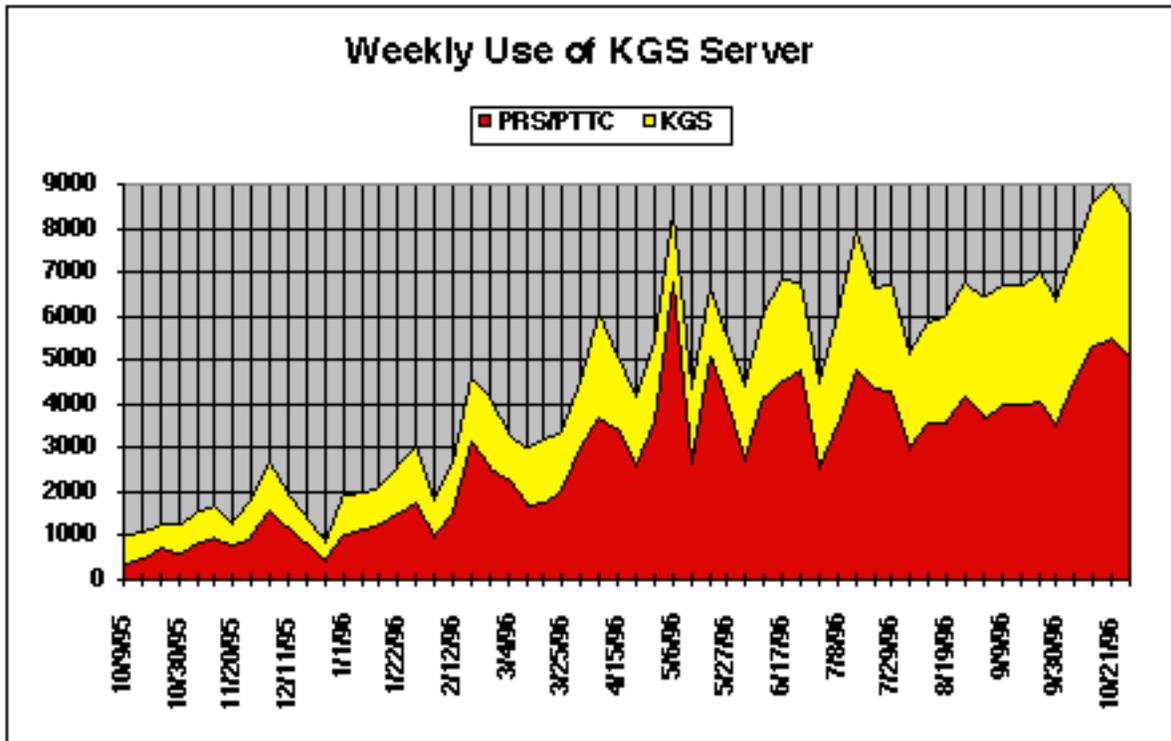


Figure 3.-- Usage of the Petroleum Research Section (PRS) and Kansas Geological Survey web site through the week of 28 October 1996. Updated graph and detailed statistics are available at http://www.kgs.ukans.edu/PRS/usage/past_stats.html.