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Taking advantage of geography to maximise decision making and performance

Maps have always been an important information tool for resource and energy organisations. By using Geospatial/Geographic Information Systems (GIS), resource companies can help improve their understanding, decision making and performance within their organisation. Widely recognised as a key tool to help organisations better manage their asset base, GIS is uniquely placed to help combine disparate data and provide a powerful visual integration of an organisation's enterprise data. This article will introduce the key areas for applying GIS, the benefits an organisation can realistically expect to achieve and some of the challenges and issues likely to be encountered. In this edition, we have asked GeoSolveIT, an award winning and independent provider of business ICT solutions using geographic information systems (GIS) to provide us with an overview of how organisations involved in the metals, minerals and energy market can leverage the use of geographic information to help improve strategic and operational decision-making.

It is often stated that 85-90% of business data has a geographic component. This is most definitely the level of geographic content that would be expected within natural resource organisations. For example, in the June 2008 edition of *Global Capital Magazine*, 3D laser mapping was discussed as a technology to help capture topographic information in order to assemble key data about volumetric information for mines. Geographic Information System (GIS) can help organisations improve their decisions by combining geography and its associated information. Whether it is analysis of land ownership boundaries, permitting, infrastructure location decisions, or the operational management of your assets, if you have not considered using GIS, you may be failing to maximise the returns on your assets. How organisations collect, manage and report geographic- related information is vital. Geographic data should be one part of an organisation's wider consideration in its information management strategy. How this data is harnessed within an organisation will directly impact the benefits realised.

So just what is GIS?

In its simplest terms, GIS provides organisations within the metal, minerals and energy industries with the capability to manage data. GIS brings information from one or more data sources and analyses and presents this within a single uni ed map-based environment to help make more informed decisions. Provided it is possible to relate information held to a location or geographic area (say a mine or political boundary of operation), it is then possible to consider the use of GIS-technologies to bring together disparate data in a highly effective and informative manner. Crucially, GIS can help decision-makers visualise geographic relationships through the use of a map base to integrate and derive additional value from otherwise disparate information repositories scattered across their organisation. GIS is therefore more than just a tool to create hardcopy maps, (although this is often a key output), it is an effective and flexible tool with the potential to offer businesses a highly pervasive analytical solution that transcends an organisation and delivers genuine returns on investment. The power of information management within the context of GIS should not be underestimated.

The Geospatial Information Technology Organisation (GITA) is a global professional association representing the interests of users and vendors of GIS technologies around the world. Major asset owners are members of GITA, including most of the major oil and gas companies. Bob Samborski, executive director of GITA remarks: "In its simplest form, the term 'Geographic Information System', or GIS, is an acronym for a technology that offers a radically different way in which we produce and use the maps required to man- age our communities and industries. Using computer

programmes, the technology links items displayed on a map with records in a database with the answers displayed on a map. The resulting combination, and the ability to manipulate the data in response to any number of 'what if' scenarios, provides industries with a powerful and dynamic new tool that has opened doors in management effectiveness and organisational efficiency. A GIS creates intelligent super maps through which sophisticated planning and analysis can be per- formed at the touch of a button."

Many will have no doubt encountered the term 'GIS' in discussion. However clients will describe GIS in accordance with their own experience and exposure to the technologies. Some may see it as a way of working, others a toolset, others a general framework for managing data, others simply as a way to map information. Whichever definition they use does not matter. The key is that GIS has been recognised as a toolset that helps the business add greater value to the tasks and decisions it makes as an organisation. Indeed as many organisations realise the extra value GIS can add, their definition of the technology will change.

Increasingly with the advent of the World Wide Web, GIS is now an embedded capability often subservient to a range of information solutions across an organisation. Most recently, the advent of Google Maps and Virtual Earth has done much to increase the exposure of the use of mapping to support the dissemination of web-based mapping applications. In both cases, the power to visualise and readily understand key relationships in data is vital.

Executive GIS

Imagine the ideal dashboard for the executive team.

This will be easy to use and provide the executives with a 'one-solution' to identify key performance data on the organisation's assets. Just how might this work?

- In its centre, a world globe with polygons outlining asset ownership, colour-coded by profitability, and that can be zoomed in to show colour coding by percent ownership, and zoomed further in will pop up the contact information for each operational or division manager;
- To the right are listed key economic indicators that are rendered on the globe view;
- To the left is a list of menus that provide the capability to drill down by operational unit (the central globe view having changed to a map view similar to operation managers');
- At the top left and right are small windows with date, time and stock ticker values;
- The bottom half is split among calendar to the left , and emails to the right.

This would allow executives to quickly scan an area of interest before its operational manager visits, and helps fully prepare for negotiations with joint-venture partners later that morning. Then they can quickly review – that is, view roll-ups and not input - engineering details to be fully briefed on a trouble spot with field managers that afternoon. It also allows the executive – who isn't and shouldn't be a technical expert – to pull various maps and tables into a vibrant and pertinent presentation to investors later that evening (Figure 1).

This is just one example of how geography and information can combine to bring about real value and appreciation of the business. By bringing together data across the organisation and linking to a map base, organisations have an immensely powerful way to

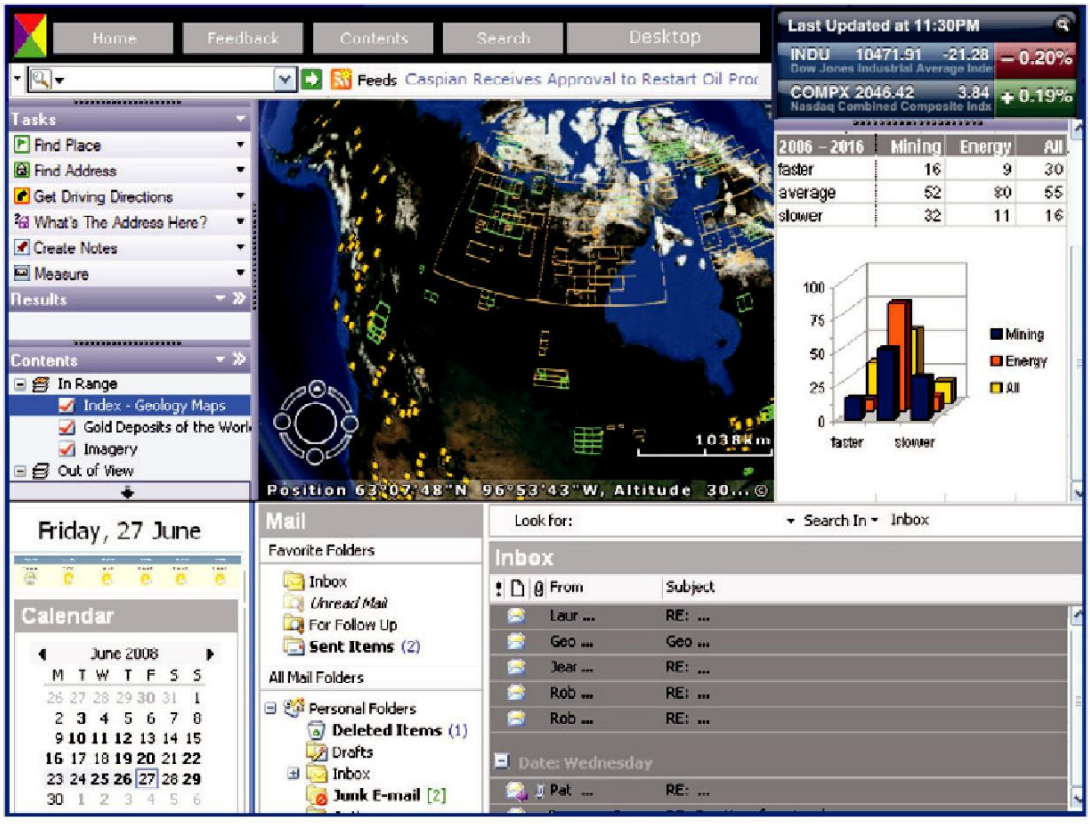


Figure 1: A typical GIS dashboard showing a range of information all available at the touch of a button.

understand and communicate key strategic and operational data.

GIS throughout the business

As already noted, GIS has the potential to have an impact across the business. So just how might GIS impact metals, minerals and energy companies?

Crucially, because a GIS may be an embedded technology subservient to other technologies (for example the corporate intranet or operational asset management system) the use of GIS technologies may not and – this author would argue – do not need to be 'called' GIS. Instead GIS, if it is to grow and develop in its maturity within an organisation it must become a tool as part of a wider business-focused information solution that integrates disparate datasets.

Selected examples of GI technology adoption in the resources industries are:

Application	Description
PDA	Field data capture of competitor well locations, own pipeline segments, mining equipment etc.
PDA	Field data delivery for seismic surveys, environmental monitoring etc.
Desktop	Integration of remote sensing, map data, scans, etc., all properly registered geographically.
Desktop	Analysis of pipeline routing, play generation, mine planning, environmental permit application etc.
Desktop/web	Map and table data integration, internal from teams or management, external from partners or agencies
Web browser	Map-based data entry or processing on secure intranet from remote office locations anywhere.
Web browser	Map-based report delivery on open extranet to partners, agencies and the public anywhere.
Web server	Centralised geo-processing of large data sets, for remote offices access on ultra-secure intranet.
Web server	Mash-up of company vector/tabular (GIS and otherwise) and public/vendor raster/vector data.
Web server	Integration with corporate ultra-secure intranet of financial, asset management and infrastructure data.

Making the right choice – the case for ROI and GIS

To help understand where in a business GIS can add greatest value, one needs to understand where the greatest returns for a business investment can be achieved. It is notoriously difficult to place a monetary value on some of the qualitative aspects of using spatial data, but nevertheless case studies have been undertaken and there are a number of organisations that have used the technology on a targeted basis and driven large returns to their business. To help resolve some of these issues within asset owners, GITA has developed its return on investment (ROI) approach. This provides a structured approach to determining the return on investment through a proven methodology. This will help an organisation target those 'killer' applications that will provide the organisation with the best return on investment by identifying the expected benefits arising from implementation. This will help to develop the priorities for the development of GIS technologies within the organisation.

The key challenges

Looking to the future, the need and use of GIS technologies as a means of improving decisions within organsations will only increase. As more real-time monitoring and better understanding of an organisation's assets are required, using geographic information will become an increasingly important part of the information strategy to help realise greater performance. Knowing the 'where' in response to questions about the performance of the assets will continue to be an essential information dimension when making strategic and operational decisions.

To make GIS work for the implementing organisation it must become a more widely adopted technology that enables the ready adoption and sharing of information. All too o en, GIS technologies are used in standalone applications; in these instances their value is 'locked in' with the application and not shared in the wider enterprise environment. Bringing about greater integration of GIS technologies requires the achievement of a number of fundamental tasks:

- Demonstrating the business case and convincing senior management that the outlay to implement GIS within their organisation is vital. As stated above, the work of the US-based Geospatial Information and Technology Association (www.gita.org) provides a proven methodology for showing determining the return on investment arising from the adoption of GIS technologies;
- Creating enterprise-wide standards, in particular relating to the capture of data such that information can readily be captured once, but used many times. In doing so, the sharing of data within a standards-based geographic framework will ensure that any form of collected data – for example, geological data, asset locations – can all be shared and analysed with confidence concerning the positional accuracy of the diverse datasets;
- In creating standards, a unified data model that

transcends the organisation will be required if information Flows are to be minimised. This is particularly important to the geographic definition of the assets. Ideally, a single asset model should underpin the display and analysis of spatial data such that data can be shared using the same geographic framework and tools. By adopting standards, this will enable sharing and ease of reporting of asset- related information.

Implementing GIS within the business

There is a generic business process flow common to most resource companies 'from cradle to grave,' and is depicted below in Figure 2.

The key ingredients of GIS are location and attribute data – information that is pertinent throughout a project. By using GIS, information about the project can be geo-referenced and hence searched, queried and reported from the same database based on its location as well as and in combination with other attributes. Envisage a project where information is processed from one step to another:

1. Say a seismic survey is used to spot a well (planning/exploration), then to set up the proper spacing for production wells (production/development), and finally used to tie in the field gathering pipelines (transportation). All such information can be managed and visualised via the GIS...this is syndication;
2. The potential now exists with GIS to ensure data is never re-created, it is always augmented with additional information anchored to identical reference points, e.g. production measurement information gathered over time into a SCADA system. is could be readily brought together through an intuitive mapping interface (development/transportation...this is aggregation
3. The same GI framework can be served up on the web for remote access to joint venture partners or government regulatory bodies (transportation/ divestiture), all with proper access privileges...this is entitlement.

In the case of petroleum companies, it is now typical that Petroleum Exploration and Production (E&P) maps, and therefore geospatial data, are used from the initial planning stages. For example, surface infrastructure data for location (existing roads and pipelines) and environment (populated or environmentally sensitive areas), as well as subsurface geological and geophysical data (drilling and seismic) for the imaging and delineation of potential subsurface reservoir targets can all be displayed, analysed and reported using GIS.

Once an exploration or development programme is commissioned it is critical to precisely de ne any successful venture that the knowledge gained until then is verified and augmented in order to refine and precisely

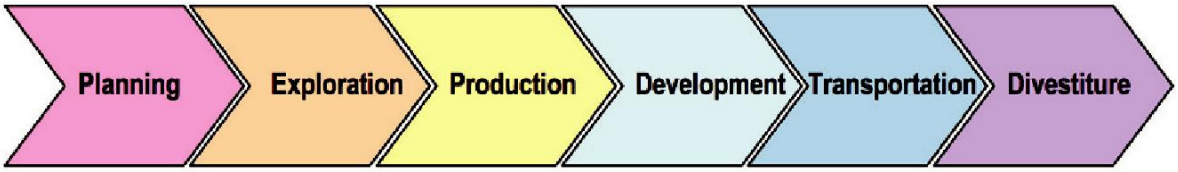


Figure 2: A generic business flow diagram showing business practices employed by most resource companies.

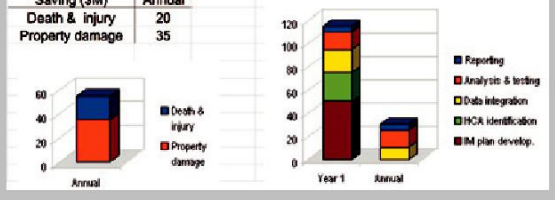
Case Study 1: Pipeline regulations

In the 2003 public consultation'RSPA-00-7666,' the US Pipeline & Hazards Material Safety Administration (PHMSA) pegged a return-on-investment based on the annual cost versus benefits of pipeline integrity management, against an initial outlay.

Years	5	10
Benefit	275	550
Cost	215	365
ROI %	28	51

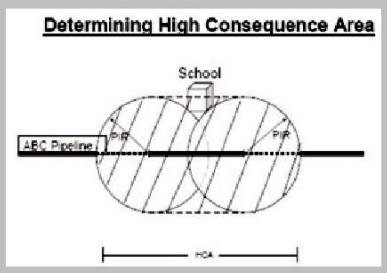
Expense ($M)	Year 1	Annual
Reporting	5	5
Analysis & testing	15	15
Data integration	20	10
HCA identification	25	
IM plan develop.	50	

Saving ($M)	Annual
Death & injury	20
Property damage	35



Pipeline transmission and distribution companies have an infrastructure of pipelines last decades or more. And they carry flammable liquids at or near the surface. Their proper planning and location is therefore more critical, to the extent that stringent environmental regulations must be met by 2009 in Europe. How can GIS help?

New pipeline regulations not only restrict the proximity of at-risk areas (environmentally sensitive, more dense and less mobile population), they require the reporting and periodic inspection of cathodic protection (against metal corrosion) and MAOP (maximum allowable operating pressure) of the pipeline against prescribed standards. The tracking, calculation and mapping of so-called High Consequence Areas is best handled by GIS, as it keys all pertinent data to their location, and calculations of buffer areas along the length of a pipeline are not simple (the diagram below is from the US PHMSA, Part 192 – Transportation of Natural and other Gas by Pipeline: Minimum Federal Safety Standards).



Pipeline inspections mentioned above, and regular auditing for mergers and acquisitions or communications with emergency management teams (internal or external) for example, require detailed and timely reporting of the locus, status and the state of the pipeline network at any given time (planned or unplanned). GIS data management means that all information is maintained accurately and thus ready to be queried and reported upon. GIS tools will, moreover, allow managers to be specific on which section they need reporting at any time.

[1] *http://www.phmsa.dot.gov/*
[2] *http://www.hse.gov.uk/pipelines/hseandpipelines.htm#legislation*

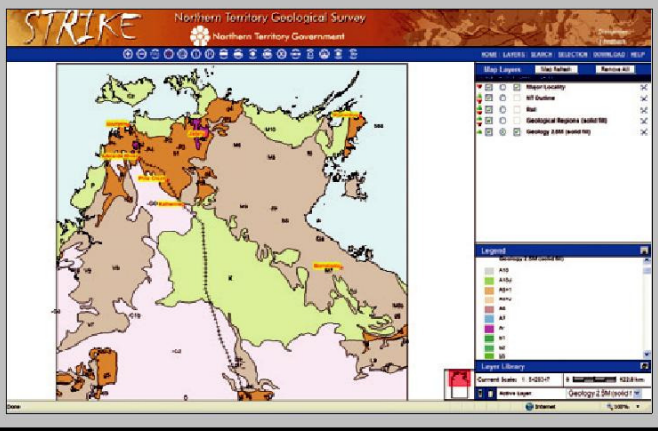
Case Study 2: STRIKE

The Northern Territory government in Australia identified that to ensure future investment in the territory's mining sector, it needed to encourage exploration throughout the region. The government launched 'Building the Territory's Resource Base', an incentive programme aimed at promoting the prospectivity of the Northern Territory through the delivery of quality geoscientific data to exploration companies both in Australia and overseas.

The key challenge facing the government was how to make its large amount of geological data (much of which are stored in disparate formats) easily accessible to potential explorers, especially given the remoteness of the territory.

The result was STRIKE, a toolset developed by NGIS Australia for the Northern Territory government. STRIKE's ability to interact with multiple data sources enables users to spatially compare both vector and raster geological, geophysical, exploration, tenement and ancillary data for the entire Northern Territory. Vector layers can be queried and downloaded, providing explorers with much better insight into the potential prospectivity of an area.

According Kon Vatskalis, Northern Territory mines and energy minister: "STRIKE is an exciting tool that can be ac- cessed by explorers wanting to do business in the territory. This is a fully interactive application, allowing minerals and petroleum exploration companies to add or remove layers of information, zoom in and out of the map display and search for specific information to determine the prospectivity of any area in the Northern Territory."



de ne the programme that will be presented to external stake holders (e.g. joint venture partners and local agencies). This may include plans to delineate the location, factors and costs of the programme, a means to monitor their evolution through the life of the programme and timely maps and reports that will keep all parties informed and engaged.

Towards a strategy for adoption

Here are some of the key factors to consider when adopting and developing GIS in a resource organisation:

• Have agreed standards: Standards should be defined to enable easy sharing of information. This should encompass the data and methods of capture as well as common standards for reporting on the asset;

• Integrative workflows: All information is at hand and can be modelled into workflows that help develop every step of the petroleum or mining life cycle;

• Measurable ROI: Pegging monetary values to the geographic and engineering framework allows to calculate, predict and adjust the economics for better pro t;

• Rational framework: A single ground truth of all relevant surface infrastructure and subsurface E&P;

• Audit and reporting: All the pertinent information can be queried and tabulated in its location and temporal context, and thus can be reported upon for audits.

Concluding remarks

From this brief overview, it becomes clear that a geo-information framework can only benefit the business processes of a petroleum or mining company. And it can only help in days of intense competition for permits and capital, and even more intense scrutiny of internal audit and external scrutiny – corporate transparency is now truly possible with an end-to-end geo-information system that is both internally rigorous and externally visible.

About the author

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Case Study 3: BHP Billiton

As a global market leader, BHP Billiton has been quick to recognise that mining, more than most other industries, depends on locational information. Accurate, accessible and reliable knowledge about the position of infrastructure, such as lease boundaries, rail lines, heritage sites and plant, is crucial to both the effective optimisation of an orebody and to preserving community support for mining activities.

In 2005, BHP Billiton Iron Ore acknowledged that it needed a system to manage and access location data at an enterprise level and commissioned NGIS Australia to develop a solution. Although many business units collected and used spatial data, there was limited coordination of software and methods, and no easy way for information to be shared. This ad-hoc approach met localised needs, but failed to deliver consistent, accurate information on a timely basis to the organisation as a whole.

The review identified that a uniform spatial approach was likely to deliver significant time and cost savings while helping to alleviate the multi-million dollar risks associated with inappropriate infrastructure placement, inaccurate property boundaries, or operational activities being carried out in the wrong place.

Notable for its simplicity and user appeal, the ioMaps system demonstrates an innovative and sophisticated approach to integrated spatial applications. It successfully utilises web services and a powerful tasking engine to combine more than 800 datasets which interact seamlessly with business processes via a single browser interface.

It would also help the company satisfy growing public demand for accountability by integrating environmental and cultural heritage information with mining and geological data in a single, holistic view that was available to all staff .

The application sets a new benchmark in Australia's mining industry and helps to increase productivity, reduce cost and risk, and improve the speed and accuracy of critical decision-making.