AUTOMATED MAPPING AND FACILITIES MANAGEMENT

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Most utilities and local governments have drawn maps for as long as these organizations have been in existence. These maps are usually large-scale, 1"=100', 1"=200', sometimes 1"=50'. They show varying degrees of land or geography, generally referred to as planimetric and topographic features. Utilities use this as a background for showing plant - generally referred to as facilities - information. Facilities/plant information is shown on different map sets for electric, gas, water, wastewater, steam and any other utility systems in a combined locational and schematic manner. Local government engineering and public works departments have map sets that contain more geographic detail while tax assessor departments have parcel boundaries and tax identification items on their map sets.

The mapping systems for most communities and utilities have been developed and are maintained independent from each other. They have evolved over 50, 100, or more years as communities and utilities have grown. Usually the maps in the system have been created, one or a few maps at a time. They do not necessarily accurately tie together from map to map. In many cases they follow the U.S. land system and each map covers a quarter section or a section. Since it is universally recognized that sections are not exactly one mile square, it is difficult if not impossible to have a continuous mapping system. In years past, monumentation was not nearly as

good as it is today. Many times in the past, developers, subdividers and land surveyors laid out developments starting from a known monument which may or may not have been accurate. This worked out well until a second development occurred near or adjacent to the first one. In these cases a new development survey could have very well started from a different monument. As you can expect, the surveys of the two developments may or may not have met. Thus, the map makers were required to make adjustments which were probably not accurate. Thus, today, utilities and local governments find that their existing manual mapping system does not truly represent what is on the ground.

You have undoubtedly noted that this discussion has not been confined to utilities but has included local governments. This may be considered an infringement on discussions on Urban Mapping. However, utilities and their facilities reside in communities which are, for the most part urban and the urban mapping, in most cases is controlled and perpetuated by local governments. In any one community the utilities and local governments are concerned about the same geography. Granted, each organization may require different levels of accuracies and different levels of information on their maps, and they may use the information on the maps for different purposes. However, this is still the same geographic territory and should be mapped once, and maintained once for the benefit of all the organizations in the community. Unfortunately, there are minimal examples of this having been successfully accomplished. To create one manual mapping system that would serve all of a community's needs has not been economically, technically, and politically feasible until recently. Although it is feasible today to use computers for a community system, the fact that it has not been successfully done indicates that it may be a few or several years before it becomes a reality.

Some events have occurred over the past ten years that provide the foundation for community and utility mapping systems and data bases. For years the aerospace industry, architects and academicians have been developing and using graphics, computers, and programs for design and modeling purposes. However, until about ten years ago, the cost was prohibitive, except for very specialized projects. In the late 1960's and early 1970's a phenomenon occurred unrelated to mapping, which has

turned out to be a boon for automated mapping and facilities management. With the development of the so-called minicomputer, several companies put together turnkey systems called interactive graphics systems (IGS). These were developed and have been sold extensively to fill a need in printed circuit board design, engineering and architectural drafting, and other graphic applications. They were generally marketed as computer-aided drafting (CAD) systems. These systems centered around stand-alone minicomputers and included digitizing boards, cathode ray tubes, keyboards, tape and disk storage, and mechanical/electronic plotting devices.

In the early 1970's a few people who had previous associations with utilities began to recognize that these interactive graphics systems could be adapted for computerized mapping. Prior to that time, work on automated utility mapping had been done on large host computers and required the development of large, complex computer programs. The interactive graphics systems provided the breakthrough that was needed. Albeit, the software at that time was not sophisticated enough to satisfy the mapping needs. However, a few groups began to expand, evolve and refine the software to address the ultimate needs. As the power/cost ratio of minicomputers improved and the software sophistication evolved, these systems became very usable for automated mapping. Along with the mapping system developments it became evident that facilities/plant management systems were as needed as was drawing maps. And thus, today, automated mapping is a product of facilities management and facilities/land data bases.

As is generally the case in our society, the economic and political development has not kept pace with the technical development. There have been a few examples of successful utility automated mapping and facilities management projects. There are minimal examples of successful local government projects. Perhaps the one factor having the biggest influence on this process is what is termed "conversion." In order to have a successful project the massive amount of geographic and facilities/plant information contained in the manual system must be converted into the computer system. This is a large resource-consuming, time-consuming and extremely expensive process. Very few utilities and local governments have been able to convince management that these large expenditures are justified.

Fortunately, today there are some subtle, and not so subtle events occurring in society that are tending to change the situation. Utilities and local governments are facing external pressures to a degree that has not been felt before. The energy crisis, taxpayers' revolts, environmental impacts, opposition to rate increases, proliferation of government regulations, inflation and difficulties in financing, are prompting an introspective look by management on how to cut operating costs and still maintain the expected level and reliability of service. Stated another way: How can organizations more efficiently manage their operations? In general, these organizations have done a good job in improving the engineering of the components of their services. And there appears to be minimal opportunity to achieve savings by improving equipment engineering.

However, there is one basic resource that has had only limited attention. As a matter of fact, until recently, this area has not really been considered as a resource. This resource is "information." As we all know, most organizations are paper mills. The amount of required information for efficient operation is minimal as compared to the total information maintained. And, yet, all departments and all individuals within an organization must have certain amounts of quality information in order to effectively perform their functions. A large portion of the required information in a utility is contained on maps and in facilities records. The availability, the accuracy, and the quality of this information is highly important to successful operation. In varying degrees a similar statement could be made about local governments.

The amount of information that is maintained in a utility almost defies one's imagination. Very little thought has been given to controlling and managing this vital resource. The required information as maintained on the maps and facilities records of a utility is extremely important to the organization. It is so important that they each spend sizable sums, perhaps $1 million or more a year, to maintain this information. However, duplication, lack of timeliness, and the quality of the information is a very serious problem. The redundant files, nonagreement between files, and the perceived lack of reliability by the users, has created immeasurable problems.

As an example, one utility had five card files, in five different departments, consisting of information about 700,000 customer connections. All five card files were being maintained independently while getting their change and update information from the same source. The information in these five card files did not agree from file to file. You can imagine the time spent in reconciling the differences. The files were used by many, frequently, and continuously. The same situation can be applied to local governments. For example, any resemblance between engineering deparment maps and records and assessors maps and records may be purely coincidental. If the time spent resolving the differences was measurable, automated mapping and facilities management projects would be much easier to justify. In terms of usability, if one were to do a thorough investigation, maps and records in utilities and local governments in this country are probably not serving their perceived purpose. And, the sad thing about this is that many - the creators, maintainers and users - don't realize it. There are many examples of redundant, out-of-date, unreliable information that the users in the field do know about but are powerless to change. Therefore, they find expensive, time-consuming ways to get around the problems.

Another aspect of this is that planning departments, the census bureau, and other government agencies, have come up with methods and shortcuts to serve their needs. However, they have avoided the real issue. They have not encouraged local governments to go back to ground zero and remap, starting with aerial photography - tie all the maps together creating a continuous mapping system in the computer - resolve the differences and inaccuracies, and provide this base map to utilities, planners, police and fire departments, election commissions, and all the other organizations in the community. Yes, the cost for the total project would be high, but if it was split between fifty or more organizations in the community, the cost would be very minimal for each organization. In lieu of attempting to solve the fundamental problem, someone created the Dime File resulting in the expenditure of unbelievable sums of money.

On the other side of the coin, a few utilities have faced the task head-on and have attempted to do it right. They have gone back to the basics, acquired aerial photography, tied maps together into a continuous system,

used coordinate systems and put this into a computer. They have placed their facilities and plant on this accurate land base. Over a period of years they will save their organizations sizable sums of money because the changes will be input once, all departments in the organization will be utilizing the same geography, the same coordinate values for the intersection of the streets, and will be communicating accurately with each other.

As was stated earlier, the conversion from manual maps and records to computer, which results in automated mapping and facilities management, is expensive. Projects can run from $1 million to $30 million, or more, depending on the geographic size, density of the area, amount of detail required, amount of storage required, and source document conditions. One utility company has budgeted $3.5 million for a pilot to convert one of its operating districts, a district consisting of 400 square miles. If the pilot is successful the utility anticipates it will cost in the neighborhood of $50 million to convert the land and facilities records into the computer for their total service area. This service area obviously is extremely large. The impetus behind this pilot and conversion is the Public Utilities Commission of the state that they reside in. The PUC has, in essence, said: You have computers and we don't think you are getting reasonable benefit out the the money you are spending for maintaining your maps and facilities management. One could reasonably expect that other state commissions could say similar things to the utilities under their jurisdiction.

Automated mapping and facilities management projects are not only costly but they are extremely complex. Perhaps it's the other way - they are extremely complex and thus expensive. There are 1,000, 5,000, 10,000 items that must be understood, defined, coordinated, specified and managed in a project. One must have a working knowledge of aerial photography, photogrammetry, mapping, grid systems, geography, utility operation, engineering, accounting, customers, energy flow, computer hardware, computer software, human relations, management, organization, planning, and a myriad of other skills. The magnitude and complexity of projects make it almost imperative that experienced, expert help be obtained.

Kellogg Corporation, located in Littleton, Colorado, a

suburb of Denver, is a group of engineering management professionals doing many things, one of which, the one that I represent, is consulting with utilities and local governments on how to put together an automated mapping and facilities management project from inception to implementation. We provide history, background and understanding. We recommend and assist in maps and records audit of the existing manual system. We help define the needs of the organization. We help prepare the specifications and translate those into requests for proposals. We help justify the economics of projects. We provide a systematic approach for the evaluation of hardware, software and conversion services. We help negotiate contracts. Perhaps, above all else, we help to plan, organize, coordinate and manage the project. I personally have been involved in automated mapping and facilities management for over eleven years - that is about as long as anyone has been involved. We have a good understanding of most of the projects that occurred in the past, including those that were less than successful. We know about most of the hardware and software systems which are available. We know about most of the conversion services that are available. We are involved in, or know about most of the projects that are in progress today. We know what stages they are in and in what direction they're going, and we have a good understanding of why they're going in these directions. We have a good understanding of why they may be successful and why they may not be successful.

The Kellogg Corporation has recognized a need in the automated mapping and facilities management industry for the transfer of experience and understanding between utilities, local governments and the providers of services. In an attempt to address this need we publish a bimonthly AUTOMATED MAPPING CHRONICLE which is distributed to over 1200 individuals.

We plan, coordinate and sponsor annually the Keystone Automated Mapping Workshops. The recent Keystone II was attended by 80 individuals from 46 different organizations. Highlights of the workshops are panels on timely subjects and discussions on currently active projects. The panels and project discussions are led by the utility and local government project managers who are in the process of making their projects work.

Kellogg Corporation provides a one-day seminar titled

BOAMAP (Basics of Automated Mapping Projects) which is designed as an overview for management, engineers, operators, analysts and others who need to know.

Finally, the Kellogg Corporation is perhaps the only non-affiliated group providing consulting services in automated mapping and facilities management directly to utilities and local governments. Our only interest is to assist these organizations in achieving the most beneficial results from their project.

In summary, automated mapping and facilities management for utilities and local governments is a fledgling industry. Tremendous progress has been made in its ten plus year history. Much still remains to be accomplished. However, today there are far more projects either in progress or being considered than ever before.

The future looks extremely bright!