Transport and Works Enterprise G.I.S: How We Got Here

Authors

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Abstract

This is the story of how the Ministry of Transport and Works leverages Geographical Information Systems in driving effective business processes. Having this expertise has facilitated appropriate decision making at all levels, as well as provides transportation services to many organizations. This is also utilized in the distribution and the streaming and sharing of data through web application. This paper speaks to the journey, the strategies and the initiatives employed; from gaining upper management support to the integration of information technology services to develop the Transport and Works' Geographic Information Systems.

History

The advent of Geographic Information Systems (GIS) within the Ministry of Transport and Works (*here in after referred to as the ministry*) came about in the mid 1990's. This was significantly attributed by a number of factors such as the need to enhance the management of the ministry's resources, as well as, the need to improve decision making processes. At the same time, restructurings were being undertaken within the ministry, this was in an effort to modernize its offices under what is called, the **Public Sector Modernization Programme**; this eventually became an impetus that would further drive the need for GIS development within the ministry.

The Ministry of Transport and Works, Jamaica

In actuality, initial works of GIS commenced within the Road Safety Unit. Its main goal under this Unit was to build up a system that would aid in traffic management and of which would inadvertently aid in reducing motor vehicle accidents throughout the island of Jamaica; subsequently this led to the emergence of a **traffic accident database system** in 1999.

The move to further expand the GIS did not commence until 2004; when Senior Personnel made the decision to have a core GIS infrastructure that would manage all aspects of transportation that falls under the Ministry's portfolio (which includes air, land and sea).

Structure of the Corporate GIS

At present, within the Ministry, GIS operations are now being carried out under the Directorate of the Technical Services Unit, with two GIS positions namely; GIS Analyst and GIS Technician. The responsibilities of these GIS Personnel includes activities as it relates to the continuous development of the GIS and ensuring, its seamless integration within the Ministry; provide relevant information for policy decision through analysis; and to bring about the whole awareness of GIS to a wide cross section of Ministry.

Resources

Major funding for the GIS has been generally derived from the Government of Jamaica (Capital A funds), which is allocated to the yearly budget of the Directorate of the Technical Service Unit. In respect to this, the Unit was able to acquire a number of hardware and software infrastructures to support its GIS functions. Among these are as follows:

- o Two GIS computers, which are operated on Windows XP system, Pentium Xeon
- o H/P designjet Plotter (5500 series) and Printer (coloured).
- o Data Storage external Hard Drive (wire) – Maxtor Fire wire USB 5000 XT (250 GB);

o ArcGIS 9.3 (concurrent 4 concurrent Arc Editor user license and 1 concurrent Arc View Lic.) from Environmental Scientific Research Institute (ESRI); ArcGIS Server 9.3 Enterprise (Advanced)

o IKONOS satellite imagery for the island and aerial photographs;

o Two GPS devices (Garmin 76CSx)) that would facilitate data collection activities;

o Internal Network Environment – 100BaseT fast Ethernet;

Data that has been collected and created in-house includes the following: land transport, rail lines, road sections, bridge location, bus terminals, transport centers; marine transport – ports lighthouses, light structures; air transport – aerodrome, as well as, other general information such as settlements, contours, river/ drainage, census, schools, hospitals, police etc.

For many years, the work done in the GIS section generally focused on in house application development of data, technological research and analysis (as it relates to GIS software, hardware and GPS options), data sourcing and management, as well as, map production for inclusion into relevant reports such as the annual publication of the Ministry's Statistical document.

Previously, the main users of the GIS deliverables or maps produced were those of the Technical Services Unit such as the Transport Economist, Analyst, Environmental Officer, Statistician and Research Officers. Nonetheless, the GIS System has grown from

being just limited to one department to being able to serve a more centralized function in disseminating of spatial information across the Ministry via the web.

Strategies employed in attaining the dream of the Enterprise GIS (EGIS)

Achieving the goal of an Enterprise Geographic Information System (EGIS) [1] is not an easy one; it took hard work, ingenuity and the constant focus on the goal to be able to attain it.

Firstly, in order to develop an appropriate system, the GIS team had to assess the user needs and the potential uses of GIS within the Ministry and its relation in serving its entities, in addition to, other government organizations. Evaluations were done on software (GIS), hardware, human resource and other peripherals.

Objectively, it was identified that the Enterprise Geographic Information System (EGIS) would provide services that would leverage resources and allow for improved quantification and assessment of transportation problems that would assist policy makers and planners in making adequate and effective decisions, in identifying and addressing potential transport issues.

The ministry therefore sought to find successful case stories of Enterprise GIS development internationally that could be modeled; in light of this, the ministry gained a close association

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[1] Enterprise Geographical Information is a combination of different GIS databases at an organizational level. An EGIS allows for easier accessibility to spatial and other information, in this case the Ministry acts as a clearinghouse/hub for all relevant geospatial information which will be made available, via web to its stakeholders.

with the Central Transportation Planning Staff (CTPS) in Boston Massachusetts and seeing their strategies used in developing an EGIS and the level of the success attained, the ministry subsequently adapted their mechanisms within its own structure; as the methodologies and design of the CTPS system were easily replicated and inherently, has drastically reduced the learning curve and timeline in implementing the ministry's own EGIS.

In attaining all this, it is also most relevant to highlight all the challenges that were experienced and the strategies utilized to overcome the countless hurdles. These are as follows:

1. Funding

    a. *Justification* – It is most common that in many organizations the issue of availability of monetary resources can determine whether a proposed project gains financial approval or not. In this regard, it is usually an interesting series of events just to gain the necessary funding for the GIS system. To begin with, the team has to make suitable justifications, as to the reason why a large sum of money is required to invest in developing a GIS. For this reason, the most convincing method was the use memorandums. At most these were usually ten pages long; but no sooner upper management, being unable to deal with the amount of papers on their desk from the GIS team, would place a ban and requested only two page memos. Strategically the team did as required, the two page memorandums were prepared but in addition to eight or more attachments that relates to GIS. This was done just to ensure that the attention of senior managers was attained; of which the team did manage to accomplish overtime.

b. *Procurement procedures* – The procurement of any goods or services in the government sector is a tedious process, and therefore it was no different when it came to GIS. Meeting with a board of about eight senior managers that sits on the procurement committee usually felt like a court house; the interrogations were harsh but full preparations made it possible for the team to be able to achieve approval for financial support.

2. Team Work

   a. *Conflicts* – In carrying out any project it requires team effort to realize the end results, and inherently in many cases conflicts normally arises. This was no different in the developing the ministry's EGIS. The battles between supervisor and junior staff, consultant and team was one of endless remorse but nonetheless, the interest of keeping stead fast to the vision in spite of differences was always at the fore and so all had to be laid a side to achieve the common goal.

   b. *Additional Human Resource*- As mentioned earlier the ministry has only two core staff members that develop the system and with a major task of developing an enterprise wide system it became an insurmountable task. Therefore, in order to overcome this obstacle, the ministry obtained the services of university students each summer, to assist with data collection and development; this was a

much cheaper and feasible option than employing additional full time staff at that time.

Moreover, the team sought assistance from other government entities which soon developed into a cross agency corporation where not only human resources were shared but also technology and data. The Ministry of Transport and Works has been able to and still has a secured working relation with partner organizations such as the Ministry of Health and Environment, Ministry of Water and Housing and the Jamaica Constabulary Force in particular the statistical and traffic department.

3. Outsourcing

In expanding the system the team soon came to recognize that it would have been virtually impossible to pursue the dream without gaining specific expertise, of which was not available within the ministry. The search to find a consultant was also difficult, particularly with the limited budget that was allocated to carry out the mission. Nonetheless, through networking and GIS conferences the team was able to outsource aspects of work, which further aided the ministry in realizing its aspiration.

4. Training –

   With any technological implementation it is most essential that the staff utilizing the system, does so efficiently and this is mainly attainable through continuous trainings. In this regard, the ministry realizing its concerns in this area opted for customized trainings, particularly in the areas of ArcGIS server and database management. As Per se the ministry ultimately carried out joint trainings with a few of its portfolio entities and other governmental agencies. This has not only guaranteed that the intricate skills to manage and develop an enterprise system are realized but also has facilitated the continued networking and corporations between other organizations

Pictures of training programme.

Group picture of the Ministry and other entities

Training in session being conducted by Geovisus Inc. and Geonet

We had a little fun with video games online during break (It's not just all about work).

Good food was a also a critical component

Day to Day Management

To date the ministry has been able to develop a web based GIS application with the use of ArcGIS Server (enterprise) that provides mapping services mainly to the Ministry's corporate staff, who are now able to access geospatial information on the intranet. These maps are not static which provides individuals capabilities to conduct defined searches or queries and analysis as it relates to the data such as our general transport infrastructure which includes:

- Rail
- Airport/aerodromes
- Ports
- Transportation centers
- Lighthouses
- Bus terminals
- As well as accident points.

In particular, road safety data is aggressively being utilized to analyze the occurrence of traffic accidents in Jamaica; this has extensively led to the curtailing of fatal accidents especially in the Parishes of Clarendon and Westmoreland.

Data is continuously being collected, cleaned and developed and is served up on the web, and to note that in the very short term this information will be made accessible to external organizations.   Nevertheless, there are still a few short comings, such as down time in the network system which has affects the work flow, but in most instances this is infrequent.
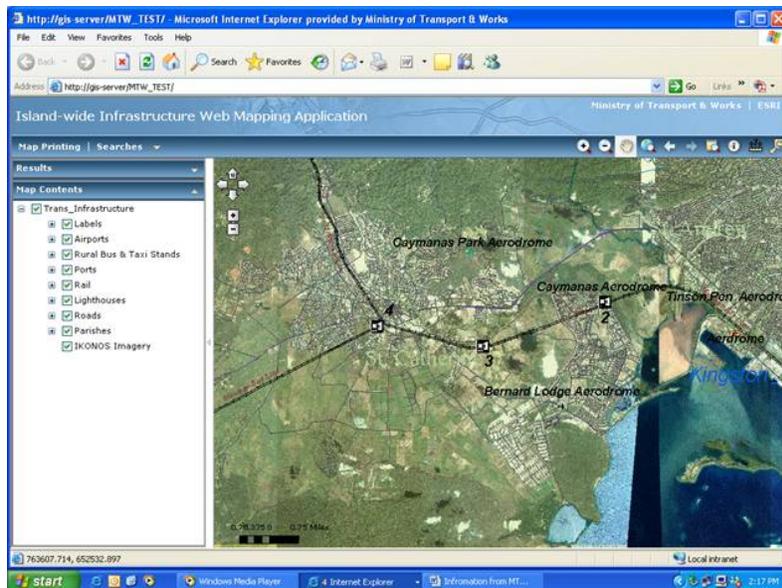
<u>Samples of a few maps published online</u>
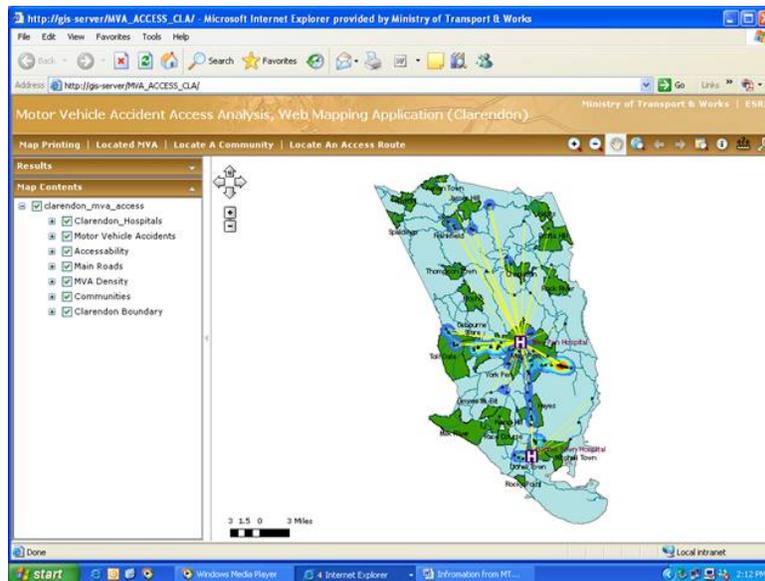
Fatal Accident analysis in the Parish of Clarendon
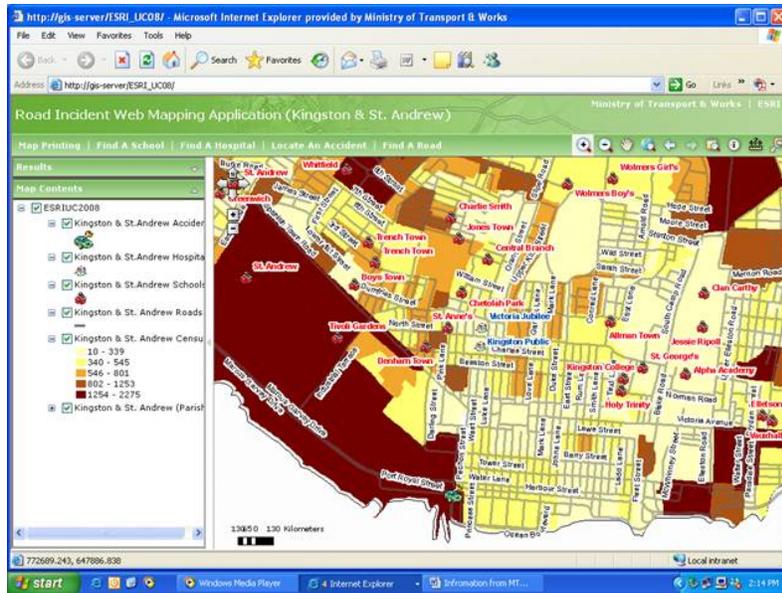
Population density in relation to social services

Iknonos imagery and location of general transport infrastructure

Future Plans

By utilizing Arc GIS Server enterprise 9.3, all relevant GIS transport data and related information is stored in one location. Intrinsically, the Ministry having the responsibility for over thirteen (13) portfolio entities and with the application and distribution of information through an EGIS, in this respect, will eventually facilitate their overall functions in fulfilling their respective mandates, and ultimately that of the ministry its self which is to ensure a safe and sustainable transport system.
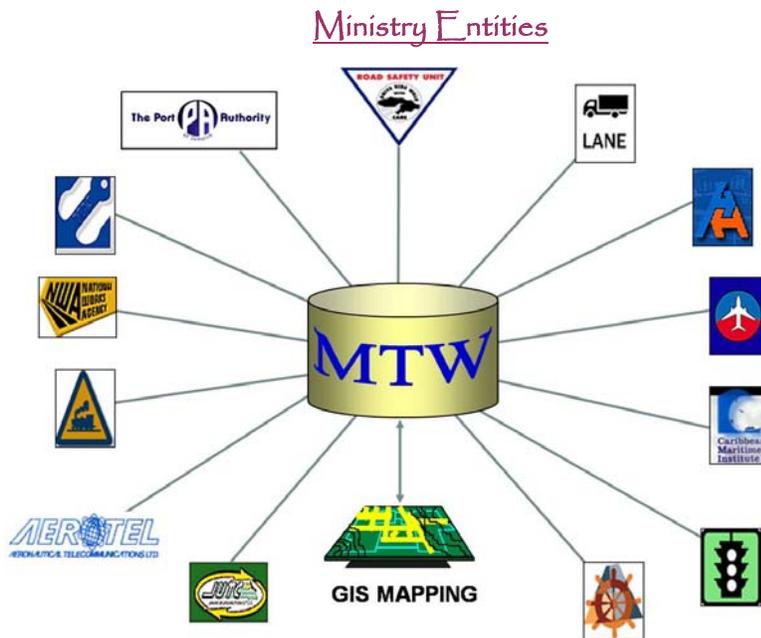

Ministry Entities

Table 1: Future application of the E GIS in Transportation.

Aspect of Transport	Entity	GIS Applications
Land Transport	Jamaica Railway Corporation (JRC)	- In fracture management - Condition/ status of rail, bridge, tunnels and track network - Real estate management – valuation maps, lease and tenant management - JRC and Private rail routings - Feasibility studies
	Island Traffic Authority (ITA)	- Analysis and identification of "bad spots/ accident spot" - Crash location and reporting - Geographical analysis of motor vehicles ownership and certification patterns
	Jamaica Urban Transit Company (JUTC)	- Fleet management - Automatic Vehicle Location - Pilot Project - Routing patterns - Bus stop and facility inventory - Passenger movement
	Montego Bay Metro (MBM)	Routing patterns and passenger movement
	National Works Agency (NWA)	- Bridge management and Road Management – Hazard mapping, flood mapping, highway maintenance, prioritizing areas of immediate need of repair - Traffic management - Road Planning and design

Aspect of Transport	Entity	GIS Applications
		- Drainage management - Speed limit and Sign Inventories - Project Management and Coordination
Air Transport	Civil Aviation Authority (CAA) & Aerotel	- Location of transmitting facilities - Flight line information
	Airport Authority of Jamaica (AAJ)	- Geographic Location of Aerodromes/ Airports - Characteristics of the Aerodrome
Marine Transport	Ports Authority (PA)	- Facilities and unity management – asset and inventory management - Cargo, mail and passenger movements - Emergency Respond and management – Spill response and management; incident tracking - Ports Operations – Vessel routing tracking, dangerous cargo display, cargo and berth time calculations
	Ports Security Corps Limited (PSC)	- Location of work activities - Deployment, arrest and patrol operation

It is also hoped to have the transportation GIS services extended to areas such as the private sector particularly Insurance Companies. This is in aim of providing relevant data services and in return the GIS will be a fiscal self generating resource tool for the Ministry.

Additionally, the ministry seeks to serve the general public by providing access to information online, as civic interest is one of integral importance.