LEGISLATIVE ANALYST REPORT

TO: The Honorable Members of the Board of Supervisors

FROM: Elaine Forbes, Legislative Analyst

DATE: May 17, 2001

SUMMARY OF REQUEST

On February 6, 2001, the Board of Supervisors requested that the Office of the Legislative Analyst (OLA) conduct a survey of all City departments to determine their use of Geographic Information Systems (GIS). Additionally, the Board asked the OLA to research the possible linkage of all such systems and to determine whether the Board of Supervisors, City departments, and the public have, or could have, access to the various systems. In response, the OLA surveyed City departments regarding which departments use GIS, who has access, whether departments without GIS use the service of other departments, and whether departments that do not use GIS would like to do so.

EXECUTIVE SUMMARY

GIS is a computerized tool for mapping and analyzing information. Presently, 15 City departments, and the Redevelopment Agency have a Geographic Information System. These systems can be described as decentralized. However, they have the potential for integration because they share common features. Currently, most GIS users have access to shared data through DPW's Basemap files and the Data Library program. However, many Departments do not submit data to the library. Consequently, data sharing typically occurs on an ad hoc basis. The current system may create inefficiencies because separate departments may create the same, or similar, data sets.

Currently, City departments, the Board of Supervisors and the public have minimal access to the City's various Geographic Information Systems. While providing access is technically possible, doing so would require technology upgrades, dedicated staff with technical expertise, Citywide standards, changes to the Basemap program's licensing agreement and fee structure, and departmental support. Integrating the various GIS systems in the City and expanding opportunities for GIS to other City departments and the public, offers the City an opportunity to achieve greater efficiency and to provide a public service.

BACKGROUND

Geographic Information System is a computerized tool for mapping and analyzing information. A GIS is capable of assembling, storing, manipulating, and displaying geographically referenced information (data identified according to their locations). GIS allows users to create graphic displays with information stored in a spreadsheet or database and to overlay layers of information on a base such as a street grid. With this technology, users can view information on maps and discern relationships, patterns, and trends not always apparent in a non-graphic database format. The technology has a variety of applications from managing environmental cleanup to project planning and program evaluation. For example, the Department of Public Health uses GIS to map and compare the density of injection drug users to HIV/AIDS incidence and prevalence in order to plan intervention strategies.

The most widely used GIS software packages are ArcView and MapInfo. AutoCad is also commonly used for architecture and urban design. These software programs require a base map, also referred to as the primary layer, to create maps and conduct analysis. The quality of the base map determines the level of accuracy of the system. Primary layers are available from the Census Bureau at no cost but these layers are not highly detailed and are somewhat inaccurate. Complex base maps that include features such as curbs and block and lots are more costly to create but give GIS the precision necessary for public works and planning related projects. Systems that rely on different base maps cannot easily share information for technical reasons.

GIS in the City and County of San Francisco

Following the 1989 Loma Prieta Earthquake, the City's Electronic Information Processing Steering Committee (EISPC), the precursor of the Committee of Information Technology (COIT), began to explore the potential for GIS in the City.[1] EISPC established a Basemap program in 1993. In September and October of 1993, aerial photographs were taken and used to create an accurate (within ± 2 ft) computerized base map of San Francisco. The Department of Public Works/Office of Geographic Data Services (DPW/GDS) oversaw all phases of the Basemap program, which culminated in the release of the first version of the DPW/GDS Basemap data files in 1996. DPW/GDS continues to maintain and expand the City's Basemap files. The Basemap files are currently comprised of four layers: 1) digitized aerial photographs (orthophotographs), 2) assessor's blocks and lots, 3) street center lines, and 4) curb and pavement edges.

In addition to the Basemap program, EISPC planned a GIS library function (in which departments would share the most accurate data with one another), and a distribution and a technical assistance function. The library currently includes 50 layers, which include supervisorial districts, streetlights, fire battalion districts, liquefaction and landslide zones, and the City's essential facilities. The library is primarily comprised (approximately 80%) of files that DPW/GDS develops and maintains. Of the 15 City GIS users, only 3, City Planning, The Department of Parking and Traffic, and the Public Utilities Commission, provide data to the library.

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[1] COIT is the policy-making group that formulates policy and defines the direction of Information Technology in the City. The group is composed of the Mayor's Budget Director, a member of the Board of Supervisors, the Controller, the Director of DTIS, and one representative from each of the following six groups: 1) Public Protection, 2) Public Works, 3) Human Welfare and Neighborhood Development, 4) Community Health, 5) Culture and Recreation, and 6) General Administration and Finance.

To date, DPW/GDS has been responsible for all aspect of the Basemap program. Once a year, the department and agency subscribers meet to receive the Basemap data files and the data library and they discuss changes to the files. In the early stages of the program (1992-1994), EISPC coordinated the Citywide GIS concept, but the group has since disbanded.

In June 1999, DPW conducted a technology assessment and customer satisfaction survey to better understand how the Basemap data files were being used in the customer's environment and to gauge the level of client satisfaction with the Basemap program's products and services. The survey showed that DPW/GDS had primarily emphasized maintaining the Basemap files. As a result, many departments expressed a desire for DPW/GDS to play a greater role in planning and developing GIS applications, and in providing technical assistance. These issues were also noted in the 2001 OLA Survey.

Currently, the Department of Telecommunications and Information Systems (DTIS), in response to departments need for GIS applications, and with the support of the Mayor, has taken on the task of developing an enterprise GIS plan. Enterprise GIS means a geographic information system that encompasses an entire organization. Many smaller systems can exist within, but an enterprise GIS is a consolidation of them all into one accessible system. Working closely with DPW, DTIS will assume responsibility for the distribution of Basemap data files on July 1, 2001. According to DTIS staff, in addition to distributing GIS, DTIS plans to work with departments to integrate data from various systems, as well as provide user-friendly web-enabled mapping applications. DTIS has initially hired several FTEs, which a GIS manager heads, to meet this goal. DTIS is developing strategies to implement the Enterprise GIS approach, and has a Citywide GIS meeting scheduled for May 30, 2001.

CURRENT PRACTICE

Between March 19 and April 25, the OLA surveyed all City departments and the Redevelopment Agency to determine GIS use and linkage and accessibility of the various systems (see Attachment 1: GIS Survey of City Departments for more detail). Of the 62 departments and agencies surveyed 52, or 84%, responded. According to the survey results, 16 respondents (26% of those surveyed) use GIS, including the Assessor-Recorder's Office, City Planning, the Department of Elections, the Emergency Communications Department, Mayor's Office of Emergency Services, the Office of the Treasurer, the Port, the Police Department, Public Health, Real Estate, Department of Telecommunications and Information Services and Traffic and Parking, MUNI, the Bureaus of Public Works, the Redevelopment Agency and the San Francisco Public Utilities Commission. Approximately 26% of the 62 departments and agencies surveyed use GIS. The Office of the Treasurer and the Port's Health and Safety Group have GIS software and the Basemap files, but do not currently use their systems because they have not had the necessary staff and/or funding.

City departments and agencies use GIS in three principal ways (see Attachment 2: Citywide Geographic Information Systems for more detail):
1) Reference – for example, the Assessor's Office researches the zoning on a particular parcel;
2) Mapping and analysis – for example, City Planning analyzes geographic data and presents information in maps and reports.

3) Application development – for example, DPW/Bureau of Street Use and Mapping coordinates street construction using a GIS application.

Based on the OLA survey, departments typically have a user's license for one of the GIS software packages (ArcView, MapInfo, or AutoCad) which they maintain on a desktop computer or on an internal network. Most GIS users (14 of 16) subscribe to the DPW Basemap, which includes the Data Library program. However, they utilize the Basemap files in different ways based on their mission and needs. Some departments, such as the Assessor's office, use the Basemap files as is. Others, such as City Planning and the Emergency Communications Department, alter the Basemap files to add information to suit their particular information needs. Most GIS users import and/or create additional layers of information, which are specific to their own system. Two GIS users employ other basic map data from other sources, such as the Census, as their system's primary layer and do not subscribe to the Basemap program. In short, the systems throughout the City are decentralized and operate to suit the particular needs of the department employing the system. Therefore, they differ considerably.

While GIS is an integral part of the work of some departments, according to the OLA 2001 survey, most City departments (74%) do not use GIS, and over half (62%) of the non-users expressed no interest in having access to GIS. However, 11 departments (Adult Probation, Building Inspection, the Office of Citizens Complaints, the Office of the City Attorney, the Mayor's Office of Community Development, the Department of the Environment, the Department of Human Services, Investigations, the Municipal Transportation Agency, the Public Library, and the Sheriff's Department) expressed interest in gaining access to GIS. To date, these departments have not had the capacity (technical staff and/or resources) or the volume of work necessary to acquire their own system but would benefit from access to GIS.

Fee Structure. GIS software (MapInfo, ArcView, or AutoCad) costs approximately $2,000 per year. Simple primary layers, or base maps, can be downloaded from the Census website or from ESRI (the producer of ArcView) free of charge. Complex primary layers, rather than simpler maps, are used where need for accuracy justifies the cost.

According to a February 28 Budget Analyst Report, the cost of maintaining the Basemap files is estimated at $538,676 for FY 2001-02. Regarding funding for GIS, DPW/GDS recaptures expenditures on a fee-for-service and work order basis. The Basemap program is not general fund funded. In 1996, DPW/GDS began charging City departments subscription fees for the Basemap files. Subscriptions are currently $20,000 per year, which generates approximately $400,000 annually. DPW/GDS also sells the Basemap files to private entities. To participate in the Basemap program, departments and agencies must sign a license agreement that prohibits sharing Basemap file information with other departments and the public without the express consent of DPW/GDS. This licensing approach allows DPW/GDS to protect its investment and to exclude those who do not subscribe from use. However, according to DTIS, as the process of GIS data distribution transfers on July 1, 2001, DTIS will re-examine the current cost-recovery procedures.

ISSUE ANALYSIS

System Integration, Coordination and Information Sharing

Presently, the City's Geographic Information Systems are generally decentralized. However, most of the systems have centralizing features. Specifically, most users (14 of 16) subscribe to the Basemap and use shared data from the Data Library. Nonetheless, as discussed above, most users do not submit information back to the Data Library and employ the Basemap with varying levels of complexity. Several options for more integrated systems exist, including a centralized shared system[2], more deeply coordinated systems, and/or enhanced information sharing. Each scenario is technically possible according to DPW and DTIS staff. To more fully integrate the various system within the City and County would require funding for technology, citywide enforceable standards, designated staff with technical expertise, and a willingness to share what, to this point, has been considered proprietary data by departments and agencies.

System Integration/ Technology. Fuller system integration could be achieved through Web-enabled GIS applications (computer programs that are tailored for use on the Internet); in order to work, GIS users would need access to the City's Intranet. The 1999 DPW survey found that many users were able to access the Intranet but significant exceptions included City Planning, DBI, PUC and DPT, where network issues must still be resolved.

Citywide standards. Citywide, GIS varies in relation to level of sophistication. Some departments have hired staff with an expertise in GIS or have trained existing staff. Other departments, which lack funding and/or do not emphasize GIS, have tended to fall behind in their GIS use. According to the 1999 DPW survey, the degree of sophistication with which a department uses GIS is directly correlated to the presence of trained staff dedicated to this work and the priority the department placed on GIS. To a large extent, departments have been responsible for securing technical expertise in house in order to operate GIS. While this practice has worked for departments like City Planning, other departments or agencies that have less intensive GIS needs, and likely do not need the sophistication of the DPW/GDS Basemap files, have not invested the time and funds necessary to employ GIS. In order to integrate or coordinate systems, the various users would need enforceable standards, in terms of data quality and format. Additionally, some departments will require technical assistance to meet standards.

Sharing data. The GIS Data Library provides the foundation for data sharing. According to the 1999 Assessment, the majority of departments and agencies were interested in finding out what data other departments had to offer, but expressed concern about releasing their own data which they regard as proprietary. The 2001 OLA survey found that less than 20% of GIS users in the City submit data to the library. This program could be strengthened if departments and agencies were encouraged, through incentives or mandates, to share data and if a standardized mechanism for data distribution to all City departments was created.

Benefits of system integration. The City would gain some benefits from more fully integrating its various systems, including increased efficiencies, more available data that can improve decision-

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[2] In a centralized system, the Basemap and the data layers departments and agencies create would be in a centralized location, accessible through the Intranet. This type of structure optimizes efficiencies gained through integration but minimizes departmental autonomy.

making, and cost reductions. For example, several departments (Mayor's Office of Emergency Services, Police, Fire, Public Health) have expressed interest in a consolidated emergency management GIS application. Such as application would enable multiple city departments, in locations throughout the City, to view consistent and changing map data. The City has already benefited from system integration. For example, the PUC mapped many of the streetlights Citywide to coordinate repairs. City Planning uses this data for urban design projects, for example a citywide illumination plan. According to DTIS, several large metropolitan governments, including Los Angeles, New York, Chicago, and Seattle, have recognized how an enterprise GIS approach can effectively integrate previously unrelated data sets into a common framework. Additionally, integrating data from many departments into a single "portal" allows the public and others to view location-based information.

Access – Departmental, Board of Supervisors, and Public

Currently, City departments, the Board of Supervisors and the public generally do not have access to the various Geographic Information Systems unless they specifically request maps and/or information (see Appendix A: Citywide Geographic Information Systems Survey for more detailed information). However, internal and public access to the system(s) is technically possible due to continuing technological advancement in GIS and in web-based applications.

Internal Access. Based on the OLA 2001 survey, several departments, such as the Office of Citizens Complaints and the Public Library, indicated that they could benefit from access to GIS, but that they may not have the capacity (funding and technical expertise) to acquire a system. These departments could access GIS in other departments through the Intranet or though a work order system. The current cost of participation in the Basemap program ($20,000) is an issue for some departments. The current funding system for the Basemap program creates a disincentive for departments that may benefit from GIS but have a lower level need and/or do not require the accuracy and detail of the DPW Basemap files, from participating in the Basemap program. Currently, departments of this type tend to not use GIS, or contract outside for GIS, or set up a GIS system that uses simple primary layers. However, this type of system (as discussed above) is not easily integrated with systems that use the Basemap files as the primary layer. Achieving broader internal access may best be accomplished with Intranet technology and a restructuring of the DPW Basemap license arrangement so that all departments could have access to GIS and the accuracy of the DPW Basemap files.

Public Access. Currently, the public has limited access to the City's various Geographic Information Systems. The public may use City Planning's Sfviewer at the Planning Department, and the Department of Traffic and Parking make GIS maps available to the public upon request.

Available technology could provide system access to the public through the Internet. Cities, such as Los Angeles, Oakland and Vallejo, for example, have used available technologies to provide services online (see Attachment 2 for the Los Angeles Web page entry to its GIS services). Information such as land use and zoning, occupancy/vacancy rates, and property size (square feet) is available on the City of Vallejo's website. In Los Angeles, GIS allows the public to obtain permits and other services online. Oakland's map room shows parcel zoning information, crime statistics, and the location of public facilities and service areas. These GIS applications allow the public to view specific building and demographic characteristics about the cities and their

neighborhoods. Public access to this information on the Internet would also be expected to reduce demand for staff time to address such requests for information.

The OLA survey found that several departments, including City Planning, the Department of Public Health, Muni, Real Estate, and the PUC are pursuing external, or public, GIS access. These efforts could be coordinated through DTIS. As with internal access, adjustments would be necessary. For example, the DPW subscription policy currently prohibits sharing Basemap files with the public.

CONCLUSION

City departments use GIS to improve both their operations and analytical functions. DPW/GDS has developed and coordinated the creation of the City's Basemap files. However, Citywide GIS has lacked coordinated planning and support. One result is that departments maintain their own systems. Some further level of system integration could reduce replication and redundancy and improve information sharing among departments. Expansion of the existing Data Library program could have a productive effect as well. DTIS plans to work with departments to ensure that issues effecting GIS Citywide are addressed.

Currently, City departments, the Board of Supervisors and the public have minimum access to the City's various Geographic Information Systems. However, providing access is technically possible. To achieve this goal, the Board may consider encouraging technology upgrades, dedicated staff with technical expertise, Citywide standards regarding information, and changes to the Basemap program structure.   More fully integrating GIS Citywide and expanding access and use of GIS to other City departments and the public offers an opportunity for the City to work more efficiently and to provide a public service.

APPENDIX A: GIS SURVEY OF CITY DEPARTMENTS

1) Does your department use GIS?

   a) If yes, for what purpose(s)?

2) Does your department maintain GIS?

   a) If yes, please describe the system.
     i) Capability

     ii) Cost
       (1) Setup

       (2) Operations

     iii) Other

   b) Does the Board of Supervisors, other City departments, and the public have, or could have, access to your system?

3) If your department does not maintain GIS, do you use GIS services? If so, who generates your maps and analysis?

   a) What is the process for filling such a GIS requests?

4) If your department does not currently use GIS, would you like access to GIS?

   a) For what purpose(s)?

APPENDIX B: CITYWIDE GEOGRAPHIC INFORMATION SYSTEMS

City Department	GIS Usage	System Access
Assessor-Recorder's Office	Research assessor's parcels	Department only
City Planning Department	Staff uses Sfviewer, an application written by the GIS group at DPW, for the Basemap and aerial photos. Also use GIS for land use studies and for preparing graphics that go into reports or before the Planning Commission.	Sfviewer available at our public PC on the first floor of 1660 Mission Street. Otherwise, Department only
Department of Elections	Drawing district lines and precinct lines, to locate polling places, and to lookup address	Department only
Department of Public Health	**Service assessment and program planning,** for example analysis of 911 calling patterns and pedestrian injury data. **Program Evaluation,** for example distribution of mental health providers and mapping of substance abuse services and clients. **Health Risks and Exposures,** for example locations of vulnerable clients in emergency situations, mapping of liquor licenses and gun fire incidents, and density mapping of injection drug users and HIV/Aids incidence and prevalence.	Currently, Department only. Website viewing maps will soon be available. Displays will be on the DPH intranet (accessible only to DPH), Citywide intranet (accessible by other departments and the Board of Supervisors), and internet (accessible to the general public). GIS manager will determine access limitations in order to ensure confidentiality.
Department of Public Works	**Permit system**, provide drawing tools for the street excavation permits, and automate the processing of permits by integrating various street data using common data from the Basemap. **Street construction coordination,** compile 5 year plans from all the agencies and companies that excavate streets and coordinate permits using system to flag other construction in the area. **Other**, systems such as complaints, inspection, and urban forestry also use the Basemap to plan, locate and report on services. **Presentations,** maps are created routinely for presentations and public information.	Sewer map is available on GDS intranet site, street construction information (BSM) is available on BSM internal site, new applications are being developed for sewer repair mapping, side sewer permits, street construction coordinator (5 year plan). Working to development sewer information on the Internet so City Departments, like the PUC, who do not have intranet access, can access the information.

Department of Telecommunications and Information Services	**Application development**: As the overall application development provider for the City, DTIS implements GIS application development on a contractual basis for several departments (Real Estate, Assessor, Recreation and Park), **Telecommunications infrastructure management**: DTIS has recently begun to manage the City's telecommunications assets using ArcView. Staff update and maintain changes, and work with outside contractors.	DTIS does not provide GIS information to outside departments, the Board of Supervisors, or to the public. DTIS is working to implement an enterprise approach to GIS, with the department serving as distributor, integrator, and applications provider. In this capacity, DTIS will assist with provision of City GIS information to City departments, the Board of Supervisors and the public.
Department of Traffic and Parking	Monitors and tracks traffic collision statistics; inventory of traffic signal equipment; display and tracking of Residential Permit Parking areas; planning and tracking of traffic signal construction projects; area wide school safety studies; display of traffic speed limits; display of functional street classifications; and planning for street traffic calming projects.	GIS maps or displays are available to the public on an as-requested basis. Traffic signal database has been made available to other City department through the GIS Data Library maintained by DPW. Electronic GIS applications are not released to the public or private consultants unless permission to use the City GIS Basemap is obtained first from DPW.
Emergency Communications Department (ECC)	Emergency response planning.	The San Francisco police, juvenile probation, and ECD use ECC data currently and the Sheriff may soon.
Mayor's Office of Emergency Services (OES)	**Emergency planning** - identifies and plans for specific emergency responses, such as rotation power outages. **Training and Exercising** - Simulation of problems, modeling. **Emergency response** - identify areas of concern, post emergency response action	Department only due to confidentially agreements.
Muni	Daily operations as well as long-range planning and service planning.	Currently, Department only. In the future, both systems will have a web interface, and the public will be able to access bus schedules and other information.
Office of the Treasurer	Due to turnover of key personnel, the GIS system is not in use. The Office of the Treasurer intends to utilize the system once MapInfo training is provided.	Not available outside of the department due to confidentially agreements.

The Police Department	This system is new and is still being developed. In particular, the Police Department plans to link its Records Management System (RMS) with GIS for grant proposals and for program planning and evaluation.	Not available outside of the department.
Port of San Francisco	The Port's engineering department uses GIS for a variety of studies. The Environmental Health and Safety group has GIS but found an easier system and process (the Basemap process was cumbersome) in which to manage environmental information.	Department only.
Real Estate	Currently a test system is being used to locate City owned property, leasehold interests and a limited number of city facilities. Future plan to use the city's Basemap as an index to access detailed property information regarding city owned land, facilities, or leaseholds and department jurisdiction.	Currently, Department only. Future plans include a web version, which will be made available with three level of security. The third level would be for internal use; level two would be for Board of Supervisors, Mayor's Office, and level one could eventually make city property information available to the public.
Redevelopment Agency	Mapping, land use data, zoning and preliminary blight analysis	Agency only
SFPUC – Bureau of Light and Power	for street lighting maintenance and inventory	Department only
SFPUC – City Distribution Division	Accessing City's water distribution system information and electronic gatebook for valves, gates, pressure zones tracking and adjustments on real time basis by operational, engineering and management staff.	Department only. However, other City departments can have access to most of the information indirectly from the ArcIMS server if they have access to the PUC intranet (system maintained by PUC-BMIS).
SFPUC – Water Supply & Treatment – Land and Resources Management Section	Watershed and fire management and threatened species monitoring. Currently developing a GIS system for management of Right-of-Way lands, including maintenance of property data, encroachment monitoring, incident reporting and facilities mapping. Map production for operations and planning	City department and public access to GIS data is available on request. Access to GIS data by other departments and the public is planned via Internet or Intranet once fully implemented on an enterprise basis.

Source: OLA Survey, April 2001.