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Geographic Information Systems 2004 Update: Essential Technology for P&C Insurance

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Report Coverage

This TowerGroup Research Note provides an overview of geographic information systems in the P&C insurance industry. TowerGroup believes this technology has the potential to increase efficiency and impact the most important areas of information processing in the industry today. This Note also provides a brief overview of several GIS vendors. In addition, we propose a prototype strategy for use of GIS by insurance companies that will make GIS an actionable component of carriers’ information technology (IT) and business infrastructures.

The Geographic Dimension of Insurance

The insurance industry continues to be under pressure to increase its cost efficiency and automate its operations, delivery channels, and customer relation activities. Changes in federal and state legislation have added the specters of demutualization, consolidation, and financial services convergence to the list of things that keep insurance executives awake at night. To meet these challenges often requires insurers to spend more of their budgets on information technology. Individual companies are increasing their use of technology in order to improve the efficiency of specific business areas such as underwriting, risk management, claims handling, distribution channels, and marketing. Insurers also need to consider tools that provide a broad spectrum of both tactical and strategic advantages for dealing with the challenges mentioned. Geographic information systems enable a wide range of solutions that are ideally suited to optimize many areas within an insurance company.

TowerGroup Take-Aways

- Geographic information system (GIS) technology is an essential enabler for insurance operations because of the actionable knowledge it can add to traditional data on policyholders, claims, and service providers.

- Some carriers use GIS technology to power locator functions on their Web sites that find the agent or service provider nearest to the customer; others use it to improve risk management, underwriting, and rating territory analysis.

- The recent emphasis on higher-quality risk management and the analysis of risk concentration has increased interest in geospatial technology.

- Investments in GIS technology can benefit noncore insurance areas such as property management, real estate investment, company-owned agency management, and employee benefit services.

- The reason that carriers have not widely adopted GIS as a strategic solution may be that it is a technology that enables optimization of many processes rather than a large initial savings for a few projects.
GIS technology provides information centered on the geographic dimension of data and the ability to process existing data in that context. Other terms used to describe this type of technology are “geospatial intelligence” and “location-based intelligence.” What makes GIS such a useful technology for property and casualty insurers is that almost all aspects of insurance have a geographic component. Whereas traditional insurance data concerns the “what” of P&C insurance (the vehicle or property that suffered damage, the names of persons involved, the address of a risky location), GIS technology concerns the “where” (useful details keyed to the geographic dimension of the physical space the “what” inhabits).

Using geography as a key to insurance information can yield efficiencies in many aspects of insurance. When more data and information are made available to the mix in any insurance transaction, better decisions can be made, costs can be better controlled, and profitability can be increased.

**Overview of GIS Technology**

A geographic information system is an application of information technology for the purpose of managing the location dimension of data, an aspect of information that is overlooked or neglected in most business transactions. Without GIS, even if a data record has a geographic component, such as an address, region, or postal code, that data rarely has any depth beyond its primary use such as mailing or work distribution. The closest a business not equipped with a geographic information system usually comes to using GIS technology is to access an electronic map from Microsoft’s Expedia “Streets” product or from MapQuest. Although map access is convenient, reliance on such technology is a false economy. An insurance company’s offering such “electronic maps” on its Web site is the equivalent of being satisfied with offering only “brochureware” on the company Web site. These static information-only Web sites miss entirely the value of e-commerce and e-business. Likewise, simple mapping fails to address an insurer’s need to integrate geographic or spatial analysis into its business or insurance activities. Spatial analysis is the process of relating business objects or events as referenced by their geographic location in a known area and their attributes.

A GIS system works on the many dimensions of data stored in a relational database. The data can be referenced by a common factor known as a “key” in information processing terminology. The most basic key for a GIS system is the latitude and longitude pair that describes a location. A more commonly available key is an address, a postal code, or a political division such as a county or state. Any point on the surface of the earth can be defined by a latitude and longitude pair (in GIS lingo, a “lat/long”). Once an area or location is defined, it is possible to link it, via its key, to many types of information available about the area. Examples could be the number of automobile accidents recorded for a particular intersection or the proximity of a house to a seacoast that makes it susceptible to hurricanes. The key in the case of the intersection could be its generalized location as defined by the lat/long of the center of the streets in question; the accident data would come from the local transportation department for the municipality.

**A Wealth of Data**

One of the most interesting aspects of a GIS is that the data related to the intersection in the previous example is not limited to one or two features. The lat/long key of the intersection could also reference the age of the traffic signals, the type of material used as paving, the number of vehicles that travel through the intersection, the number of policyholders that cross either road, and much more. A large component of the GIS marketplace involves the collection and distribution of computerized geographic data. Some of the geographic data is sourced from independent firms, but a large portion comes from US government agencies such as the US Census Bureau, US Geologic Survey, and Department of the Interior. That data is
then merged with many other types of information from government or commercial sources. The merger, called geolocation, produces spatial data, information that is logically tied to a region of four-dimensional earthbound coordinates: latitude, longitude, altitude, and time.

A Brief History of GIS

Layers of Information
Modern GIS is based on a technique of cartography that forms a composite map by layering transparent films, each showing different features of an area. In the past, a cartographer might, for example, overlay a basic political map with a transparency showing only geographic features such as bodies of water and another transparency showing transportation infrastructure features such as roads.

As computerized data processing matured in the late 1950s and early 1960s, early computerized mapping was done by printing alphanumeric characters on paper to form lines crudely bounding an area within which data on some feature, say number of voters, might be printed (see Exhibit 1). The utilities industry pushed for more detailed mapping to indicate the location of infrastructure elements such as power and telephone poles, sewer and water lines, and fire hydrants.

As information technology evolved in the 1960s and ‘70s, so did computerized cartography. Data formats became standardized, and spatial data was stored in databases. Improved input/output devices allowed for production of higher-quality maps. These basic events and the demand for geographically referenced information led to the creation of GIS applications as we know them today. GIS was used initially in environmental impact studies, urban planning, and military applications.
**GIS History: From Layered Maps to Satellite Positioning**

<table>
<thead>
<tr>
<th>Early 1960s</th>
<th>Late 70s to Mid 80s</th>
<th>The 1990s</th>
<th>Today</th>
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<tbody>
<tr>
<td>First computerized maps, printed on paper, have some data represented.</td>
<td>Enhanced graphics allow for greater detail and complexity of data representations; databases store spatial data; GIS workstations and PCs proliferate.</td>
<td>Spatial databases, object-oriented data models, 3D imaging, space imaging, and GPS combine to make GIS a highly powerful toolset.</td>
<td>The miniaturization continues with handheld GPS devices, PC cards (PCMCIA cards) for laptop computers or embedded as add-ons to personal digital assistants (PDAs), pocket PCs, and cellular phones as GIS gets smaller and more accurate.</td>
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**Exhibit 1**
GIS History: From Layered Maps to Satellite Positioning
Source: TowerGroup

**Satellite-Enabled Global Positioning and Imagery**

Systems designers continue to apply the latest advances in information technology to improve the functionality, ease of use, and accuracy of GIS. In 1996, the US Department of Defense made the satellite-based NAVSTAR global positioning system (GPS) publicly available. This greatly increased the accuracy and ease of determining latitude, longitude, and elevation, and the number of commercial and personal GPS receivers in use has burgeoned as a result. Automobiles equipped with GPS devices employ GIS software to help drivers find the best route to a destination or simply to locate themselves in unfamiliar surroundings. On May 1, 2000, President Clinton authorized removal of the degradation signal that limited the accuracy of the nonmilitary GPS data to 100 meters. As a result, all GPS receivers can now work with a nominal accuracy of 10 to 20 meters. A technique called differential GPS, which employs multiple receivers and earthbound transmitters to augment the satellites, is accurate in determining location to within a fraction of a centimeter.

The size and cost of GPS receivers continues to shrink. Receivers and antennas have gone from backpack size to lunchbox size to palm size. In the past five years, handheld GPS devices from companies such as Garmin and Trimble Navigation have become popular with boaters, hikers, and hunters. The current crop of GPS is implemented as PCMCIA cards (PC cards) for laptop computers or embedded as add-ons to personal digital assistants (PDAs), pocket PCs, and cellular phones. PCMCIA, or Personal Computer Memory Card International Association, is an international standards body and trade association that has promulgated the PC Card Standard that enables data to be transferred readily from small portable devices.
to PCs.) GPS technology has been a significant part of the continued development of GIS, and the combination of these two geographic technologies has particular import to the insurance industry.

**Seeing the Big Picture.** Satellite and aerial imagery continue to benefit from technological advances that increase their utility and reduce their cost. GIS software providers and the vendors of imagery have worked to ease the integration of image data with other spatial data. This enables sophisticated geographic analysis and data presentation without the need for specialized image consulting or more expensive software products. The results are images that can be tied very accurately to physical features visible on photographs. This gives insurers the ability to analyze the intersection of real-world elements with logical data elements. For example, this capability has been used to determine which properties are actually in a flooded area by comparing the known location (lat/long) of a house and the farthest extent of floodwaters by means of aerial or satellite photographs taken over several days of flooding.
Examples of GIS Utilization in P&C Insurance

For an insurance company to make optimal use of a geographic information system, it must understand this technology’s flexibility and applicability to many insurance and general business processes. It is important to recognize that almost every process, and consequently every data record from that process, has a geographic component. It is fair to say that “everything has to be somewhere,” and that includes policyholders, prospects, competitors, service providers, risks, and employees. The following sections of this TowerGroup Research Note briefly review the potential applicability of GIS utilization for the sales and marketing, underwriting, and flood insurance functions of P&C insurance and give examples of actual systems implementations.

Sales and Marketing

E-Business

Much GIS activity in insurance companies focuses on e-business functions such as agent and service provider locators. These may not represent the highest expenditure but are deemed crucial. The locator function within a Web site is a perfect example of an interactive GIS application. Unless a locator function has a GIS component that is integrated into a company’s e-business operations, it is simply a list that is manually maintained and not necessarily accurate. GIS locator functions use a combination of GIS-enabled maps, street addresses, and other spatial data to match policyholders with the providers of services they need, such as glass replacement shops or auto body shops.

A good example of this application is Microsoft MapPoint. Software from this product suite provides agencies with a Web-based locator to insurers as well as detailed driving directions. This product and ones like it maintain an accurate spatial database that has geocoded public addresses (i.e., mailing addresses with a lat/long associated) and a list of agencies or provider addresses as well. When a policyholder enters his or her address information on a GIS-enabled Web site, the GIS determines which of its available providers is the closest to the customer’s location. Other functions compare spatial database coordinates to calculate potential routes between the policyholder’s location and that of the service provider. The provider’s location is highlighted on the resulting Web page map along with the suggested route. Beyond the Web-enabled scenario, the same mechanism can be used by an agent or by a call center to assist a policyholder or claimant.

Marketing

Other valuable uses of GIS are found in insurance company marketing areas. Before GIS, the marketing department of an insurance company would purchase mailing lists aligned with various demographics such as young married couples or affluent seniors. The accuracy of the lists and the resulting success of marketing campaigns were questionable at best and hard to gauge.

To improve marketing analysis and the results of marketing campaigns, insurance company marketing departments can make use of GIS, pertinent geographic data sources, and demographic data. Data sources such as the US Census Bureau’s Topographically Integrated Geographic Encoding and Referencing (TIGER) offer street centerline maps, demographics data, and local tax assessments that allow for general estimates of income. The same methods can be used to study retention efforts and cross-sell opportunities. While some have expressed concerns that such techniques can lead to the illegal practice of “red-lining” poorly performing areas, the opposite can be argued. Companies such as Direct General Insurance use MapInfo’s GIS solution to study their current pattern of sales and policyholders in order to be proactive in urban renewal efforts in economically depressed or distressed areas.

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P&C insurance companies should consider how a GIS could improve customer relations while enhancing the productivity and effectiveness of an agent force. The advent of the Internet channel for insurance sales and service heralds the era of what TowerGroup calls the customer-controlled relationship (CCR). CCRs will become the norm as more consumers of financial services literally control the time, place, and extent of interaction with financial holding companies. Insurers can offer premiums and discounts to entice customers to “opt in” and authorize the sharing of some of their personal data through a combination of channels such as a Web site or installed GPS device. The insurers can then use the data gathered to produce an in-depth model of behavior and lifestyle that will be useful for marketing, underwriting, and servicing of policyholders.

**Underwriting**

**Geographic Factors in Risk**

In the underwriting operation GIS can yield a high return on investment (ROI) by improving the accuracy of underwriting for automobiles and homeowners insurance. Insurers that use GIS to improve their underwriting performance can accurately determine key factors involved in auto risks such as distance to work, route driven, garage address location, and auto theft statistics for work, home, and garage address. When assessing risks, insurers that provide homeowners’ and small commercial policies can check on geographic and spatial features such as distance to a fire station, distance to a fire hydrant, soil type, location on a floodplain, windstorm risk factors, and windstorm history as well as road surface types.

The combination of GIS-related data and rule-based expert underwriting systems will streamline the underwriting process and reduce costly errors. Underwriters can segment risk more finely by incorporating more granular geographic data. The result will be less underwriting “leakage” (inaccurate matching of risks to pricing and rating tiers).

**Rating Territory Validation and Correction**

During the underwriting process, an underwriter can use a GIS to check whether a policy has been assigned to the appropriate rating territory. Although this application may seem elementary, it shows an immediate ROI because it highlights miscoded policies. Rectifying this type of policy leakage is tantamount to gaining a new stream of revenue since the carrier can use the information to collect the appropriate premium for the rating territory from holders of the miscoded policies.

Besides the increased profit obtained by correcting miscoded policies, rating territory analysis prevents fines from state insurance regulators for incorrectly coded policies. This type of application is a win/win for the carrier.

**Personalized Risk Assessment**

The trend toward accessing more data at underwriting time will lead to issuance of a new type of insurance product, the personalized risk analysis policy. Progressive Insurance of Mayfield, Ohio, made news headlines several years ago with the pilot of a system it called Autograph, which was a real-time “pay-as-you-drive” mechanism for setting premiums. The Autograph system used GPS tracking and cellular communication to establish the location, speed, and distance a vehicle had traveled. After reviewing the data, Progressive produced a bill that very closely matched the risks incurred. If the vehicle made short trips on less crowded suburban streets, the bill was smaller than if the vehicle had traveled moderate distances through heavy traffic on freeways. The Autograph test, which ended in 2001, found that the biggest issue wasn’t privacy concerns. Instead, Progressive felt the device was too expensive (mainly
due to the GPS component) and drivers resented having to pay to get it installed. Progressive is now experimenting with a different component, TripSense, which does not include a GPS component. It is unclear at this time whether this approach to insurance pricing and rating will appeal to consumers. The approach does, however, offer a look into the future of personalized risk and pricing made possible by IT and particularly by GIS.

**Flood Insurance**

One of the earliest uses of GIS in the insurance industry was to facilitate the federal government’s drive to have floodplain dwellers purchase flood insurance rather than rely on federal disaster grants. The federally backed insurance is provided by the National Flood Insurance Program (NFIP), created by Congress in 1968 and administered by the Federal Emergency Management Agency (FEMA). NFIP works with local, state, and federal government agencies to provide the insurance to communities that make use of floodplain management techniques and enforce ordinances designed to mitigate losses from flooding. Insurance companies handle the sales and underwriting aspects. In 1983, the Write Your Own (WYO) program was created to allow participating P&C companies to write and service under their own names the Standard Flood Insurance Policy created by the Federal Insurance Agency. The WYO companies receive a fee to cover the cost of underwriting and claims processing, but the government covers all underwriting losses. The goals of the WYO program are to help NFIP to distribute the flood policies more widely and to promote awareness of NFIP.

![Savings Due to National Flood Insurance Program](image)

**Exhibit 2**
**Savings Due to National Flood Insurance Program**
Source: Federal Emergency Management Agency
FEMA credits NFIP with helping to reduce flood damage by nearly $800 million a year. This can be attributed to the fact that buildings constructed to NFIP standards suffer 77% less damage than those that don’t meet the program’s standards. Benefits to the consumer are substantial as well, as shown in the FEMA graphic in Exhibit 3.

**Selling and Underwriting Flood Insurance**

To pinpoint the location of a current and potential policyholder who lives in a flood zone, an insurer previously needed to get access to a hardcopy floodplain survey called a Flood Insurance Rate Map (FIRM). Created by FEMA and the US Geologic Survey, these maps are named according to extent of flooding and frequency (e.g., 100-year flood zone or 500-year zone).

Modern GIS technology has allowed for creation of digital floodplain maps to augment the detailed hardcopy surveys produced by FEMA. Insurers can integrate them into a GIS for general flood insurance operations and then pursue at least two approaches. One is to plot the location of a policyholder’s home or business on the digital map as a new layer. This provides a marketing and sales tool to agents and their managers. A second approach would use the same type of map to assess flood exposure for a given area. To facilitate either process, a GIS programmer would perform a spatial query highlighting those properties situated in a flood zone. The resulting new layer would mark homes with a color gradient indicating the level of risk associated with each location. An icon on a marketing opportunity map would then be used to alert agents to the homes most in need of flood coverage (see Exhibit 3).

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**Exhibit 3**

**GIS Representation of Floodplains**

Source: MapInfo, TowerGroup
**Catastrophe Response**

Being able to respond to policyholders efficiently during the claims process is critical for an insurance carrier to succeed and grow. The need for rapid response is amplified after a catastrophe (CAT) such as a large-scale fire, earthquake, or windstorm. The hurricanes that struck Florida during August and September of 2004 left a trail of death and destruction. Several carriers have been able to improve their response to such catastrophes via GIS technology, which helps to locate claimants’ properties and route resources to them. While the value to an insurance carrier in terms of efficiency of resource deployment can be measured, the goodwill and positive customer service generated by the use of location-based intelligence can be worth much more.

Geocoding, GIS, and GPS devices are becoming critical assets for safety-related first responders and for insurance claims handling in the aftermath of a catastrophe. However, as is often the case following a devastating hurricane, tornado, fire, or other CAT event, policyholders are displaced from what is left of their homes. Beyond assessing the damage and providing emergency resources to assist claimants, a carrier with a GIS capability can keep track of where its policyholders have moved so that its follow-up efforts are as efficient as its initial response.

**Claims Processing**

GIS technology is mission critical in claims processing because it enables the insurer to quickly access value claims data. For example, the hurricanes of 2004 could have been devastating to insurance carriers, especially the smaller, midtier carriers, but by using GIS technology, carriers were able to strategically deploy adjusters and hire additional adjuster staff to ensure they had adequate personnel to handle all policyholders’ claims in a specific locale.

**Vendor Spotlight: MapInfo**

MapInfo Corporation (Troy, NY) is a global software company that integrates software, data, and services to help customers realize greater value from location-based information and make more insightful decisions. An established market leader with a history of proven success, MapInfo continues to gather momentum in the market.

**GIS for Enhanced CRM**

One of the MapInfo’s major customers, Florida Farm Bureau Group (FFB), a wholly owned subsidiary of Southern Farm Bureau Casualty Insurance Group, uses the vendor’s GIS software for a variety of processes and strategies. One use of GIS is to automate FFB’s agent force: an agent simply types in a name and an address and the application attaches a lat/long to the address and then queries the lat/long against the rating territory maps as well as pertinent risk data sets.

**Catastrophe Response**

FFB developed a series of CAT response applications using GIS tool sets from MapInfo. The applications allow FFB to calculate which of its policyholders are most likely to be affected by the high winds, storm surge, and power outages along the projected path of large tropical storms. Armed with this foreknowledge, the carrier can plan ahead and be prepared to move CAT response resources into areas with the highest potential for damage. The same system also uses actual data after a storm passes to pinpoint the locations that are most in need of adjusters and other resources. For Hurricane Charley, for example, the insurer used the previously geocoded addresses of policyholders to move adjusters where they were needed most.
**Claims Processing**

FFB also uses GIS technology from MapInfo Corporation to plot the location of policyholders and adjusters down to the street level and then overlays the two files to locate gaps in the network of adjusters. In addition, FFB is able to locate the areas with the highest concentration of claims and deploy the necessary resources. With this type of analysis, the carrier was prepared for catastrophic storms and was able to be proactive in its response to claims. The carrier used GIS subsequently to compare closed claims versus claims not closed to make sure it was tracking all claims so as to allocate resources accordingly. A theoretical sample of claims not closed can be seen in Exhibit 4.

![Catastrophe Claims Not Closed](image)

**Exhibit 4**
An Example of Application of a Geographic Information System to Track Catastrophe Claims Not Closed
Source: MapInfo, TowerGroup

**A GIS Strategy**

The broad applicability of spatial data to insurance makes formulating a GIS strategy very important for an insurer. Without a company-wide strategy, individual departments would likely strike out on their own and purchase incompatible GIS software or data. Economies of scale would be lost for data purchases, training events, and coordinated use of an enterprise-wide GIS. Because a GIS can provide cost-efficient solutions to many aspects of P&C operations, it is one of the few IT applications that cross over to become
a technology infrastructure component, much like communications or Web technologies. Staff responsible for formulating a GIS strategy within a P&C insurance company need to analyze both the carrier’s strategic business goals and its strategy for technical infrastructure in order to prioritize projects that could benefit from a GIS. Once the group has identified and approved several projects, the carrier can purchase and deploy GIS infrastructure components. Crucial components include the following:

- GIS data sources and the contracts for keeping them current and expandable
- GIS server and database selection designed to fit into the existing architectures and infrastructure plans
- Core GIS toolsets to support the creation and distribution of datasets, applications, and training
- End-user tools for viewing and working with geographic data and maps
- Robust GIS output devices for map and report production
- Outsourcing contracts for higher levels of output

Budgets for the GIS infrastructure should include full-time equivalents (FTE) for business liaisons, trained GIS application developers, and a project leader or managers to ensure project success. Training budgets must also be kept at levels sufficient to maintain the department’s technical edge.

**Summary**

Geographic information systems are being utilized by the P&C insurance industry but not always at levels that truly exercise the ability of GIS technology to improve efficiency or impact other strategic goals. Too often the systems are viewed as point solutions and applied in only the most obvious cases. The total context of the operational processes that could benefit from the integration of a geographic solution is quite broad. Once a carrier has established a GIS infrastructure for whatever reason, it should leverage the system in both tactical and strategic projects. TowerGroup research indicates that more insurers are recognizing this fact and taking advantage of this technology to move beyond simple agent locator functions to add a geographic dimension to their business capability.
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