Globalising GIS in Shell

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Shell Exploration and Production (Shell EP) is the most profitable division of Shell, operating worldwide. Cultural diversity, experiences and creativity in people is balanced with a need to act quickly and apply best practices to provide a competitive edge in an ever-changing world. The modus operandi of Shell E&P changed from a local to united, global operating model during 2003 to assist this process.

During the organisational re-design, GIS was explicitly recognised as a key enabling technology to leverage the value of our information asset, allowing quicker, more informed business decision to be made.

This paper will describe:

- The drivers for Shell's global organisation and how GIS supports this.
- The route taken to arrive at a global enterprise GIS.
- The first truly global GIS business applications in Shell.
- The GIS plans ahead.

Note : Our broad definition of GIS in this paper encompasses management, visualisation, and analysis of any information with a geographic component.

Shell's Global EP Organisation

There were many advantages to be gained through the introduction of a global operating model, aimed to increase both effectiveness and efficiency of the organisation.

Organisational Driver	***Global Application of GIS***
Allocation of limited local expert resources to	• Explorationists located in the United Kingdom applying their knowledge to undertake geological mapping for

globally prioritise opportunities	Brazil.
Global processes to shorten learning curves and enable the sharing of resources and experience	• Best practices and knowledge sharing network (GIS Technical Advisory Panel) for the last 10 years • Standardised global PC desktop environment and software application, which includes ESRI ArcGIS.
Remote management of operations	• Data management from Europe to support local GIS data interpretation located in Russia. • Application and data hosting in Europe for African ventures.
Reduction of cost	• Reduction in local data duplication through pooled regional/global GIS networks (portals, web services, etc.). • Utilising out-the-box GIS products, with minimal software customisation co-ordinated at a global scale (standard legend, layer management, portal, etc.). • Economies of scale in data procurement, both regionally and globally from third party data providers.
Outplacement of activities to low-cost countries	• Existing global IT call centre will provide GIS helpdesk (24 hours, 7 days week).

Shifting towards a global operating model during 2003 posed challenges in the way information is managed. All forms of local information needed to be consolidated and made available in a consistent and standardised way on a global scale to enable a larger community to find, understand and use the valuable information asset.

The spatial location acted as the natural integrator for information often stored in different applications and databases, frequently managed by different organisational groups (despite sharing the same common spatial location). With about 80% of all E&P's information having a spatial or geographic component the location of assets was the simplest connection that could be made.

The route to arrive at a global enterprise GIS

Within the countries where Shell EP operates it was common to find a dedicated group (Geomatics department) responsible for the management of the geographic component of assets. These assets included wells, pipelines, concession and sub-surface hydrocarbons - both expected (prospects) and producing (fields).

The Early Skills required to effectively manage the geographic information, have evolved over time as technology has matured. In the late 80’s and early 90’s, within Shell, most geographic based information management was performed by surveyors and cartographers. The focus during that time was on acquisition and presentation of relevant information, to a desired accuracy, and quality. This was commonly presented in paper form.

The Era of CAD, most notably MicroStation, but to a lesser extent AutoCAD (for engineering) dominated in Shell since the late 1970’s. Individual products were generated from data which was often acquired multiple times - it was easier than attempting to convert or manipulate existing data.

Later during the mid-to-late 90’s, improvements in underlying technologies (CAD, GIS, personalised databases) and broader IT skills became more commonplace in the workplace. This facilitated a slow evolution and later revolution in the management of (geographic) information.

Growing trust in data from others – Whilst the focus remained upon acquiring quality data, the increasing speed of decision making in the business meant that more emphasis had to be placed to re-use existing data. Mining for internal (cross-discipline) and Third Party data became socially acceptable i.e. there was a growing trust using other people’s data, with vendors gaining experience servicing global customers.

GIS early-adopters The mid-90’s marked a time when Shell EP set out to introduce a unified, standardised enterprise GIS.

The selection of the first GIS system was driven by the depth of technical functionality available in a product suite – not by ease of use for end users. Genamap (Genasys II) was successfully introduced in 15 countries where Shell EP operated. For technical guru’s Genamap provided a robust, UNIX based workhorse. End-users did not have the time, nor inclination to learn a command-line driven tool, which resulted in Shell investing to create an enterprise wide, UNIX based GIS system called Group GIS. This aimed to be a user-friendly GUI driven GIS.

The development and deployment of Group GIS system introduced users : to the language and concepts of GIS; to the impact of data visualisation to improve the

quality of existing data; to sharing of data between disciplines of properly managed data; to opportunities for creative thinking through manipulation of data, enabling more informed business decision making.

GIS in Shell's mainstream IT environment. The internal success of the home-grown GIS system during the mid-90's created a growing enthusiasm and wave of demands by the business for more. More usability, more data integration, more analysis tools and less reliance upon a small number of highly skilled technical guru's.

The shift from self-build to off-the-shelf products was a conscious one made in the 1998-9 by Shell EP. Despite ESRI being the market leader, Shell's evaluation process and decision to adopt their tools was still not taken lightly. Shell's drive was to establish GIS in the mainstream, to be easily available on everyone's desktop. The selection of GIS had to fit Shell's global IT infrastructure - Microsoft NT and Oracle databases. GIS data inter-operability through a common database and application suite was essential.

The adoption of ESRI's product suite with ArcGIS as the main product fulfilled the requirements to fit into Shell's mainstream IT infrastructure when coupled with data storage in a vendor independent database such as Oracle Spatial.

Oracle Spatial, ArcSDE and Other Formats. Since 1999 the strategic intent was to implement Oracle Spatial through Shell EP as the (only) corporate geographic data store. This has, until now, not achieved the global penetration first envisaged by Shell.

Shell faced a steep technical learning curve and struggled to resource (internally or externally) skilled staff to assist with the adoption of Oracle Spatial. With hindsight the route and progress may have been easier by adopting a more ESRI centric GIS implementation strategy - drawing upon a wider external consultancy network. However, irrespective of the underlying data storage format (ArcSDE Binary or Oracle Spatial), ESRI's tools for the management of data have posed equal challenges to be overcome when operating within a global, standardised, controlled (PC and database) enterprise environment.

Today a mixture of global, corporate Oracle Spatial databases are complimented by regional data repositories utilising Oracle relational (ArcSDE) and

simpler formats from both ESRI (Shape Files and Geodatabase) and MicroStation (Design Files).

The availability of technical skills and organisational support has, and will continue to drive the selection of GIS data formats adopted.

The GIS Landscape

Shell recognises that geo-information is not only managed and used by mainstream GIS (formats and functionality) alone, but co-exist with other GIS *"capable"* vendor products.

Figure 1. The Exploration and Production Life Cycle

Table A demonstrates how geo-information is used and for what purpose in the Exploration and Production business life cycle (*figure 1*), and with what GIS products (mainstream GIS or otherwise).

Purpose	Function	Data	User	GeoScience: Explore	GeoScience: Appraise & Develop	Engineering: Produce	Engineering: Decommission
Show data	*View*	*V, R*	*Casual*	*WEB, GIS, other*	*WEB, GIS, CAD, other*	*CAD*	*CAD*
Simple Query	*Point in polygon ;Overlay; Buffer*	*V*	*Casual*	*WEB, GIS*	*WEB, GIS, CAD*	*GIS, CAD*	*GIS, CAD*
Business Analysis	*Full range of GIS operators*	*V, R*	*Power*	*GIS, FME, OS*	*GIS, FME, OS*	*GIS, FME, OS*	*GIS, other*

Work flow where extensive data manipulation or reformatting required

(GIS) DeskTop GIS ; (CAD) = 3D and 2D CAD ; (Web) Web-GIS ; (OS) Oracle Spatial functions ; (V) Vector Data ; (R) Raster Data; (FME) Feature Manipulation Engine (by Safe Software Inc) ; (other) Technical subsurface visualization/interpretation tools.

Table A : The use of geographic information, with what GIS products, during which phase in Shell's EP business life cycle.

At present, the main value for Shell EP will be in removing the boundaries in data sharing, manipulation and editing between CAD and GIS. This boundary is depicted in table A by

The first truly global GIS application in Shell

Shell has focused to implement ESRI software suite married closely to underlying databases. The quest has been to standardise GIS around the globe and improve

utilisation of existing data to glean new insights through GIS. Despite struggles and tensions as we learn the new IT tools and skills to drive the deployment, there have been several notable successes which best depict the achievements made. A few brief examples are listed here :

[Enterprise GIS] Global Exploration Management System (GEMS)

Imagine a situation where geologists located in the Far East and South America are both completing the identification and mapping of different subsurface hydrocarbon resources (prospects). New businesses are also being identified, triggered by the resolution of a disputed national boundary, subsequent permit (licence) rounds, or changing economic conditions. Choices must still be made as to which opportunities will be funded.

Figure 2 Global Exploration's GEMS central geo-information database and distributed data editing.

In themselves these are normal activities in Shell, utilising GIS, local and Internet hosted Third Party data. However, the difference is that as of February 2004 all these activities now occur in "real-time", utilising a single ESRI GIS-enabled corporate data centre located in Europe, and maintained by people in each country. The net result allows Shell's Global Exploration management team to dynamically manage the portfolio of business opportunities, steering the strategic direction for Exploration in Shell – all with one eye on GIS.

As a result of clear business drivers and a champion within the organisation, GEMS has put GIS in the limelight and increased focus to deliver an integrated, corporate solution. A global virtual team, incorporating Shell's internal GIS and business experts, Third Party consultants and ESRI support

(regionally, and ESRI's headquarters in Redlands) collectively achieved this.

The unique Enterprise solution utilises Microsoft .Net, out-the-box ArcGIS and minimal ArcObjects customisation. Shell's data is held in one Oracle Spatial database. Third Party data is managed external to Shell and hosted via the Internet to ensure an up-to-date view of industry activities, removing the need to duplicate data management (and IT) services within Shell. The end-users utilise the system and information via thin-client Citrix hosted environment for global access within Shell's global IT environment.

Explorers located in many countries now simultaneously maintain (edit) their local assets, which form part of the overall global portfolio of new and existing business opportunities. Real-time business analysis and decisions are being made globally, confident in the knowledge that the most up-to-data information is being used.

[Enterprise GIS] GIS integration in Shell's Corporate SAP Portal

There is a wide range of data available within Shell's corporate SAP portal. Generic news feeds (CNN, BBC) and industry specific oil & gas events are available. Drilling down to internal and externally hosted technical information, held in libraries and other data repositories, is one mouse click from users.

The information sources commonly available inside the portal were text based. However, the business demanded the ability to visualise geographic information and enhance the existing text-based searching through use of the geographic component.

At a local level, and occasionally regional level, Shell has made some successful ArcIMS web gis mapping projects, aimed to publish critical geographic information of relevance to key user groups. Examples include environmental biodiversity monitoring and pipeline asset management. Some early experimentation and adoption of metadata has also resulted in the development of an IntraNet "Geography Network". However all these projects were aimed predominantly at GIS-competent user groups to visual and search for data, which was performed outside the portal environment.

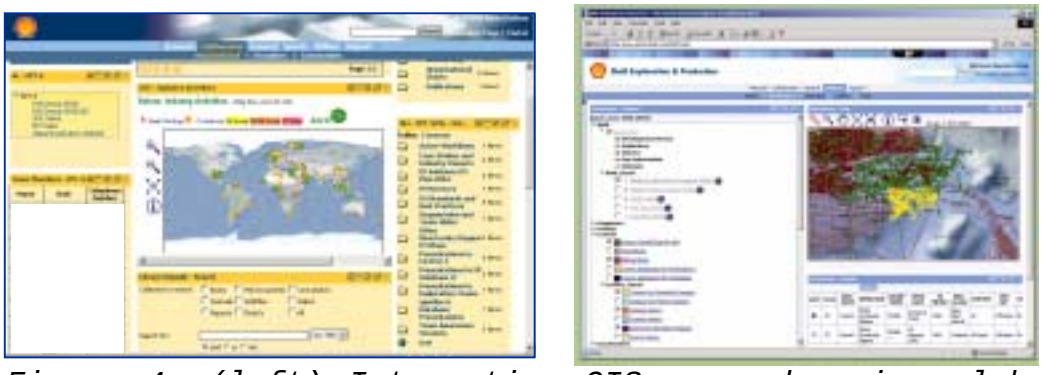

Figure 4a (left) Integrating GIS as a dynamic, global news feed (left) ;4b (right) Geographic and text querying of portal content (right).

In mid-2003 a project was started to integrate geographic information as a standard portal data source for visualisation and data querying. Having established the IT integration between ESRI ArcIMS and the SAP portal, the existing text based query engine was enhanced in February 2004 with the addition of an integrated geographic search engine.

The Geo Information Plans Ahead

GIS has rapidly become a global system within Shell, with local challenges becoming global challenges. The plans ahead focus on improving further the efficiency and effectiveness with which the business can make informed decisions based upon our geo-information assets. This will require quicker and smarter use of available geo information, tools and expertise.

For the short and medium term Shell EP's GIS efforts will concentrate on:

- Globally integrating geographic data and documents. Harness information held within Shell's corporate memory that is currently managed in library systems and non-graphic data repositories. Global library workflow processes must be altered and document classification taxonomy supplemented by geo-coding. End users will benefit by being able to carry out "*Google*" type queries on the Intranet to quickly mine relevant data also using the geographic component in the search engine.

- Reducing and hopefully eliminate the need for data conversion (and individual preparation) between CAD and GIS to display, query and manipulate spatial and

attribute data. With support of Vendors further streamline two-way data interface between CAD and GIS.

- Sharing of GIS data between the various sub surface applications through a common format (e.g. ArcSDE) or ‘connector’ such as OpenSpirit.

- Improving efficiency of data sharing and GIS data manipulation/querying through wider adoption of web based services (ArcGIS Server, ArcIMS) on a global scale.

- Implementing a corporate, global Spatial Data Infrastructure (SDI), using ESRI’s GIS technology, standardising data models and workflows across Shell. Publish yet more geographic information through the global SAP portal front-end.

- Ensuring geo reference integrity within and between the various GIS enabled applications in use in Shell EP. Use certified coordinate conversion engines and globally accepted geodetic parameter databases, for example APSG/EPSG (Americas/European Petroleum Survey Group).