USL/STATE FACILITY PLANNING AND CONTROL AUTOMATION PILOT PROJECT

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ABSTRACT

State supported Universities often lend a helping hand to their state by providing services which may be difficult or impossible to acquire otherwise. This presentation reviews the process of computer aided facility management with special reference to a recently completed joint venture project to fully automate Louisiana's Facility Planning and Control services.

1. INTRODUCTION

James Burke, in his book, **Connections**, describes an event which many of us may recall: "*In the gathering darkness of a cold winter evening on 9 November 1965, just before sixteen minutes and eleven seconds past five o'clock, a small metal cup inside a black rectangular box began slowly to revolve. As it turned, a spindle set in its center and carrying a tiny arm also rotated, gradually moving the arm closer and closer to a metal contact. Only a handful of people knew of the exact location of the cup, and none of them knew that it had been triggered. At precisely eleven seconds past the minute the two tiny metal projections made contact, and in doing so set in motion a sequence of events that would lead, within twelve minutes, to chaos. During that time life within 80,000 square miles of one of the richest, most highly industrialized, most densely populated areas in the Western world would come to a virtual standstill. Over thirty million people would be affected for periods of from three minutes to thirteen hours. As a result some of them would die. For all of them, life would never be quite the same again.*"

That event caused havoc with many people throughout most of north-east America--elevators stopped, airport lights and air traffic control devices went out, water supplies dried up, and street lights no longer managed automobile circulation.

Fortunately such a catastrophe does not happen very often. Many lessons were learned by the experience but the most important message seems to be that if the right people have access to critical data in an emergency situation, an event such as the one mentioned above may have been prevented or at least rectified in a shorter period of time. The interdependency of objects and systems in this highly technical society requires us to maintain sufficient information to identify critical connections and dependencies. While facility managers are seldom faced with life-or-death decisions, most decisions, particularly those affecting budgets, require more data than is usually available. The best tool available to manage data is the computer. It is, therefore, the intention of this presentation to provide an overview of the entire process of facility management automation which includes:

- Initial Commitment.
- Needs Definition (Systems Analysis) .
- System Modeling and Performance Specifications.
- Request for Proposals.
- Computer Aided Facility Management Software and Hardware.
- Pilot Project.
- Revised Needs Definition.
- Return on Investment.
- Implementation Schedule.

It is difficult to know where to start a facility management automation project. Depending on the expertise of the facility management personnel, the project may start with defining the flow of activities or it may start with writing a position paper and defining needs. In any case, the project should be taken very seriously and nothing should be assumed. It is sometimes advantageous to have a consultant available during the critical phases of the project. A consultant may be able to bridge personality and administrative problems which "insiders" may not be able to solve. Also, consultants can help divert problems and misdirections which can cost money and time and sometimes the success of the project.

References will be made throughout this paper to the "Louisiana Project". The Louisiana Project successfully automated the services of Facility Planning and Control--an agency within the Department of Administration which is responsible for reviewing all major Capitol Outlay Requests for new facilities and renovation or maintenance of existing facilities, selecting (together with the Louisiana Architects Selection Board) design consultants, administration of design and construction contracts, and coordinating moves. Facility Planning and Control is a well managed agency which processes about $100,000,000 per year in Capital Outlay projects. As Facility Planning and Control improves the management of facilities, the need for more accurate data becomes increasingly important.

Louisiana owns approximately 60,000,000 square feet within its 9,000 buildings and other structures. At the beginning of the automation project, Louisiana was spending approximately $26,000,000 per year on leased space. That figure has been reduced by about fifty percent with the help of facility management automation.

2. INITIAL COMMITMENT

Sometimes the most difficult part of an automation project is securing the initial commitment to proceed with a feasibility analysis. The problem is not so much with top administration objecting to the investigation (any substantial return on investment should provide the necessary incentive) but with middle management and staff who may be unsure of this type of automation. This concern seems to be particularly strong among public staff people who feel that their positions or status may be jeopardized by change. A strong emphasis needs to be made at the very beginning that the project is being considered to improve the way things are currently being done and not an attempt to change everything. Systems analysts not familiar with the organization may not respect the fact that while a person is performing his or her daily duties he or she is also fine tuning a process which is an important link in the chain of activities which comprise the department or section. It is, therefore, vital that each person who will be directly affected by the automation project be invited to participate early in the investigation. Those individuals directly affected may include:

- Facility management administrators and staff.
- Data processing or information services personnel .
- Buildings, grounds, and maintenance personnel .
- Risk management personnel.
- Inventory management personnel .
- Architecture and engineering personnel .
- Accounting personnel.
- Leasing and property management personnel .
- Asset management personnel.
- Personnel (Civil Service) staff and administrators.
- Telecommunications personnel.

Automation is often thought of, perhaps with some justification, as impersonal but it does not have to be that way. System design should be flexible and capable of responding to informal as well as formal activities, relationships and motivations. Staff should be assured that what they have learned while performing their duties can and will be used to help define system requirements. It will be the job of

middle management to help prepare the proper vehicle for staff participation. Project coordinators--usually people from the Information Services Department (MIS) and outside consultants--must assist management with this task. Management may already have some of the most important data which can identify opportunities for staff involvement: general organizational staff and upper management complaints and concerns. This may sound negative but it may be one of the best ways to attract attention and interest. Facility management personnel hear complaints constantly (if there were no such problems, there would be no need for facility management in the first place). Some topics which may surface from "complaint" data include:

- o Improper or inadequate facilities.
- o Inadequate information.
- o Slow response time.
- o Poor location of facilities and/or personnel.
- o Cost concerns.

Requests brought to the attention of facility managers require information to be acted on. Once the request becomes a project, data is produced which can be helpful the next time the facility is changed. If it can be shown that automation could be of benefit to the entire process, commitment on the part of middle management as well as staff should be easy to achieve. Commitment becomes participation and the project soon becomes "our" project rather than "their" project.

> ***Louisiana Project:*** State government needed to save money managing and occupying its buildings. Louisiana owns over 60 million square feet of space in approximately 9,000 buildings and other structures. Initial commitment for the project was easily gained. Many millions of dollars were being spent on leased space and it was suspected that many state-owned buildings were not completely occupied. Data was needed to accurately determine the correct approach to "compress" employees into state facilities. The fact that Facility Planning and Control (FP&C) enjoys the advantage of having control of all state facilities played a significant role in achieving initial commitment. FP&C consists of the Director, architects, engineers, accountants, secretaries, clerks, and other support personnel.

3. NEEDS DEFINITION

Probably the most important phase of a CAFM implementation project is Needs Definition (facility management systems analysis). It is in this phase that the project coordinators will specify precisely how the system should operate. Needs

definition is a very tedious task requiring careful planning and coordination. It must tell how the old system works and what the new system must do.

Needs Definition considers three factors: activities, processes and data. Activities and processes are the tasks people perform and data is the result of the work performed. Both aspects must be equally analyzed to fully define the needs. The analyst must determine the exact inputs, operations, and outputs of the system. Activity analysis requires the analyst to understand the general organizational structure as well as the specific tasks of each individual. This is usually a time consuming job which requires the analyst to interview people, distribute questionnaires and sometimes directly observe the functions of key individuals.

Depending on the size and complexity of the organization, interviews may be restricted to middle management. Management can often provide an overview of the activities of his or her staff as well as specific job descriptions and work-activity specifications. The analyst must understand the characteristics of the activity procedure: the input factors, the operational factors and the output factors. This is often referred to as the work breakdown structure (WBS). The WBS is a level- by-level hierarchical definition of tasks. Some appropriate questions which could be answered by facility management personnel include:

- What are your principle responsibilities?
- What are your goals for achievement?
- What programs are you now conducting?
- What reports or documents do you receive--how frequently, and how timely?
- What other information do you receive that is necessary to do your job?
- What information do you receive which is not necessary to do your job?
- Do you use graphic data (drawings, diagrams, etc.)?
- Do you require as-built drawings before you begin a renovation project?
- What do you do with the documents?
- What information do you find it necessary to request because it is not supplied to you routinely?
- What other information do you receive routinely by means of telecommunications (on-line data bases)?
- Do you send information to databases? If so, please list.
- What files do you maintain in your office (both standard files and drawings)?
- What information which you maintain is also maintained in other files outside of your area?
- How do you feel about having access to a computer system which would help you maintain information and offer greater query possibilities?
- How do feel about replacing paper drawings with electronic drawings?

- How do you feel about taking short training courses in computer applications?

In addition to interviews and questionnaires the analyst must gather additional information on job titles and position descriptions, operations, filings, transports, inputs and outputs, equipment used, work relationships, work measurements and other information which might be helpful in analyzing facility managements systems. The analyst may find it important to draw a series of diagrams and flow charts which will indicate sequencing of activities, operations, logic flow, materials flow, data and information flow, authority flow, etc. The flow chart is a requirements programming and creative problem- solving process. Each project will command its own unique flow- charting requirements.

Louisiana Project: Needs Definition started with an analysis of the functions and activities of Facility Planning and Control. As mentioned earlier, FP&C maintains almost complete control over most facility projects including new construction, renovation of existing facilities and maintenance. Analysts considered themselves fortunate that FP&C had a strongly structured and functioning procedure for all phases of its operation. The Needs Definition task was to define the "expert system" already in place and then support and improve the system with automation. Many flowcharts were drawn, questionnaires were distributed and analyzed, and existing data was studied.

4. SYSTEM MODELING AND PERFORMANCE SPECIFICATIONS

The size and complexity of the organization and its facilities will generally determine the characteristics of the model and requirements specifications. The type of existing automation facilities, the number and proximity of the users, the availability of existing useful databases, the availability of trained data processing personnel, and the level of commitment of those directly affected by a CAFM system will also determine the nature of the model. If, for example, the organization already maintains a substantial computer system with adequate networking, the first consideration would be to include the existing system as part of the model. The Information Systems Department (MIS) may have standing requirements for new applications-- such as a requirement that all new applications are to be mainframe- based or all graphic CPU-intensive applications are to be done on work stations. These kinds of decisions will dramatically influence the type of system the organization will eventually have. One word of caution: MIS people may not be familiar with computer graphics and its requirements. The speed of the machine, the type of network capability, and the amount of file storage space is most often very different from other types of computing applications.

Sometimes MIS's rules and regulations just cannot apply to CAFM. One should attempt to maintain a degree of technological neutrality. The model should not bias the subsequent implementation effort toward one technology or another. Existing procedures and physical fossils (remnants of the technology used to implement the current system) may have to be eventually considered but the model should avoid as many predeterminations as possible. The model should illustrate the "perfect technology" necessary to fully implement a CAFM plan. The decisions made thereafter will determine how close the system will come to the perfect technology.

A system model is a replica of the components and operations of the system. The model should show interactions between the system and the environment, activities necessary to execute phases, interactions among the activities, and memory the system needs to support activities. The essential ingredient of the system model is the data flow diagram (DFD). The DFD simulates, in a decision-tree form, the flow of activities and interactions and illustrates system requirements to support the activities. There are usually many DFD included within the model. Each DFD should be as simple as possible to afford the opportunity for all individuals directly affected by CAFM to understand the diagram. The final system model should be a clear and easily understood document which illustrates all phases of system activities and system requirements. The next part, Performance Specifications, is mostly a matter of "translating" the system model into a set of requirements that a CAFM system should meet. This phase should be done with the help of data processing personnel so that system compatibility needs can be met. The Performance Specifications phase will become an important part of the next phase: the Request for Proposals (RFP).

It is the System Modeling and Performance Specifications phase of the project which produces the necessary information to began to determine the type of CAFM system which would best serve the needs of the organization. As information is analyzed, a decision tree can be structured to help with the process.

5. REQUEST FOR PROPOSALS

There are many CAFM products available on the market. It would be a bewildering experience to listen to every software and hardware company's representative in the hope of finding something that will fit the organization's needs. The Request for Proposals will help screen those companies which obviously cannot satisfy the requirements. The following is an example outline:

- Instructions to the Vendor.

- o Guidelines for Submitting Proposals.
- o Proposal Conditions.
- o Directions for Completing the Proposal.
- o Survey of Organization's Facility Management Operations Information from the Performance Specifications can be used to clearly describe needs.
- o Applications Requirements Checklists.
- o List of Functions.
- o List of Features.
- o List of Standard Reports.
- o Description of Query Capabilities.
- o System Requirements Questionnaire.
- o Application Suitability Questionnaire.
- o Power and Capacity Questionnaire o Reliability Questionnaire.
- o Ease of Use Questionnaire.
- o Expendability Questionnaire.
- o System Configuration.
- o System Configuration Questionnaire.
- o System Configuration Summary .
- o Customer References.

Ideally, it would be better to wait until after the pilot project to make the final selection of software and hardware. Unfortunately a computer system is needed to conduct the pilot--the performance of the system is being tested as well as everything else. If the system does not perform as well as it was supposed to, there should be some way to try another system. It is for this reason that many organizations contract with computer companies to try systems before a commitment to purchase. Such an agreement may become part of the RFP.

6. CAFM SOFTWARE AND HARDWARE

The computer industry provides an adequate selection of software products for CAFM. Software is available within a wide range of costs: from several thousand dollars to several hundred thousand dollars. Although the applications vary, most software packages have common functions. It is often necessary to use several types of software packages to satisfy the requirements. An outline of software packages which may be required for a large application includes:

- o Prerequisite software (data base manager, graphics interface, etc.).
- o CAD graphics package.

- Networking software.
- Facility management software.

The facility management (FM) software will be the most important part of CAFM. It is vital that it function in a way which will best serve the needs of those using the system. The following is a list of component modules which are generally common to most facility management software packages.

- Inventory Manager Module (IMM).
- Requirements Programming Module (RPM).
- Location and Layout Planner Module (LLPM).
- Intelligent Drawing Module (IDM).
- Master Planner Module (MPM).

The Inventory Manager Module is the primary database for managing personnel, buildings, space, furniture, cabling, leases, and equipment data. It generates ownership, usage, cost, land availability reports, and also documents space standards. The IMM can help reduce costs, achieve better utilization of resources, improve maintenance scheduling, avoid emergency moves and improve asset control. An essential part of IMM is location identification. Facilities are identified by a single geographic region such as a country, state, city or complex of buildings such as a university campus. This identification can (and should) become part of the general inventory database. The location identification also indicates where the physical items (buildings, floors, spaces, furniture, equipment, activities and personnel) in the inventory can be found.

The Requirements Programming Module produces summary needs for all agencies or departments, projects space requirements, generates detailed space needs forecasts covering individual workstations, equipment, and support areas. RPM also documents adjacency requirements to assure optimal location and interaction of personnel and processes.

The Location and Layout Module optimizes occupancies for buildings on a site or across the state, departments within a building or activities on a floor. It automatically optimizes space layout and resolves adjacency demands. Automatic solutions may be adapted or modified as necessary. Interface with a CAD program provides planning data which is used in preparing design and development drawings from layout schematics. The integration of the two software packages also handles production of detailed construction documents and provides a means for cataloging and referencing as-built drawings.

The Intelligent Drawing Module allows access to both graphic and alphanumeric databases from remote terminals (terminals which may be located miles apart). Questions about facilities can be addressed through inquiry panels. Answers are displayed as highlighted plan drawings or reports. By zooming in and pointing to an area of interest personnel can immediately see what information is available about a particular area (occupancy, area, equipment, people, activities, etc.). The system then lets you access the data.

The Master Planner Module offers the capability of developing a phased, long ranged plan for space and equipment needs. The plan may specify activities and needs such as the movement of groups within an agency from one location to another, remodeling of space, construction, leasing or purchase of space, disposition of unneeded space, amount of vacant or unoccupied space, number and cost of moves, cost of employee downtime, and the cost of operation of a planned facility.

There is often another module used with facility management software which can be a part the FM package or it can be a part of the CAD package: it is sometimes referred to as a CAD access module (CAM). The CAM contains user-callable utilities capable of performing interactive-like functions and other essentials in element creation/query/modification, data management, system parameter access, color/style/width, debugging aids and special applications support including the bridging functions between FM software and CAD software.

The selection of hardware should be finally considered only after the software has been chosen; however, since the type of CPU and applications greatly impact costs, an overview of system types is necessary early in the project. There are generally three types of computers (categorizing computers is becoming more difficult as the power and speed of CPU's are quickly being improved): micro computers (personal computers), mini computers, and mainframe computers. Micro computers are usually the most versatile and least expensive. Micros can be linked together with a network. The network can be served by a single file-server which distributes the data to other micros. The file server usually has a greater capacity than the other computers. Some possible disadvantages of using micros for a large operation is that they sometimes lack control (data can be stored separately on disks without storing it in a central database), capacity is often limited, and interface with minis and mainframes is sometimes restricted. Minis usually have a greater computing and storage capacity than micros. Minis also distribute data to terminals located on a network system. The terminals, however, do not have local storage capacity thus eliminating the control problem. The disadvantages of mini computers are that they are expensive when compared to

micros (expense is a relative term--a byte to byte comparison often shows a lower cost for minis and mainframes), users often are reluctant to use a terminal, and minis and mainframes require data processing people and system managers to insure smooth operation. Mainframe computers are, of course, the largest computers. To the user, the mainframe would be much like a mini in function and operation. Minis and mainframes often have a "virtual machine" capability: an interface that relieves the user of any need to be concerned about most of the physical details of the computer system or network being accessed. Figure 4.1 illustrates some considerations which may be important when considering hardware system types.

Louisiana Project: The FM software selected for the project is the Computer Aided Design Group's CADG+FM. Additional software includes IBM's Structured Query Language/Data System (SQL/DS), CADAM, Inc.'s CADAM (CAD software) and various other prerequisite packages.

Hardware consisted of an upgrade to an existing IBM 3083 mainframe, IBM 5080 terminals, IBM 3192G terminals, plotters, screen printers and other support items. The network was IBM's SNA which already networked most state facilities.

7. THE PILOT PROJECT

CAFM can be expensive both in the cost of computer hardware and software and in the cost of personnel time. It also requires substantial commitment by all those directly affected. It is incumbent, therefore, on those recommending CAFM to conduct some sort of test program to determine feasibility. An excellent test program is a Pilot Project--a small project which will exemplify most aspects of the CAFM project. The Pilot Project requires at least the same commitment (it sometimes requires more commitment because of the compressed schedule) and some computer hardware and software. The pilot study is not intended to be the beginning of CAFM implementation; rather, it is intended to determine possibilities, costs, extents, and parameters for feasibility analysis. Pilot programs usually require funding and should always have a specific time schedule. Some of the most important ingredients which should be included in a Pilot Project are:

- Clear definition of scope and intention.
- A specifically targeted group for study and analysis.
- Designed forms and other instruments for data gathering.
- Computer hardware, software and networking necessary for the project.

o Means for establishing benchmarks and standards.
o Time commitment schedule for participants.
o Means for judging the success or failure of the program.
o Means for determining the cost of activities (i.e.,data gathering, data input, training, etc.).

Louisiana Project: The intention of the project was to establish a means for testing the feasibility of the CAFM project and to test the selected software and hardware. The group selected for study was approximately 1,000 people in the Department of Social Services. Existing data was bridged into the FM system.

The project lasted six months. Systems were tested under actual work conditions and constraints. Although the personnel "learning curve" was still quite high toward the end of the pilot project, reasonably accurate work-task analyses figures were produced.

The CPU used for the pilot was the University of Southwestern Louisiana's (USL) IBM 3090-200 mainframe. A high speed line (56KB) was installed connecting USL with FP&C in Baton Rouge (50 miles away). Software was then purchased and loaded on the computer. Terminals were installed at FP&C for use by architects and engineers. USL's Computer Center support staff helped with loading and bridging existing data bases into the CADG+FM software.

8. REVISED NEEDS DEFINITION

The Pilot Project is the first real opportunity to try the system under almost normal conditions. Personnel are able to input data, retrieve data, study the processes and become familiar with the software and hardware. Generally, personnel can better understand the power of the system after the pilot. This almost always causes a reevaluation of the needs definition. Hopefully, this only means a fine tuning of some of the elements.

9. RETURN ON INVESTMENT

Many organizations have shown substantial Return on Investment (ROI) after implementing an automated FM system. As we see the cost of labor increasing and the cost of computer hardware and software decreasing, an automated system may be the most cost effective way to manage facilities.

Any software company worth dealing with offers ROI figures which can be applied to any specific situation. Make sure that the figures are accepted industry averages before attempting to apply them. A typical ROI list includes:

- Reduce facility management labor by 30% to 70%.
- Reduce cost of movable assets by 10% to 30% .
- Reduce cost of space by 10% to 30% .
- Reduce churn (constant movement of people) by 10% to 30% .
- Reduce cost of leases by 10% to 30%.

Hardware costs are often thought to have the greatest impact on the total cost of the system. This is usually not the case. Hardware can be leased or purchased outright. The life expectancy (time when the system becomes obsolete) of hardware is about three years and five years for software. The following is an example of cost breakdown for a large CAFM project:

- Software Purchase.....24% .
- Hardware Purchase.....23% .
- Personnel Training.....12% .
- Data Entry.....21% .
- Consulting.....05% .
- Maintenance (Annual Cost)...15% .

Maintenance cost listed above includes annual costs for software, hardware, yearly training, and data maintenance. Data should not be used if it has not been maintained. The system is completely dependent on accurate data. It is a good practice to assign someone the job of data base manager. The data base manager would be responsible for assuring the quality of data input as well as the maintenance of data. The cost of data maintenance can vary greatly depending on the availability of information. Data which must be inputted manually will cost much more than data which can be retrieved from an existing data base and loaded into the system.

The cost of CAFM is high: ranging from several thousand dollars to several million dollars depending on the size of the organization and the number of square feet. The investment in facilities, however, is also dramatically high. Facilities often amount to 30% of total assets. Facility operations amount to 75% to 85% of total life cycle costs. Facilities can account for 20% of total expenses.

Louisiana Project: One of the most immediate uses of the system was to use it to help FP&C employees reduce the amount of space Louisiana leases. At the time of the pilot project, Louisiana leased about 1,400,000 square feet of space. Based on Pilot Project results and on national averages on space reduction by automation, it is expected that Louisiana can reduce the amount of leased space by about 111,000 square feet per year for about five years. The average cost of per square foot for leased space is about $10.00 thus producing a savings of about $1,110,000 per year. At the time of the writing of this paper the projected savings had been surpassed.

FP&C did not reduce its staff as a result of the savings in employee time; rather, FP&C used the savings to perform facility management services which it has never had time to do. Reduction in churn is expected to be about 12% per year. Reduction in the cost of space is expected to be between 10% and 22%.

Louisiana's cost of implementation, not including data gathering and data input, was less than one million dollars.

10. IMPLEMENTATION SCHEDULE

Project implementation schedules should be as realistic as possible. Three to five years from the start of Needs Definition to the completion of data gathering and input is common for a large CAFM project. Actually a CAFM project is never complete--data gathering and maintenance is a perpetual task. There is, however, part of the project which might be considered the primary project. The primary project includes those phases covered in this paper.

11. CONCLUSION

This project was very successful not only in providing a service for Louisiana but in supplying needed information for future decisions. The Department of Architecture gained hardware and software which is now used for teaching as well as for maintaining facilities at the University. Links were established from the Department to other data bases which provides additional information for research and instruction. Everyone benefits from such a project.