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A method for approaching the problem of relocating a data processing installation.

Horace William Townsend

A METHOD FOR APPROACHING THE PROBLEM OF RELOCATING A DATA PROCESSING INSTALLATION

by

Horace William Roberts Townsend

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Professor in Charge

Chairman of Department

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ABSTRACT

With accelerating technological changes and the increasing dependency on the electronic computer, the task of relocating or changing out a computer without disrupting the activities supported by it will continue to be a large and risky project.

As the dependency on a computer and the complexity of the move increase, it becomes harder and harder to find a reliable and proven method for approaching the problem of relocating a data processing installation. This paper provides such a proven method.

Because there are so many concurrent activities during a computer move that must be synchronized precisely, any delaying problem will threaten the successful completion of the move. There is a limited amount of time that any organization can survive without computer processing power; so, the risk of exceeding this limit must be controlled and reduced as much as possible.

To reduce risk and to prepare for a successful move, goals and objectives must be clearly understood that will guide planners toward selecting reasonable and feasible move strategies.

Planning is the underlying secret of success. Understanding what might happen in the future and having a course of action ready to deal with any possible situation is the only way to prepare for an upcoming

computer move. This is easily said, but difficult to achieve. There are many analytical and subjective tools available to aid in planning.

Getting organized is the first important task in move preparation. Appointing a Move Manager and selecting a Move Team must be done early and with great care and thought. Developing backup and alternate plans is the second most important work that must be done. What if this part of the plan does not work, what will we do? Provisions for running the ongoing work while the computer is out of action must be developed and tested.

Scheduling will tie all of the preparation together. A move schedule must be prepared that is as detailed as a stage director's script. A lot of down time and risk can be eliminated by detailed and analytical scheduling. There are many scheduling jobs that must be done from: when should the move begin to what order work teams will eat meals. Everything must have a time to begin and a time to end.

Great care must be taken in deciding what will be moved to where along what route and in what order. Computers are heavy and bulky and can be damaged easily. It will not matter if the move was completed on schedule if the computer is damaged and will not work.

Everything in a new facility must be tested to be sure that it will support the computer once it has been moved in and installed.

Contracts must be signed. Agreements to commit resources must be made; and all who will be involved must be informed as to what is expected of them.

The method described herein has been synthesized from many sources including the experiences of successful computer move projects, and has been applied to and proven valid with the computer move project at Air Products and Chemicals, Inc., March 1976.

CHAPTER I - INTRODUCTION

The Problem Defined

Over the ages man has developed and depended on his machines. Man with his great ingenuity has always been able to make do when one of his miraculous devices failed to perform its designated duties. It has not been until recently that man has become so dependent on particular machines that his survival depends on them. The electronic data processing computer is one such device. This machine, one of man's most amazing inventions, has become an integral part of the daily events of Twentieth Century man.

There are volumes written on how to use computers to solve man's problems and improve his life. There is also a great fund of knowledge pertaining to how to keep these incredible machines doing what they are intended to do. Inevitably, the situation will arise when a computer that is heavily depended on will have to be relocated or replaced due to any one of the reasons that will be discussed later. It is at this time that the inventory of man's knowledge becomes thin and is unable to provide answers to pressing questions.

This, then, is the problem: a great need exists for a method that can be used when approaching the relocation of an electronic data processing computer along with the resources it requires to perform its designated functions. This method must answer the questions that will allow plans

to be made that will minimize the impact and the risk of being without the computer for an extended period of time.

Dimensions and Limitations of This Paper

Any subject worthwhile must be balanced between generality and detailed facts. In this paper some limitations must be placed on the universe of computers discussed to allow the facts to take on needed value.

The first limitation will be placed on the size of the electronic data processing computer and supporting resources. For the purposes of this paper, only above average to large computers will be discussed. This is not to minimize the problems associated with relocating smaller models but, as the installations get larger, the amount of useful knowledge on this subject decreases.

The second limitation will be placed on the criticality of the functions performed by the computer to be moved. The need for information and a method of approach is greatly reduced when the functions performed by the computer are not critical to health, safety, and survival. Only computers that perform functions critical to the health and safety of organizations, institutions, and mankind in general, will be considered in this paper.

At this point, a comparison can be drawn between computers performing real-time control of a nuclear power station for a large metropolitan

area and a large, multi-processor installation supporting a huge multi-national corporation. The size types of problems that deal with the complexity of logistics and controlling a large number of events must be solved when considering a large corporation. The power plant computer relocation will have to solve problems in scheduling and the minimization of great risk. The element common to both is a critical function that must be performed to maintain the health and safety of the activity the computers are intended to support. In both cases a dependable method is needed to insure a successful computer change-out or relocation.

The last limitation on this paper is that only computers that are relocated or changed-out will be addressed. It is the intent of this paper not to discuss the first computer situations for one main reason: these computers do not perform a critical function before the time of installation. It is true that in many instances directly after installation these computers are critical to the activities they support, but the problems that must be dealt with here are only a subset of the problems that must be addressed when relocating or changing-out an existing critical computer activity.

This paper is the result of the analysis of successful computer moves (2,3,4,7). There is very little documentation regarding unsuccessful ventures for several reasons: it has only been in recent times that this type of problem existed at all. There have been failures but due to the severe ramifications and personal embarrassment, few of these cases find

their way into print. because of the great risks, great amounts of resources go into insuring the required success.

It is important to realize that this paper is not a cookbook on how to relocate a large or critical data processing installation. There are many situational and emotional issues involved in relocation activities and these issues make each relocation project unique and to a large extent different from all others. It is possible, though, to analyze the commonality within the existing examples of successful computer relocations and to identify common elements that are independent of the unique or local situations. These elements can be grouped together into an approach which can be applied to a class of related problems. The common elements of a successful move are straight forward in themselves. It is the proper combination, balance, and integration of all of the appropriate elements that will produce the desired results.

It should be clear by now that, although this paper will deal with large-scale examples, the benefits of a logical and successful approach can be of value in different proportions when applied to the problems involved with relocating smaller or less critical computers and electronic data processing installations. So then, this paper is the discussion of an approach to a family or class of management problems centered around relocating, reconfiguring, or changing-out electronic data processing installations.

CHAPTER 2 - THE DIMENSIONS - CAUSE, COST, AND RISK

The Cause of the Problem

Accelerating change is the main cause of the problems in relocating a data processing installation. Society demands more goods and services than ever before and the rate of increase accelerates with every passing television commercial. National economices are planned and managed by the hugh, multi-national corporations. Extremely large organizations are managed by groups of corporate executives and controlled by large and complicated data processing networks.

There is hardly a product, a service, or an activity in Twentieth Century life that is not dependent on automation. A great amount of automation is computer controlled. Plants covering acres can be managed by a handful of men with the assistance of computers.

Aviation, rail, sea, and space travel have grown to a magnitude beyond the physical capabilities of the men responsible for managing and controlling them. Computers have been enlisted to keep order in this hectic segment of modern life.

Medical centers have put computers to work in medical analysis, X-ray, brain scanning, research, statistical analysis, surgery, and hospital administration. Without a doubt man's increased life span can to some degree be attributed to computer technology applied to medical science.

This discussion can go on and on, including government, science, military, and so on. But, the point being made is that the life of modern man is complex. It is really not important to determine if computers are the cause of this complexity or contribute to the cure. The fact is that large computers are critical to our way of life and our survival in the Twentieth Century, and will be more so in the future.

Compounding the problem is the growth in the population of installed computers. As described in C. P. Lecht's THE WAVES OF CHANGE, COMPUTER WORLD, Aprial 18, 1977, it is estimated that there were three thousand installed computers in 1959. In 1975, just 16 years later, there were an estimated one hundred and fifty five thousand computers installed. By 1985 there may be over five hundred thousand installed. Computers are becoming part of all aspects of our lives.

Computer technology has improved and refined this amazing tool from the Mark I of 1939 and the 1946 ENIAC to the giant data processing devices of today. The ENIAC covered 1800 square feet of floor space and require 18,000 vacuum tubes to operate. Today, all of that processing power plus a lot more can be stored in a few miniaturized electronic components and require only a few square feet of floor space in the corner of a room.

The cost of these miraculous devices is another element of the problem. Although the power, capabilities, and functions have increased at

exponential rates, the costs have decreased dramatically to a point where it is not a luxury to own and operate a computer any more.

The cause of the problem is clear: Computers through technology can provide great assistance in problem solving, decision making, and control. At the same time their costs are decreasing which makes them applicable to almost any situation. The dependency on these machines has increased substantially and will continue to do so in the future. The new and more powerful generations are coming off the assembly lines every year. Change-outs and relocations of electronic data processing equipment have become, and will increasingly be a significant problem for modern management.

What Are the Costs?

The measurement of an activity or a project in terms of cost provides a universal and well understood yardstick for analysis and decision making. There are volumes written on cost analysis and feasibility studies. Reviewing this is not our current task. It is important though to spend some time discussing the dimensions of costs that are involved with the relocation of a large or critical electronic data processing computer.

There are related costs that can be categorized across a range from the finite to the subjective. In most instances the total cost of a relocation or computer change-out is high, but if done poorly, or if

problems develop, the cost can be astronomical.

The most straight forward are the out-of-pocket costs. These costs deal with services, stand-by capability, moving equipment, manpower, overtime, extra security, duplicate equipment, consulting fees, rented computer time, and transportation during the move.

The next category of related costs could be thought of as indirect costs. These costs represent the expenditure of resources but cannot be totally identified. Examples of these costs might include staff employees assigned to the relocation project, routine services generally available to the organization, employees made idle due to down time in preparation or during the move, delays in cash flow or shipments, and overtime in organizations or departments dependent on the services of the computer.

The third and most subjective cost category are the opportunity costs. These costs result from diverting resources from existing important activities. These costs may include the costs associated with unsolved problems due to computer downtime, information needed but delayed due to move preparation and downtime, lost control of critical activities and disruption of activities and procedures.

The point to remember here is not the actual costs but that there are a wide range of costs brought into any computer relocation decision. When alternative plans, approaches, and procedures are evaluated, it will be

critical to include some representation of all related costs to see clearly the effect of proposed plans.

What Are The Risks?

The risks of future events, either expected or unexpected, will be the central, binding thread of this paper. If life were completely predictable and without exception, there would be no need to present more than a check list or a cookbook on what to do first, second, so on. Life is not that simple, particularly, in the business of relocation data processing equipment. The risks range from the simple: "Something may go wrong." up to: "The equipment may be involved in an accident and be completely destroyed." Obviously the ramifications of these two examples carry different levels of severity and may completely change the anticipated success of the overall relocation project.

It may be important to restate at this time that only large, complex, and/or functionally critical computer relocations are being considered here. The same risks are a part of all relocation projects, big or small, but the arborescent backlash would clearly be quite different.

Although not academically based, Murphy's Laws show dramatically why risk must be considered within every activity of computer relocation planning.

1. In any field of scientific endeavor, anything that can

go wrong, will go wrong.

2. Left to themselves, things will always go from bad to worse.

3. If there is the possibility of several things going wrong, the one that will go wrong is the one that will do the most damage.

4. Nature always sides with the HIDDEN FLAW.

5. If everything seems to be going well, you have obviously overlooked something important.

Of course, then there is O'Flaherty's Correlary:

Murphy was an optimist.

CHAPTER 3 - ALTERNATIVE APPROACHES

History

When the first computers were being installed, many times they were built from scratch right in the building that they were to be used in. This was the case in the 1940's with Mark I and ENIAC. With the combined advances in computer technology, modular construction of interchangeable components and the increasing demand for general purpose electronic data processing computers, data processing equipment was installed, rearranged, and moved in a manner similar to that used for other machines used in industry.

As technology continued to improve and as the individual needs for more processing power grew, new computers replaced existing ones. The functions these devices performed were important, but due to the limited integrated use, the task of relocation or change-out was only a matter of stopping the activity altogether, reverting to a manual substitute, or using someone else's computer until the new one was available. Then the time pressure of today was not a great factor.

The dependency and complexity did grow and the time factor became important. Machines had to be disassembled, moved, reassembled, and tested within a shorter period of time in order to be ready for prearranged processing cycles. In some instances, other computers had to be installed in parallel to support on-going functions while the main

computer was removed and a new one installed and tested. During this phase the time periods were measured in weeks. The risk factors increased due to the more complex and fragile electronic components. The cost factors also began to increase because of the larger logistical problems encountered.

The next phase involved the improvement in the support facilities for computers. New air conditioning and power requirements had to be met. Insurance carriers required better fire detection and prevention capabilities and space for future growth was a critical element of any new computer site. Relocation planning was made somewhat easier during these times, primarily because most moves were synchronized with machine upgrades. The new computers would be delivered, installed, and tested in the new facility while the old computer satisfied existing requirements. When the testing was completed, work would be transferred from the old computer to the new one and the old computer would be sold or returned to the vendor. This was not seen as unnecessary cost because during this phase a hardware upgrade many times required a significant software upgrade also. Having the two computers made software development and testing much more productive.

Today life is much more complicated. With the development of integrated data processing, time sharing services, national and international communications networks, electronic banking, computer assisted surgery, and the like, the time horizon that a computer can be out of action is

measured in minutes, and in many cases, seconds. How, then, do you move a computer, upgrade it or change it out?

In approaching a subject as large and as complex as the one being discussed, the first step should be the setting of goals and objectives for the task to be performed.

Goals and Objectives

Each organization for each computer move must develop a clear, written understanding of the principal goals and objectives that will be part of all move planning and activities. These statements should be at the level of importance that if only these goals and objectives are achieved, if all else fails, in other words, the move will be considered a complete success.

The following are considered to be goals or objectives that could be utilized when describing a computer move:

- -Minimize all reasonable risks
- -Minimize out-of-pocket costs
- -Minimize the risk of putting the organization out of business
- -Minimize the cost to users
- -Provide coverage to critical teleprocessing activity
- -Minimize the risk of damage to the equipment

-Continue to provide one hundred percent of contract service

-Minimize worst case possibilities

-Support critical functions with no interruption in processing

-Complete the move in X days

This is not an exhaustive list, of course, and there is a wider range of objectives represented here than would normally be associated with any one move. Whatever the right combination, the remainder of the planning and preparation activities should focus on and expand only these goals and objectives.

Some Basic Models

There is no one right answer to the question: "What strategy should be used to successfully relocate electronic data processing equipment?" There are general groupings of strategies that will be outlined for reference. Each represents a different balance between cost, risk, exposure time, logistical support, and the probability of success.

Model 1 - Shut it down and move it

This alternative seems simple, but it is the most risky. It involves picking an advantageous period of time and, with no real contingency plans, just moving the computer. The main advantage is that if all goes well the out-of-pocket cost is insignificant. If things go poorly, however, the results could be devistating. This model can only be used

if there is in fact some reasonable period of time during which the computer is not needed. Hopefully, this period will be longer than the time required to relocate or change out the equipment. Catch up time must be added to the move time extending the expected downtime of this alternative.

Model 2 - Schedule the move with a machine change out

Many times a move and a machine change out can be synchronized. The new machine goes to the new site and is set up and tested while the old computer supports the processing load. When all is well at the new site the load is shifted and the old machine is sold or returned to the vendor. There is no downtime and the exposure time is limited. This model is low on the risk scale. There is additional cost due to machine overlap and dual facility operation. The planning is straight forward and the vendor will be more than willing to help make the job go smoothly. There is one disadvantage in that many times this model is just not appropriate.

Model 3 - Offload work to time sharing service

In this model all processing will be shifted over to a time sharing service. Then the machines will be moved or changed out and the load will be moved back. This is one of the more expensive and complicated models. With a lot of processing hours, data and master files, it may be difficult to find service bureaus that can handle all of the work. A

large communications commitment may also cause problems. If this model fits, it is low on the risk/ exposure scale. It does involve working at more than one facility, and depending on compatibility, there may be a lot of preparation required. Move elapsed time is dependent on available rental computer time. There is a large logistical problem moving data and reports to and from the service bureau.

Model 4 - Offload work to neighbor with capacity

This model is very similar to Model 3 in that another existing data processing facility is utilized to support the workload. In this model the cost will be a lot lower, but so will the chance of getting the required computer time. Incompatibilities may be greater but neighborly cooperation will also be greater. Planning will have to synchronize the activities of two organization and, if things get tough for the neighbor, you may be pushed out at the last minute. The same logistical problems exist as in Model 3, but the distance may be less. Teleprocessing may be out if compatible capabilities are not available. There are very few large data processing facilities with existing capacities great enough to accept another large processing load.

Model 5 - Duplicate the configuration and swap

Model 5 is similar to Model 2 in concept, the difference being that identical equipment is obtained. In this way two sites with similar capabilities are available and the shift of the work load can be made

and all testing can be done with a complete backup facility available. Once the shift is made, the original equipment is exchanged for that at the new site plus some amount of money for the short-term use of the equipment used. This model can range from duplicating the entire configuration down to just duplicating and swapping certain critical components. This model is expensive but greatly reduces the risk of being left without processing power due to some mishap. For large installations it may be hard to find uncommitted hardware that exactly duplicates the existing equipment. Without the exact match, additional development and testing time will be required to insure compatibility.

Model 6 - Piggybacking one at a time

Piggybacking is a good model for multiple processor moves. One of several processors can be completely relocated and tested before the next is moved, and so on until all have been relocated. The key element is the temporary decrease in processing power. The risk of this model is a function of the excess processing capacity available during each step of the move. Planning and scheduling are fairly complicated but out-of-pocket costs are relatively low. The greater the number of processing units available, the lower the individual risk of taking any one out of action during a move. A lot of large sites fall into this category, but far too many do not. Many large or critical electronic data processing applications are single processor based. Different combinations within this model are possible: for example peripheral units can be piggybacked from one system to another to increase the

processing power of a machine temporarily without greatly endangering the total processing availability.

Model 7 - Move when computer is not needed

This model is of value when a machine is required seasonally or for certain events. In other words, computers can be moved or changed out at will in off seasons or idle times as long as they are ready to go on schedule. A good example are computers needed for processing income tax returns. By scheduling the move wisely, the risk, expense, and planning are greatly simplified. To some extent every site experiences some element of this model. Holidays, weekends, and vacations may be off times. On the other hand, it may be difficult to find people willing to work on a move at this time.

Model 8 - Peak load rental

Some computer vendors offer a rental package covering some limited number of months use of non-backordered computer hardware. The rate is high relative to long-term agreements but the commitment is very short-term. It is rare to find an exact duplicate of existing hardware so a learning, development, and testing phase must be associated with the rental hardware. Many times moves take less than a week to complete, so the three or four months minimum rental cost may be too expensive. As the demand for computers increases, the availability of this type of an arrangement may be limited. Move scheduling must be

synchronized with machine availability.

Model 9 - Always have a spare

Some applications are so critical that backup or spare computer components are already available as normal standby. If this is the case, these components can be used as primary processing units during the change out or move. The key and obvious drawback to this model is that now standby or backup components are no longer available and a higher level of risk is present during that period of time.

Most facilities cannot afford completely unutilized standby computer systems but have critical standby or infrequently used components that may be utilized in a similar manner during a move.

General Rules

There are a few general rules of thumb that emerge from these alternative move models. They are as follows:

-To minimize the element of risk, the exposure time or the elapsed time of the move must be as short as possible.

-Most move models involve at least one computer in addition to the one being moved.

-Wherever a critical component exists, so lies the source of potentially devistating problems.

-The time to debug a new facilitiy or a new arrangement takes at least as long as the time to physically move the hardware.

-A move model that is simple has a higher probability of success than one that is complicated.

-The actual out-of-pocket cost is often not the key decision issue in selecting an appropriate move model.

-Most successful moves include combinations of the above mentioned general models

-Any move will be a major event in the life of the organization involved.

-A lot of planning time is needed

-All moves had some form of emergency backup planning in case major problems occurred in getting started on the new facility.

The remainder of this paper will expand the elements of these models and will discuss methods and techniques for reducing the inherent risks,

minimizing the total cost, simplifying the procedures, and generally increasing the probability of success of any computer move, change out or relocation.

CHAPTER 4 - PLANNING

An Overview of Move Planning

Webster's New College Dictionary defines planning as "1. A method for achieving an end; 2. A detailed formulation of a program of action; 3. An orderly arrangement of parts of an overall design or objective." Everything being discussed in this paper falls under the definition of planning. A computer move can be broken into two phases: one is a planning phase and the second is an execution phase. Ninety percent of all move project time will be spent in planning because it is the keystone to success in moving an electronic data processing facility from one place to another. Without adequate planning or advanced decision making, the move will be destined to get bogged down in confusion, disruption, and failure.

Computer move planning can be compared with a miliary operation quite easily. Objectives must be set; schedules must be developed to link indepedent events; organizations and groups of individuals must be trained and organized; men, materials, and machines must be transported and their activities supported. Finally all plans must work perfectly to avoid a disasterous outcome.

Planning will be done at many levels of detail. The critical path will be discovered and key events will be identified that must be handled properly to assure the success of the total move project. Planning

cannot be done in a vacuum. Many points of view and interests must be heard and incorporated into planning activities. All plans must be documented clearly and accurately. No plan is truly finished until it is written down and agreed to by all involved.

What is involved in planning anyway? Planning is a complicated and artistic form of activity. There are no clear rules or formulas for how to perform this function. There are only guidelines and activities that should be included during the course of this procedure.

1. Forecasting conditions and environmental scanning

   It is important to understand the environment in which the move will take place. The influences impacting on it within the controllable environmental boundaries must be understood and measured. The direction and speed of growth of controllable and noncontrollable influences must be incorporated into any planning activity.

2. Setting Objectives and Goals

   Objectives and goals are the manifestation of the essence of a project or the end point that must be strived for. If the goal is clear in the eyes of planners and support functionaries, all activities will be coordinated and will work toward the same ends.

3. Programming Work and Coordination

A road map is needed to enable planners to transcend from the present to the future described in the goals and objectives. This is accomplished by programming component work activities and coordinating the rudiments of technique and technology.

4. Securing and Budgeting Resources

All important activities require a critical mass of resources to be committed to them. Budgeting can be seen as a requirement aimed at augmenting the strategy for achieving the move goals and objectives.

5. Communications

Communicating ideas, thoughts, and goals is the catalyst required to make the planning activity work. It is essential that individuals are aware of the boundaries directions, and speeds associated with move activities.

Why is Move Planning So Imporant?

Simply stated, people have to know what to do under all and any circumstances, changes, and emergencies that may occur as a result of

the move. Computers are moved every day with a high degree of success. In any computer move there is a multitude of diverse and unpredictable problems and emergencies that can and many times do become part of a computer move. Because of this several days of down time can be expected. It is the unexpected or unprepared for down time that will be devistating. The proper premove planning will minimize the inability to deal successfully with problems and will greatly reduce the risk of being without the comptuer longer than an organization can tolerate.

Planning will take many forms and will results in innumerable documents, reports, and lists. The following represents the simplified representation of major planning categories:

Move Team Organization

As will be seen in the chapter entitled "Getting Organized" the first step is lining up the people and forming up the organizational relationships. After all, nothing can really be done without people. A lot of misunderstanding and confusion can be avoided with clear organizational and responsibility descriptions.

Master Move Schedule

This should be a chart or a list describing the major events of the move in a time/calendar format. This will allow a clear view of move activities on a day-to-day basis and facilitate work scheduling and

completion auditing.

Macro Move Plan

The purpose of the Macro Move Plan is to relate and coordinate interdependent move activities. PERT and CPM are good tools to use here. Check points and milestones can be developed from the Macro Move Plan to assist in controlling and monitoring project progress on Move Day.

Micro Move Plan

This plan is similar in many ways to the Macro Move Plan above and it performs many of the same functions. The added value and importance of the Micro Move Plan is the detailed sequence and scheduling of all move related tasks and events. Work assignments and resource balancing can be done at this level. The Micro Move Plan is to a computer move as a director's script is to a theatrical production. Everything needed to perform the move can be found in the Micro Move Plan. The Micro Move Plan and the macro move plan are dependent on each other and must be developed together.

Responsibility Lists

Here is where the Micro Move Plan is broken down and divided into work lists for the members of the Move Team. The lists will show what each

responsible individual is expected to do and when.

Resource Schedules

Resources schedules show for categories of resources what is expected of them, for example, if moving vans were the resources, it would list the number and types of vehicles, their capacity and characteristics, when they should arrive, and at what location, and how long they are expected to stay.

Inventories

These are simply detailed lists of what is to be moved including any information that will fully describe the item.

The Tools of Planning

As mentioned earlier, planning is an art form. Because of this, the tools used vary with the individual doing the planning.

The most important tool used in planning is knowledge - knowledge of what is involved in the overall project. A person who does not fully understand the characteristics and idiosynchrasies of the computer being moved cannot prepare for known configuration dependent move related problems. A person who does not fully understand the organization, supported by the computer cannot hope to prepare plans to support the

organization with critical data processing services during the move. A person who does not know what resources are required for a move cannot begin to make preparatory plans.

Analysis is the second most important tool. Knowledge increases with analysis. A lot of the time expended in move planning is used for analysis. Each site is different, each move is unique. The differences must be made clear. The organization's data processing needs must be analyzed and understood. These situations must be studied so that the move related resources can be acquired. Analysis as well as knowledge is endless, so the point at which all move related analysis is finished does not exist. There is a point at which the critical mass of move related knowledge has reached the required critical mass. This point occurs when the Move Manager and Move Team are able to answer clearly and freely any reasonable move related question presented to them.

Another very important tool of move planning is methods engineering. This tool helps in analysis to answer the question: how will the job be done? There are many good books and articles written on this subject. Under the topics of operation process charting, flow process charting, flow diagraming, equipment selection, facilities layout, work flow patterning, and material handling. The techniques and particularly the method of approaching the problem will be helpful in computer move planning.

The last tool to be mentioned here, although there are many more, is in

the general topic of standards engineering. Any form of time-phased planning requires reliable time estimates for the tasks that must be performed. Work sampling and time study techniques provide the best method for estimating the expected time to complete individual work units. Once again the applied techniques are not as important as the method of approaching the problem.

Other tools that will only be mentioned are: statistical analysis, forecasting, modelling, simulation, queueing theory, CPM, PERT, Reducing the Risk

The primary goal of move planning is to reduce the risk of the unknown. How this is finally done is dependent on the imagination and creativity of move planners. Merely attempting to begin planning the move has started the wheels in motion and will in itself reduce the inherent risks within computer moves.

The remainder of this work will more fully describe the phases and parts associated with move planning. In the remainder of this chapter, some of the more artistic risk prevention tools will be discussed.

A constant vigil must be maintained to identify and measure the weak links in the move planning and preparation. The weak link may be a part of the move planning that has been completely overlooked, or it could be a good plan that after testing has proven inoperable. A person may be a weak line, someone who has a responsibility but lacks the knowledge or

enthusiasm to properly carry out assigned tasks can be a great risk to successful project completion. The most important weak link, and hardest to identify, could be the Move Manager himself. As Murphy's Law so appropriately states: "If anything seems to be going well, you have obviously overlooked something." It is easy for the Move Manager to convince himself that everything is under control when in fact it is not.

Once weak links have been discovered an analysis of the risk must be made. Some overlooked planning tasks are not that important and can be completed when time permits. Others may obsolete all work done to that point in time. Some weak links are temporary and will disappear with attention or discussion. Some will be fundamental problems throughout the move planning. It is the primary responsibility of the Move Manager to identify weak links, and take corrective action.

On another set of subjects, when alternative courses of action are available, care must be taken not to suboptimize the minimization of risk from the systems point of view. Selected alternatives should strive to reduce the total risk of the move even if individual phases within the total plan must suffer because of it. After all it is the total move project that must succeed, not just one phase.

Do anything reasonable to strengthen the remaining weak lines in the move plans. It may be possible to replace them or build them up with added resources. Duplication in a paralleling role will reduce the risk

of the link failing completely. A back up or alternative course of action can be prepared to be used in the event that the link fails.

Anyone involved in the move should stay on top of all move preparation. In this way many eyes will be aware of the activities at hand and can spot trouble early before too much time passes. There is not really that much time available for move planning so time lost due to errors or misjudgements is critical and irreplaceable.

As in any type of move, it will help to get the house in order as early as possible. Simplify activities. Postpone nonessential work until after the move. Change bad and obsolete procedures and standardize activities to clarify the truly essential work that must be performed. Begin or strengthen policies of file back ups and system recovery procedures. Premove preparation is a good time to cut the fat out of an operation. The organization will be better because of it and the move will be easier to plan.

Be sure that people know what to do. Don't assume that they know. Let them show you that they fully understand what they are expected to do. It is better to challenge a person's level of preparedness in practice than to have them let the team down in the game when it really counts.

The last point worth mentioning involves questioning everything. Never be satisified with the quick and simple answer. There are very few things in move planning that equate to being quick and simple. Ask the

questions, demand comprehensive answers, and then question the answers.

CHAPTER 5 GETTING ORGANIZED

There are many different management philosophies on how to get a job done. One thing is clear with computer moves, people are the most important single element in the preparation for and the execution of a move. It is appropriate to discuss first the important elements of organizing the people who will make up the Move Team.

Principles of Management

The purpose of a Move Team is to manage the relocation of a computer and to deal with all of the situations that may arise during this process. What does it mean to manage? To manage is to: 1) organize people, things, and events into groups in which the capabilities of each group is greater than the sum of the capabilities of its individual parts; 2) plan the sequence of events in the future that will enable individuals and groups to achieve certain preestablished goals, 3) control events to ensure that a maximum effort and an optimum utilization of resources is maintained and directed at specific tasks; 4) lead individuals and groups of individuals by motivating and stimulating people to achieve their maximum potential.

What basic management principles exist to guide managers? There are no hard and fast rules here, but one principle should deal with understanding and striving to achieve the objectives of the organization involved. If the organization's business is to serve customers, then

management should go to great lengths to insure smooth and timely service to customers even during a computer move. Another principle of management is specialization, developing expertise in complementary skills within a Move Team will greatly increase the effectiveness of the group. Departmentalization can be utilized to divide the work and responsibility into geographical, functional, or purposeful groups. In any management activity there must be unity of command, one person to give orders and direct activities. A balance must be sought between the responsibility to carry out tasks and the authority to make decisions and commit resources to execute this responsibility. The more responsibility invested in a person, the more authority he should have to make decisions or else a bottleneck will develop in the decision process. Authority should be delegated to reponsible subordinates to increase the pace of the management process. Responsibility, on the other hand, can never be completely delegated away from a superior. The span of any manager's control should not exceed his ability to perform his responsibilities of organizing, planning, controlling, and leading.

In a computer move the line/staff relationship must be fully understood to ensure that the lines of authority and responsibility are maintained. A line officer is responsible for the resources of the organization directed toward achieving the basic goals and objectives of that organization. A staff officer has the responsibility for supporting the line officers by coordinating, advising, controlling, and serving. Within any line or staff organization there is evidence of both line and staff activity. For example, some line activities perform staff

functions for other line activities.

In a computer move there must be a well balanced and clearly defined mix of line and staff activity to ensure that all of the required points of view are represented in plans and decisions.

The Move Team Concept

A simple definition of the Move Team Concept could be: "That group of responsible individuals who through their skills, influence, and hard work, plan for, prepare for, and control the execution of a computer move." Other terms can be used such as task force, committee, or project group. It is the function that is important here.

It is not critical to have a formal Move Team established. Many large moves have been satisfactorily completed without one, but there are more examples that have used formal Move Teams. The important issue here is that the utilization and size of a Move Team should be flexible and matched to the needs of the expected task. Any committee can become unwieldy if careful balancing is not done.

The Move Team is temporary in nature. It may be made up in the form of outside consultants, vendors representatives, internal personnel, or a combination of each.

Because of the ephemeral nature of this body four points emerge that

will influence the success of any Move Team.

1. Each person on the team will be assigned critical responsibilities and must have technical expertise commencerate with their assignment

2. In most cases Move Team responsibilities will be in addition to ongoing responsibilities. In this light it is important not to diluate the ongoing operational focus and risk the success of the entire project while preparing for the move.

3. When moving a computer, several long-term organizational adjustments may be required to efficiently operate the new installation. New assignments should be made during early move planning if it can be accomplished without causing severe motivational problems within the Move Team that will detract from the premove momentum so important for success. There is a great opportunity to gain knowledge and experience during a move and persons with new related responsibilities should have an opportunity to take part in the planning.

4. Senior management must be actively involved in the early phases of evaluation and planning. Although the authority has been delegated to the Move Team, the responsibility for its success cannot be delegated. It is also important that top management be made aware within appropriate limits of the commitment of resources, the proposed scheduling, the possible risks, and the contingency plans.

This type of awareness will make life easier if additional support becomes necessary later on.

The Move Team concept facilitates the assembly of needed skills, resources, and awareness during a period of time with the isolated and specific goal of successfully moving an electronic data processing computer. For this reason, the Move Team concept is a better way to do the job.

The Move Manager

The management principle of unity of command is important in computer moving. One and only one individual should be designated with the responsibility to make major decisions and to set policies. This person should be responsible for effective follow through, establing and adhering to time tables, recruiting, training, leading Move Team members, developing a Master Move Plan and, assigning duties to others, reporting to upper management as to progress, solving problems and establishing needs.

The Move Manager must receive the necessary support from management to enable him to accomplish his task. He should establish and maintain a strong communications link between himself and appropriate upper management. The Move Manager should report directly to a vice president or officer of higher authority during this assignment to gain the vantage point and leverage needed.

The qualifications of a Move Manager are many. This person must have excelled in previous project management assignments. He must have evidence of success in dealing with large groups of people representing varied levels of technical and professional abilities. He himself must possess a wide and current background in the field of electronic data processing. He must have technical expertise in computer facilities planning and the particular hardware configuration being moved. He must be strong willed, but willing and able to compromise to reach agreement. He must have highly developed communciations skills and must feel at ease in executive offices.

The selection process for the Move Manager should begin well in advance of the move. This process should be done analytically and carefully. The process should not be rushed nor the selection standards compromised. The salary spent on this individual is money invested, because on his shoulders rests, for a period of time, the health and future of the organization.

Move Team Members

As mentioned earlier the Move Team is a concept. It could on occasion represent a formal group or committee representing the various required points of view or it could mean all individuals involved in any manner in the computer move. In this section the Move Team will be discussed in its widest interpretation.

Who should be a member of the Move Team? This depends greatly on the individual environment, but the following functions should be included.

A representative from computer operations should be on the team to represent the ongoing commitments and obligations. Systems Programming will be required in any backup planning and contingency scheduling. Production control should be included to plan for and to monitor existing and special schedules. Telecommunciations and remote operations will have to synchronized with all move activities. Data entry interests will have to be considered with schedule changes and contingency planning. The interests and needs of all computer users must be represented, particularly those users who perform functions critical to the health of the organization. New application development commitments and activities must be considered with down time scheduling and contingency planning. Security interests must be included because of the increased vulnerability present during a move.

Some functions required in the Move Team only exist for the time needed to plan and execute the move. They are the Move Manager who is responsible for all aspects of the move, the Plan Coordinator responsible for check lists, schedules, meeting agendas, progress reports, and communications. Physical site preparation and move logistics will also be critical functions during the move.

Representatives of hardware vendors must be a part of the Move Team for,

after all, they will be the people who take the equipment apart and get it together and working again. They have done this many times before and will provide a great amount of information needed for move preparation. It is important to remember that they will be conservative and will represent a somewhat pessimistic point of view because of the unknowns and risks within their responsibilities during the move.

As Move Day approaches more and more functions will be represented on the Move Team. Movers, elevator representatives, plumbers, air conditioning specialists, electricians, raised floor experts, fire system engineers, building maintenance, and the telephone company will all become involved in the preparations.

By the time Move Day actually arrives the remaining functions will have added to the Move Team. Move control, offsite backup control, catch up scheduling, move group schedulers, cable rollers, elevator schedulers, truck coordinators, site coordinators, communications control, public relations, food and drink suppliers, message runners, police, and others that will have key roles to perform in individual situations.

All of the Move Team will be actively invovled with the move or on call and standby during the actual move. If all goes according to plan, so much for the good, but if trouble develops, individuals representing key functions must be able to be brought together quickly to evaluate alternative action.

The organizational engineering required to mold a group of individuals into a well disciplined and effective team requires time, but if properly done it will reap great rewards. The methods are not complicated but at times do prove difficult. Working with people always proves the exception to any rule. Organizational engineering includes the utilization of the concepts of line versus staff, span of control, and unity of command. Recruiting is of vital importance at the beginning of a move project, and training will continue through until Move Day. Some of the organizing requirements have been discussed so far. To help in further clarifying this process, a job description, either long or short, should spell out the responsibilities of the jobs involved. This is important to keep overlapping duties to a minimum. From these job descriptions a responsibility list and an organization chart should be prepared. This will reinforce the management concepts of unity of command, specialization, delegation, and organization. With this completed, the living form of the Move Team will begin to take shape.

Communications

Communications is the life's blood of the Move Team. The communciations network must be highly structured within the Move Team. If a message is lost or delayed or if the results of a decision do not reach all Move Team members, resources and actions will be directed in ways that are inconsistent with the basic goals of the relocation project. By formalizing the communciations network, the management principle of

unity of command is reinforced by assuring that all messages reach their destinations.

It is also important that communications lines be left open for informal messages too. This will facilitate feedback as to how a particular decision went over or someone noticing something out of order. The Move Team must function as one complementary and consistent body and the only way to achieve this is constant and meaningful communications between the members of the team.

The formal communciations takes several forms, but the common important element is that each message must be written. This will greatly increase the quality of messages and will provide an accurate log of events. Communications take the form of meeting minutes, status reports, procedural statements, instructions, responsibility lists, job descriptions, and informational bulletins. All Move Team members should get the distributed information. In some cases members not directly involved in a decision can add insight as an outside observer.

All of the lines of communication developed during the planning should prepare and reinforce the communications requirements of Move Day. People who will work together on Move Day should begin communciating early in the planning. So far the discussion of communications has been limited to the communications network within the Move Team. The communications to and from the world outside of the Move Team will be covered in the chapter dealing with public relations.

The Move Day communciations network must be planned, set up in advance, and tested to insure its continuous availability. A common trouble phone number should be established and manned full time during the move. Short-wave radios, walkie-talkies, and citizens band radios can be utilized to maintain continuous contact when phones are not flexible enough. Polling locations where activities are taking place regularly will provide a Move Control Individual with information required to monitor the Master Move Schedule and to spot bottlenecks developing. The entire Move Day communications network should be put through a dress rehersal to ensure that it will function properly.

The more conscientious and responsible people know about what is going on, the better they will be able to perform their duties. Good communications will help to ensure the success of a move and bad communciations will guarantee its failure.

CHAPTER 6 - PLAN B AND REDUCING THE RISK

Plan B Preparation - What Is It?

In most all move preparation planning, uncertainty and the unknown predominate. Things can just not be completely depended on. Plan B preparation is simply having something else to do if the first choice or primary plan cannot be used or fails to produce the desired results. The words "contingency planning", "backup plans", "alternative courses of action", "emergency plans" are all synonyms for Plan B preparation.

The worst thing that can be done is to let people believe that there will be no risk or disruption as a result of the move. The best case and worst case outcomes must be presented. This will educate users as to the dimensions of what is about to take place and will aid in enlisting cooperation in adjusting schedules, setting priorities, and accommodating planned or emergency situations. Users will also have time to develop their own contingency plans in a calm and orderly manner. These users plans will be of great value if the need arises.

The main plan for move activities must be coordinated and synchronize with the Plan B preparation. Each Plan B alternative is only as good as the amount of testing and rehearsal that is done with the plan before the move. All successful moves have had several Plan B alternatives ready to go just in case.

What Could Go Wrong?

One of the key ingredients of Plan B preparation is for every part of the move plan to ask: What if this part fails? One acceptable answer is: We will take our chances and hope that it does not happen. This answer is all right in many situations but in important phases of the plan it is not.

The following will describe things that could happen during a computer move and in many instances have happened.

What if the move goes a lot longer than planned? What if the central processing unit or memory does not come up after the move for some unknown reason? What if a major disk pack is lost or damanged? What if a cable or connector is damanged? What if the computer goes down two or three days after everyone believes that the move was completed successfully? What if a large application comes on stream before the move that obsoletes the move backup plan? What if the communications lines fail? What if the back up site cannot accommodate the backup plan at the last minute? What if the data center utilities fail to work once the computer is moved in? What if a key technician or move control person fails to arrive on Move Day? What if problems develop with the computer in the days just before the move that delays the operations and backup preparation work? What if the truck carrying the tape library is involved in a traffic accident damanging many reels of tape? What if the furniture for the new data center fails to be delivered in time?

What if major backup files are discovered lost after the move has begun? What if the new data center is not ready in time? What if new computer equipment delivery is delayed at the last minute? What if more material handling equipment or more move personnel are needed at the last minute? What if a truck breaks down once it has been loaded and is on the road? What if the Move Path is more congested than anticipated? What if a fire breaks out in the new data center due to power overloads at start up time? What if the air conditioning fails? What if it rains or snows on Move Day? What if the raised floor caves in under the weight of the computer equipment? What if a major component is completely destroyed and cannot be repaired? What if the Move Manager is stricken with a heart attack at the last minute?

On and on the what if questions can go. A lot can happen in a computer move because there is a lot going on. It is easy to solve possible problems if they have been thought about before the move begins. It may be impossible to solve them once the move has begun.

Many Alternatives to Existing Plans

Plan B preparation is simplified by having a primary plan of action completely thought out that already represents the minimum optimum risk for the overall move project. From this plan and the completion of the what-if this failures dialogue discussed in the preceding section, areas where additional Plan B prepration would help lower the risk even further will emerge. There is no practical way short of not moving the

computer at all to eliminate all of the risk, but the level of risk can and must be reduced to reasonable levels. A lot can be done to augment the move plans that fall into Plan B preparation. An alternative can be found for each link in the Move Path, particularly critical computer components can be identified and arrangements can be prepared to have replacements delivered on short notice. Spare parts can be built up prior to the move and returned after they are not needed. Arrangements can be made to fix important components on site. Specialists may have to be put on stand by for a period of time. Scheduling can be used to relieve the pressure of required flawless performance from an event or an activity. Personnel can be cross trained to perform several critical tasks to relieve the risk of losing a key individual due to sickness or injury. Support specialists can be moved into local lodging during the move to minimize the access time if their services are needed. Meals can be served on site to reduce delay time and risk of injury that may be part of traveling to and from public eating establishments. Limits can be placed on changes to critical computer applications prior to the move. New commitments and projects can be scheduled to avoid adding additional requirements on the electronic data processing organization just before or during the move. Vacations can be scheduled to insure a maximum of available manpower on Move Day. Many things can be done limited only the imagination and creativity of the Move Team and the time to implement the plans.

Backup Alternatives

There are many backup alternatives, each with its own advantages and disadvantages. Each must be carefully evaluated in light of the overall move strategy; because if time and resources are to be committed to preparing a backup capability, it must perform perfectly when and if it is called on. As we will be seeing with some of the backup alternative models, their suitability is situational and greatly dependent on when the move is planned to begin. A backup plan may be tested and ready to go now but in four to six months it may be completely inadequate due to changing situations. One general rule to keep in mind is that it will be extremely difficult and expensive to find an alternative that will support one hundred percent of the data processing requirements of an organization in the backup mode.

The following represents alternatives that will support data processing requirements during a move and can be used if the move activities run into trouble with the resulting extended down time.

Model 1 - Coordinate with New Equipment

If a new computer configuration is to be installed in a new data center or even just a new central processing unit or memory, the new equipment and old equipment are each available to support the other. The new machine can be installed and tested while work is being done on the old one. Then the workload can be shifted to the new machine, maintaining a continuum of processing potential. If this model only represents a new central processing unit and memory, extra peripheral devices can be

leased until the permanent ones have been moved and installed. This is by far the best and least expensive backup alternative. There is a lot of control as to the timing of events and; if problems arise, there will be little impact on users because one of the two machines will always be available to handle the load.

The disadvantages of this alternative are obvious. A new machine may just not be in the cards. There are long lead times to consider both in delivery and in approval of needed funds. There may also be operating system upgrades with the new equipment. But from a backup point of view, having an extra configuration to work with reduces the risk during the move greatly.

Model 2 - Rent Duplicate Equipment

This model will also reduce the risk level greatly. It involves renting on a short-term basis a full configuration capable of supporting the data processing needs during the move. It is one of the most expensive alternatives. All of the work required in model 1 is needed here. There will be total backup available as long as needed. The costs will be high and, of course, there must be adequate space to install the backup machine without getting in the way of the one being relocated. Delivery times, operating systems, and installation must be included in move preparation planning. There may be a problem in finding an exact duplicate that is available when needed. Anything less than a duplicate will add to the conversion time needed. The move logistics will be

doubled; because after the move, the backup computer will have to be moved out after the relocation project is completed. It may be difficult to find a vendor willing to do this for such a short period.

Model 3 - Using a Commercial Time-Sharing Firm

There are many firms that will provide as much computer resource as is needed for a price. The price is high but the available resources are extensive. Two major alternatives exist. One is to share processors with others. Here backup work will have to be converted in such a way as to be consistent with the existing standards and procedures. The other method would be to take over the whole machine and use an existing operating system and set of standards. The cost of the second is higher than the first. Provisions will have to be made for telecommunications requirements and methods must be developed to get data, master files, and libraries to the time-sharing firm's data center and to get reports back. This in itself may present real problems depending on where the data center is located and what the turn around time is for reporting. This is a dependable alternative but the logistical problems may present real draw backs.

Model 4 - Using a Neighbor's Site

This model is similar to Model 3 in many ways. The differences should be highlighted because they contribute to making this alternative somewhat risky. Although the neighbor has capacity when the planning is

being done, he may not have it at move time. His capacity under any conditions will be limited, and probably cyclical. His configuration may provide the balance in hardware capabilities needed but it may not. The preparation costs are the same as with Model 3, Alternative 1. But the neighbor will probably not charge a great amount for the use of his equipment. Equipment may have to be added to his configuration to cover data base or telecommunications requirements. The logistical problems exist here as they did in Model 3, but the distance may be far less. This is a good alternative if only a few systems must be run in a backup mode. It is limited and there are risks.

Critical Systems

As discussions and plans are being made regarding backup computer support, decisions must be made as to what work will be done and how long can the application be supported in the backup mode. Critical applications are always changing, depending on the present commitments of the data processing organization and the point in time that the move is scheduled. All applications are important, of course, but all applications are not critical. Critical applications are those that if not continuously supported will threaten the health of the organization supported by the electronic data processing function.

There is a fairly large cost associated with preparing applications to run in a backup environment. The cost of maintaining continuous compatibility is also high due to the ever-present changing and

upgrading so prevelent in data processing technology. It is probably impractical to prepare all applications due to the cost, available time and resources. But for survival in the event of real problems during the move, critical systems must be ready to go in some backup environment.

How are critical systems selected? This task must not be done by one person and it will be the source of some anxiety. Everyone asked will have a different opinion. An interdisciplinary group of responsible individuals should be assigned the task of selecting systems, balancing the costs against the risks, and appeasing those users whose systems are not selected. Even within application systems some parts are more important than others. These subsystem should be identified and their preparation evaluated.

Applications should be grouped first as follows:

1. A particular system need not be run at all 2. A system can wait until the move is completed and then

catch up 3. A manual procedure can carry the load for stated periods

of time 4. The system must be run offsite during the move

If the system must be run, users can help determine the minimum cycle time and how much down time can go by before the system must be executed.

It is important during data collection time not to allow false rumors to panic anyone. Honest and complete explanations of what is about to happen must be provided. The impact on cash flow, the availability, of manual alternatives, the use of overtime, the impact on monthly closing cycles, the possibility of running jobs early or on a less frequent cycle, pre-established user oriented commitments, the work required to catch up after the move, and the artificial peaking caused by running early or delaying certain applications all must be considered for each application before assigning it to one of the four groups mentioned above.

After the first grouping has been made, the applications must be arranged in a priority order within the category. The computer resources must be measured for each system to be prepared for backup execution. Partition sizes, files, forms, inputs, storage, and telecommunications requirements must be enumerated so that arrangements can be made.

Backup Preparation Considerations

There will always be some amount of effort required to prepare critical systems to run on backup computers. This preparation must be included in the time and cost estimates of the alternative itself because some alternatives may be eliminated due to the preparation effort needed. The purpose of the following paragraphs is not to scare anyone away from

backup planning but to highlight the areas that should be evaluated before making arrangements for backup computer processing.

An essential decision must be made as to the operating system to be used. Will the operating system be that of the backup organization or that of the relocating organization run on the backup organization's equipment. The outcome of this decision will present different problems with regard to library and data set preparation, job control language revisions, system generation and cost accountability.

The operating software version and release number must be evaluated for compatibility. A minor change from one release to another can cause operating problems if corresponding changes in application systems are not made.

Tape and disk devices may present problems in transferring master files and systems software easily and quickly between computers.

Different simulators or emulators may be used which will not run on backup computers for some reason.

Special routines or utilities may be part of application systems that violate particular rules in another operating system. These routines and utilities will have to be rewritten and programs using them will have to be re-link edited. Special modifications and patches to operating systems must be checked for consistency.

Input/output handlers, teleprocessing software, and data base capabilities will have to be reviewed and synchronized with the capabilities of the backup computer.

It may be required to convert job control language to be compatible with standards and naming conventions on the backup computer.

Special purpose tape or disk management systems may not be able to run on backup equipment. This will make the job of controlling data sets more difficult. Available disk space may force large data files normally on disk to be run from tape. This will cause large technical and operational problems.

Queue sizes set up at operating system generation time may be too short to accommodate large job streams. Streams may have to be run in pieces.

Special procedures will have to be developed and tested to establish systems in their latest version on the backup system and then to reinstate them on the moved computer after the moved has been completed. Files will have to be kept current as they are moved from one site to another. This process must also be used for testing systems before the move because files, programs, catalogues, and libraries will have to be removed from the backup system after testing.

Test time on the backup machine will be limited, thus adding to the

elapsed time needed to prepare and test critical systems. Test work must be taken to the remote site and brought back. This is also time consuming.

It is important to realize that any computer installation is a balance of hardware and software aimed at meeting specific needs. It is the difference in the needs of the organization that is moving and that of the backup organization that will cause problems in backup preparation and compatibility.

Don't Kid Yourself

Throughout this chapter we have dealt with all of the horrible things that can go wrong and sabotage a computer move. There is a good chance that while going through the Plan B preparation phase, some members of the Move Team will become pessimistic and begin thinking that there is no way to keep the move from failing. On the other hand, there will be people who will think it absurd to waste time preparing for what seems to them to be obscure possibilities. Each could be right, depending on the depth of Plan B preparation. To be sure that all reasonable risks are covered with alternative action, some obscure possibilities will have to be discussed and discarded.

Most computer moves are successful and require the use of very little of the Plan B preparation. On the other hand, the moves that have needed alternative plans and have had them ready to go have avoided a certain

disaster.

The important point here is to not kid yourself into believeing that all of the bases are covered adequately until a significant amount of effort has gone into providing for and testing the availability and adequacy of backup plans to cover known and unknown risks. The value and worth of Plan B preparation will never be known unless they are needed, and then the value will be too great to measure.

CHAPTER 7 - SCHEDULING - MOVE DAY

Scheduling Overview

What is scheduling and why is it an important part of move planning?

Move scheduling is the synchronized and coordinated arrangement of future events related to the move aimed at achieving preestablished goals and objectives. Scheduling is a time-phased planning and is one of the most important and challenging parts of move planning.

As mentioned earlier, there are many alternative strategies for relocating an electronic data processing installation. Each will require different amounts and mixes of available resources and will subject the organization to different levels of risk during the move. Once several alternatives have been chosen as possible candidates, there will be within these alternatives different methods for utilizing available resources. Scheduling all of the events of a move while in the planning mode can aid in balancing the use of resources and achieve an optimum level of risk. It costs far less to discover the inconsistency of scheduling move-related events during the planning process rather than discovering it on Move Day.

As we will see later, scheduling will help reduce the risk associated with the move. For example, when is it reasonable to expect a new facility to be ready? Scheduling the move to begin too soon may lead to

disaster. For another example, how long will a move, using a particular move strategy, really take? Will it be a few hours or a few weeks? These types of questions must be cleared up before move planning is completed.

Move scheduling is of value for the training of individuals who will participate in the move. At what pace will move events happen? How much time will an elevator coordinator or a loading dock coordinator have between events? What component will be installed first, second, and so on? What support people are on call to support which events? What is the skill mix expected on the third work shift? All of these questions and others are answered by move scheduling, and these schedules will help people prepare for their part on Move Day.

It goes without saying that without a set of comprehensive prearranged schedules of events that progress monitoring and status control reporting are impossible. You must know where you are expected to be to know if you got there. Knowing if the move preparation or the move itself is on schedule will be a critical requirement for determining if backup Plan B's will be implemented.

What Types of Schedules are Needed

1. Schedules describing the time tables and events of move planning itself
2. A move preparation check list and expected times of completion

3. Pre-move preparation processing schedule
4. Macro Move Schedule
5. Micro Move Plan
6. Elevator schedules
7. Truck loading schedule
8. Food service schedules
9. Shift change schedules
10. Move Path schedules
11. Check point and control schedules

Tools of the Trade

As in most of the skills needed in preparing to move a computer, there are volumes written on scheduling, project planning, and project control. Some of the tools that specifically prove themselves useful in move planning are the following: PERT (Program Evaluation and Review Technique), CPM (Critical Path Method), GANT Charts, bar charts, line balancing, simulation, walk-throughs, dress rehersals, and common sense.

Most of the useful scheduling tools are made even more helpful by the use of models. Models can take the form of full size mock ups of the largest and most difficult of the components to relocate or mathematical representations of the distribution of time needed to perform a critical task. Models can be blue prints, floor plans, or flow charts. Extremely helpful models can be the experiences of others.

The one thread that is common in all of these scheduling tools is the ability to aid in developing a method for logically and sequentially arranging the flow of events to facilitate the successful completion of the data center relocation.

The Move Window

The Move Window is that period of time in the future when an electronic data processing computer can be relocated with a minimum impact on the organization and a maximum probability of success for the move project. The length of the Move Window is measured from the first period of time the computer can be freed up until the last period of time the computer can be out of action without major impact on the organization. There are always several potential Move Windows, each with a different probability of risk and each with a different duration.

If we were to be honest about it, there is probably no truly best time to move a computer or a data center. What must be stressed then, is to choose a Move Window which presents the smallest risk. As explained earlier it would be irresponsible to choose a Move Window when the probability of having a completed data center by that time was only 50 percent. In most cases, the selection of the Move Window must be done nine to twelve months before the actual event. In that length of time, a lot can happen. For this reason, everything possible must be evaluated before the Move Window and move dates are finalized. On the other hand, the earlier the Move Window is fixed, the more detailed the

preparation planning can be.

In selecting the Move Window, the largest one possible should be sought. This period of time, by definition, is the when the computer is not needed. Be it hours, days, or weeks, the longer this period, the smaller the risk of impacting the organization during the move.

The next point to remember is to select the Move Window that has the least chance of becoming inoperable. For example, if one Move Window had the chance of becoming infeasible due to a possible labor action and another Move Window was more dependable, go with the second alternative. Once the Move Window is set, all planning and preparation will be focused toward that point in time. If the focus has to be changed late in the game, a high risk factor may be imposed on the project due to the large number of plans that must be changed and resynchronized.

Another guideline in selecting the Move Window is to look several periods beyond the end of the Move Window. Ask the question: If things go badly and the relocation runs past the end of the Move Window, what will be affected first, second, third, and so on? For example, if one week after the recommended Move Window, reports have to be available for the yearly board of directors meeting, it would be prudent to see if there was another Move Window alternative that did not have this data processing requirement in as close a proximity. In the next section the subject of clearing the Move Window will be discussed. It makes life a lot easier if a Move Window is initially selected that minimizes the

data processing requirements before and after the proposed move dates. The time needed to plan for the move, prepare for the move, and to prepare a facility for the move must also be considered in choosing an optimum Move Window.

The definition of an optimum Move Window must be analyzed and related to each individual move project. It may be a time of the year, a period during the month, a particular event, like an additional processor being delivered, it may be a holiday weekend or summer vacation time. There may be no truly good time so an artificial Move Window may have to be created. An example of this might be the period of time in which a second computer configuration can be obtained and installed to carry the load while the target computer is being relocated.

Computer Operations Scheduling

It is important to restate that the primary responsibility of an electronic data processing installation is to provide continuous and reliable data processing services to the parent organization at all times. The responsibility is not rescinded during the relocation process. So then, one primary objective during a move is to maintain continuous operations and support before, during, and after the computer move. It is naive to say that computer operations and user support will not be disrupted at all during a move. A must in the preparation process is to analyze and rank in order of importance the many responsibilities and functional commitments of a data processing

installation. Varying levels of effort should be directed at lessening the impact and disruption on essential operational responsibilities.

As described in the Plan B preparation, critical activities must be identified early in the planning cycle. As time and resources permit, the length of the list of critical activities may vary. It is true that all activities are critical to someone, but on the other hand, there are some data processing responsibilities without which the organization would not be able to continue functioning. It is this second list that must be clearly protected and made an integral part of all Plan B's.

There are three major operations scheduling jobs that must be included in move planning. Special attention must be given to these scheduling tasks. If these three are not done well, an increased level of risk will be added in the move project.

1. Move Preparation Schedule

After the Move Window has been selected, it will be important to reduce the requirements on the computer as much as possible during that time. This will involve changing operations schedules, covering up to four weeks preceding Move Day. The goal here will be to complete as many of the processing requirements that fall within the Move Window time period as early as possible before Move Day. This will help minimize the cost and disruption on the data processing user community. This will require a coordinated effort by both the data processing and the user

organizations. One of the major tasks here will be to be sure that all of the proper files have been backed up and that all Plan B files are properly prepared and accounted for.

2. Plan B Scheduling

Each alternative or contingency plan has as part of it definite operational considerations and requirements. Each plan requires a full complement of back up files and operating instructions. Each plan will usually have to be coordinated with the host organization providing the back up capability. This is a complicated and demanding task but must be done accurately and must be fully tested to guarantee that the backup plan will work when needed.

3. Catch Up Scheduling

If all goes well, the move will be completed close to schedule. Getting back into the routine cycle will be the primary tasks operations will be dealing with. The real test comes if things do not go well or if they go longer than expected. Catching up when a lot of processing cycles have been missed could be a difficult task to do under pressure. It is best to have plans and schedules prepared ahead of time, for if the move goes two days, five days, ten days, and so on, longer than expected. It is here that the relative criticality of responsibilities will come into play.

In the new location after the move, there will be a variety of new procedures related to operations scheduling. It is wise to have these procedures incorporated into activities before the move so that they will be familiar and less likely to cause errors or mistakes during the first hectic days in the new location.

Move Plan Count Down

What if there are a lot of operational problems a few days before Move Day? This will create the real risk of not getting all of the required computer processing completed before the move is scheduled to begin. It is recommended that a count down, detailed check off list be prepared and used during the last few weeks before the move. On this count down list there should be hold points that once operations has successfully passed these points, certain move activities are activated. If the events are not completed, remaining move activities are not activated at that time. It goes without saying that any planned potential delay or change in activities must in itself be a part of the Macro and Micro Move Plan or dependent activities will no longer be synchronized.

Once the move count down has reached three days to go, only a major set back should be grounds enough to call off the move. There must be a hold point on the count down when delaying the move to a rain date or going ahead should be discussed and decided. The appropriate time for all move related decisions must be on the Micro Move Plan. Once Move

Day arrives, any problem that causes plans to be delayed more than a few hours, should trigger the initiation of some phase of the back up plan.

CHAPTER 8 - SCHEDULING - MOVE LOGISTICS

Once the Move Window and Move Day are set, the next task is to develop the detailed events and tasks that make up the actual work performed when relocating a data processing facility. A lot of what will be discussed is dependent on individual move strategies, so if several strategies are being considered, or if a change in strategy is made, the following scheduling may have to be redone several times. A thorough and comprehensive job done here will greatly reduce the amount of time needed and the risks that are an integral part of moving an electronic data processing device.

What Must Be Moved to Where?

The task of clearly identifying what is going to be moved is tedious but extremely important for the success of the move. Everything, literally everything, must be included. It is recommended that identification tags and numbers be attached to every item or group of items that will be moved. A list should be prepared showing the identification number, description of the item, quantity of grouped items, the dimensions and weight of the item, its old location, its new location, a criticality or importance rating, a security rating, who is responsible for the item, and any special notes as to packing, handling, or departure sequencing. This list should be grouped in such a way that it is extremely clear where the item comes from and where it will go. Floor plans of the old and new sites should be prepared in detail showing the placement and

location of each item on the list. This list should be reviewed by several members of the Move Team to insure that it is complete and accurate.

It is most important to tag, list, and be fully aware of the characteristics of the components that make up the computer itself. Some of these items will probably be the biggest, heaviest, most critical, and in need of the most security of all items in the data center.

If items can be grouped or packed together, a manageable lot size should be maintained. The grouping or sizing should be aimed at allowing the items to be moved quickly and with maximum protection against damange. This is particularly true for tapes and disks. A damaged or lost tape or disk could cause real trouble at catch up time.

Any items such as new storage facilities, new furniture, and new equipment should be installed in the new location and checked out as early as is reasonably possible. This will be one less thing to be concerned about on Move Day.

How Will Things Be Moved?

A very large area that must be planned is the methods employed in material handling. There will be many types of items requiring material handling equipment with different capabilities. Arrangements and

specialized equipment must be available to relocate both the heavy and bulky controllers and the light, but sensitive, systems console. There will be several acceptable material handling methods that could be employed for different types of equipment. The method that minimizes the risk of damange should be selected.

The proper amount of moving equipment must be provided because valuable minutes can be lost waiting for trucks, dollies, and elevators. Plans and arrangements must be made to minimize or to avoid all together these types of delays. It can be done by having more trucks available, or scheduling the elevators for an optimum flow of move related items.

The mover will have to provide pallets or tubs for cables, steel ramps, dollies, pads, rigging equipment, special rolling devices for heavy units, heavy duty boxes, moving bars, cardboard and packing tape. There may be the need for special moving vans, forklift trucks, and cranes to move equipment.

A lot depends on the distance the equipment must travel. If the distance is long, involving a lot of material handling, the computer component will have to be protected by extensive and time consuming move preparation packing. If the distance is short and the material handling is less complicated, components do not have to be packed and protected as much. If the conditions allow, devices made up of several pieces can be moved as a unit, saving the disassembling time. Some cables connecting two devices can be tagged and disconnected from one device

and left connected to the other. This will cut the assembly time for these devices in half. A lot of cable tagging can be done in advance of Move Day. Special care should be taken to protect cables. They are easily damaged by pulling on connectors, stepping on and bending connecting pins, and rolling the cable into too tight of a coil.

It will be important to be sure that the individuals who are going to actually move particular sensitive or critical components are fully trained in exactly what they should or should not do. Any computer component should be moved by lifting or pushing on frames, not the panels. The panels will bend and will damange circuitry inside. The smallest bump in a floor or loading dock can break circuit boards and chips if a computer component is rolled too fast.

Packing must be done carefully and under the direction of move control personnel. Tags must be accurate and attached to items securely in a position that will provide quick and easy identification. Special handling notes should be attached to items and should be visible and easily understood. Once things start to move it will be hard to find a lost or missed labeled item.

It must be remembered that one of the responsibilities the electronic data processing organization is the security of important and sensitive data and the security of the machines to process it. Special provisions must be planned and arranged to protect information and machines when they are outside of the normal security protection while the move is in

progress. This can be accomplished by increased alertness to unusual occurrences, armed guards, limited publication of the details regarding the times and the move route, transportation vehicles that can be locked, increased security surveillance, police escorts, and common sense. Different move situations will require different levels of security planning.

The Move Path

The definition of the Move Path is simply the route or combination of routes by which the computer moves from the old location to the new location. The Move Path can include: hallways, ramps, elevators, loading docks, cranes, highways, city streets, even oceans and airplanes. On the other hand, it may simply be the rearrangement of components within the existing site. The important issue here is that every inch of the Move Path must be thoroughly understood, measured, and documented. The Move Path should be chosen to minimize the transit time and to minimize the risk of loss or damange to the computer. Each segment of the Move Path should be analyzed in detail in its self and as it fits into the Micro Move Plan.

As a starting point, current building floor plans, road maps, traffic schedules, truck capacities, floor loading specifications, doorway clearances, elevator capacities, and loading dock configurations should be obtained. Then, in a step by step manner, try to find the path that allows the quickest movement between the two points that also provides

the least risk of damage to the computer or delay in the move schedule. It is important to know the maximum dimensions of height, width, and length, as well as the heaviest items to be moved. Remember that computer components represent volumes to be moved. For example, the width and length alone may clear certain areas but when combined within a single object there may not be enough room for turning and the material handling requirements to move these heavy and bulky objects.

The hazards must be discovered and incorporated within the Move Path planning. The smallest clearance in width and height, the maximum floor loading, the maximum load an elevator can carry, the availability of appropriate airline connections, the rush hour traffic schedule along a move route will each limit in themselves the effectiveness of the total Move Path. It must be determined quickly for each proposed Move Path what the weakest link is and what makes it that way. Some alternatives will have to be discarded because of these weak points. For example, it would not be wise to choose a Move Path that included a highway that is scheduled to have major construction and the resulting detours along it during the time planned to move the computer. Nor would it be wise to choose a route that had an extremely rough surface.

Every move must have at least two Move Paths in case one becomes inoperable for some reason on Move Day. If there are particularly questionable or risky links along the Move Path, several alternatives should be available in case one link cannot be used at the last minute.

Each combination of links making a complete Move Path should be documented and uniquely identified. If on Move Day a change in Move Paths is required, a quick and well understood shift can be made by simply saying that all components or items from now on will travel on Move Path G until problems on Move Path C are cleared up.

Once a group of optimal Move Paths have been developed, each path must be tested. At minimum they should be traveled by move planners from beginning to end being alert to spot overlooked hazards and problems. Full size wooden models of the largest components can be constructed and moved through the Move Path using proposed material handling methods. A full-scale dress rehersal using component models will clarify methods and responsibilities and will uncover unforeseen problems, hazards, and risks in time to correct them before Move Day. Computer simulations can be helpful in predicting queueing problems and bottlenecks while testing the ease and flexibility of shifting from one path to another.

Micro Move Schedule

It is important to complete the macro move scheduling and planning discussed so far, but until the micro, or detailed move plan is completed, the planning job is only half done. Micro scheduling will tie everything together and will be the source of all Move Day schedules, check lists, timetables, and the estimated elapsed time of the move.

Micro move scheduling is an art form augmented with several conceptually analytical tools. The goal of micro move scheduling is to prepare a schedule of detailed events in fifteen minutes or less time slices that includes all macro planning, restrictions, and support activities; and to use available resources to accomplish all of the tasks required to move the electronic data processing facility in as short a time period as possible with minimum risk of delay and in as controlled a process as possible.

What should be done first? The first step is to prepare a list of activities. Each activity on the list should be a single task of from five to fifteen minutes in duration. If the task seems to take more time, break it down into definable subtasks. This list will contain several hundred entries and may span a time frame from several weeks before the move through several weeks after the move. The list should include sequentially dependent tasks. For example, what must be done before this task can begin. What can follow the completion of this task? It is important to include for each task the person responsible for completing the task. A measurement or estimate of optimistic, expected, and pessimistic time to complete the tasks should be added to the list. The time estimates will have been made based on the use of certain amounts of resources, i.e., technicians, movers, trucks, and so on. The required resources associated with different time estimates must be noted because in the optimization process units of required resources can be added and rearranged. This may result in changes in the estimated time to complete the tasks. The list should also note

possible risks, alternative courses of action, and any other note that will fully describe the tasks. Estimated times can be developed by simulation, time/motion study, physical modelling, walk throughs, experience, or just guessing.

The job of defining the detailed move tasks is one of the most important and exacting jobs required in successful move planning. Long hours will be spent with vendors, managers and others who have moved computers going over each step of the move to obtain the data needed here. How long does it take a technician to remove the cables from component X? How long does it take the elevator under a heavy load to go from the tenth floor to the ground level? How long does it take to move a component from point A to point B along the Move Path? If additional resources are needed, how much lead time is required? How long will it take the crane to lower a component to an awaiting truck? Questions like this will identify task/time segments that must be considered.

A very critical set of dependent tasks start around the time that premove preparation work is being completed and continues to the time when the move is well underway. This is the transition period or the beginning of the move. The point being made is that the sequence of move related tasks will not begin in full until the production and premove production tasks have been successfully completed. This may necessitate having two or three planned start points with the corresponding Micro Move Plans.

Another type of task that needs some special attention is the debugging of the computer once it is reassembled. Any estimate here can be criticized, but some attempt must be made to include a reasonable expected down time related to diagnostics and debugging. Here is an example of a method for approaching the time needed for debugging: A vendor spent between four and sixteen hours per bug during the installation of a particular computer. If there were one bug in each of the six main components currently under consideration, twenty-four to ninty-six hours could be added to the move time for the debugging task. Other types of problems could and should be included in the list of tasks in a similar manner.

The next step will integrate the detailed time/task/resource list into a coordinated list of events. PERT, CPM, GANT charts and simulation are all tools that can be used here. The important point is to develop a time, event-dependent, flexible model of all of the events associated with the move. The estimated optimistic, expected, and pessimistic total time of completion can now be obtained. This should be correlated with experiences of other moves to be sure that estimates are reasonable. The probability of completing the move in two, three, or x days can now be analyzed and reviewed in relation to the Move Window, the Plan B preparation, and the availability of needed resources.

Because the model is flexible, different arrangements of Move Paths, resources committed to certain tasks, sequencing of events, overlapping of work and alternative material handling methods can be studied.

Certain changes will increase the probability of completing the move sooner. Other changes will decrease the difference between the optimistic and pessimistic total completion time. The critical path of events and tasks should be the focus of analysis and experimentation. Critical points must be built into the scheduling process that can be used on Move Day to initiate an alternative Micro Move Plans. For example, if the move gets off to a late start, there should be an appropriate Micro Move Plan describing the move under that situation. Another example would be if after twenty-four hours into the move events are four to six hours behind their scheduled time of completion, a predetermined shift to another Micro Move Plan from then on would be available and ready to go.

A what-if decision tree should also be utilized for preparing alternative predeveloped Micro Move Plans. What if premove production work cannot be completed in time? What Micro Move Plan would be used? What if there are more computer bugs than planned for? What Micro Move Plan should be utilized?

Once the best set of Micro Move Plans and their alternatives have been developed and agreed to, move control schedules, truck schedules, manpower arrangements, work schedules, transportation and material handling arrangments, elevator schedules, loading sequences and check lists, dispatch schedules, interim or staging storage areas and individual work assignments can all be finalized, documented, and distributed to appropriate individuals.

CHAPTER 9 - PHYSICAL SITE PREPARATION

Preparation of the physical site can take many forms and can vary in complexity from just rearranging an existing computer room to building a whole new facility from scratch. To some extent all of the elements of physical site preparation must be addressed to some degree in every computer move. The bigger the task, the more time must be allocated and the higher the risk factor associated with the move. The following paragraphs will address the subject as if a completely new site is involved in the move project.

Construction Schedules

In any computer site that is being prepared for a new computer, changes are required most of the time in the facility. These changes are usually performed by some organization outside of the data processing activity. They may take the form of an architect, a contractor, a subcontractor, a plant engineering department, an office services department, a specialist or a consultant in a particular area. Whatever the group is called, there are some fundamental rules that must be adhered to.

1. The representative from the data processing activity must bring these outside organizations into the planning early. They can be thought of as members of the Move Team because their activities will set the pace for how soon the computer move can begin. How they

perform their functions towards meeting the requirements for the new facility will determine not only the success at the beginning of operations in the new facility, but will determine the overall long-term value of the facility to support data processing activities.

2. Once the outside organization has a general idea of what function they are to perform, they will begin to work as fast as possible to complete that work. It is important that the data processing planners stay well ahead of the outside organization's activities.

3. Any activities that involve communications between two individuals has the possiblity for misinterpretation. The data processing planners must continuously check on the work being done by the outside organization to be sure that the needs and requirements are being properly interpreted in actions, products, and services provided.

4. The data processing planner must have a knowledge of the areas that outside organizations are working on. The management principle of delegation of responsibility pertains here. The data processing planners are still responsible for the work done by the outsider. The data processing planners must be reasonably sure that work will meet thatir needs.

5. If planning is well in advance of doing, changes in requirements

will be minimal. But when changes do become necessary, they should be implemented as soon as possible. The further along the actual work, the more expensive and time-consuming will be any change. As the actual Move Day approaches, any change will have a tendency to increase the risk factor for the move.

6. Progress of work being done on a computer facility must be planned, monitored and analyzed. Several techniques are appropriate here. CPM, PERT, GANTT charts, activity lists, and the like can be of great value in assessing the progress of work being done on the facility. Any such tool must have the following elements: It must list activities in finite but measureable detail. Activity boundaries must be clearly defined. Each activity must have a planned start and finish time. Each activity must have a single person or organization that is responsible for its successful completion. As time passes, the amount of work remaining for each activity must be measured and reported.

   Based on the progress of the work, pessimistic, expected, and optimistic estimated times of completion can be calculated. These times will be used with other plans to assess the progress of work required on the facility before Move Day.

Facilities Planning Aids

The technology of facilities planning has developed as quickly as that

of electronic data processing. New computers require more support than ever before in the areas of power, air conditioning, fire prevention, and back-up capabilities.

What are the sources of facilities planning knowledge? (8,9)

Computer vendors are probably the best bet. This is their business and they see many examples of new facilities. They see the mistakes and the successes. They do research into better methods and approaches. Computer vendors offer some facilities planning services for free, but they will charge for the large jobs. This is money well spent.

Consultants are the next source. They provide a services similar to that of computer vendors. They excel in specialized or nonstandard facilities planning tasks and can act as a second opinion if there is limited detailed technical knowledge available within the Move Team. Consultants are expensive and are more appropriate for smaller data processing installations.

Books, periodicals, manuals, publications, and seminars will add a great amount of dimension to facilities planning. The planner can pick and choose, taking the best from many sources and adding his own imagination. This is time-consuming but cheap. It is possibly the best way to develop internal expertise on the subject.

The last source of facilities planning information is to interview others who have done the facilities planning tasks successfully, see what they did well or poorly, ask what they would have done differently. They probably have a wealth of documentation left over from their project that could be borrowed.

All sources that can be utilized should be. The more information, the better the facilities planning job and the fewer embarrassing mistakes will be made that can only be corrected when the next new facility is built.

What must be considered?

In this section, no attempt will be made to discuss the technical aspects of the areas that must be considered in facilities design and planning. Many of these areas require a large base of specialized engineering knowledge. Many times the real problem is in knowing what should be considered rather than knowing the technical details. The following will be a list of subjects and areas that must be at least reviewed. Some will not be required in a specific project. Others will be the center of the project's attention. The list is as follows:

Physical space

Floor layout

Work flow

Office layout

Work station design

Furniture

Lighting/windows

Sound dispersal

Elevators

Ramps

Food facilities

Rest rooms

Training space

Programmer work space

Parking

Privacy

Vendor parking

Vendor work space

Tape and disk storage

Supply storage

Shelving

Program library

Shipping/receiving

Waste disposal

Water conditioning

Air filtration

Air conditioning

Temperature/humidity

Cooling towers

Floor air handlers

Cold water chilllers for computer

Structural floor loading

Vibration

Computer

Raised floor

Electrically grounding raised floor

Phone coverage

Telecommunications requirements

Intercom capability

Paging equipment

Cleaning and maintenance

Safety

National Fire Protection Association requirements

Factory Insurance Association requirements

Facilities for handicapped employees

Fire detection system

Fire prevention

Fire extinguishing system

Source of power

Electrical buffering

Lightning protection

Interruptible power source

Voltage regulation

Frequency limits

Grounding

Phase rotation

Emergency power off control

Motor generators

Power circuits

Power panel locations

Utility outlets

Utility control panel

Physical security

Closed circuit television

After hours security

Security-guests/tours/maintenance/deliveries

Emergency power

Emergency air conditioning

Emergency lighting

Emergency security

Emergency chilled water

Medical equipment

Clocks

Restrictions on smoking and food

Interior design

Door ways

Carpeting

Furniture placement

As can be seen, the list is long. Each area or subject has a vast amount of detail. Facilities planning for electronic data processing equipment is just as complicated as planning for any complete new

building. As each of the areas is being addressed, growth must be considered. How long the facility lasts depends to a great extent on how well the forecast of growth in the facility requirements has been made. Time spent in planning and forecasting will yield benefits for years to come.

Equipment Configuration

The physical layout of the computer configuration is a large and exacting task. The name of the game here is flexibility. Flexibility in expansion and growth. Flexibility in operation, and flexibility to facilitate the actual relocation task. If more than one computer is involved in the move, the job becomes increasing more complicated. Each machine must be first considered by itself, then it must be considered with all the others.

The first level of the task is to lay out all of the present and near future equipment in a manner that will facilitate ease of operation. The physical dimensions and characteristics of the room must be dealt with. This is not as easy as it may sound. Computers are made up of many pieces of equipment and they can be arranged in a large number of combinations. The console can go one way or the other. The tape drives can be here or there, and so on. Each time a change is made all other devices must be adjusted. All of the skills of work space layout and industrial engineering can be brought into play here. Remember that each step saved for a computer operation can be equated to a decrease in

computer processing delay.

The next level of the equipment configuration task is the space for service clearance. Most computer vendors supply scaled down templates that show the machine outline and the space needed for door swings and servicing. In some cases service space can be overlapped. In most this will not be allowed, and may require changes in the layout of the computer configuration.

The next level of the task is the maximum cable lengths between devices. Computers require 100 to 200 cables and hoses that connect devices and run under the raised floor. Some cables cannot be longer than 50 feet. This will limit the distance between machines and will change the configuration. Sometimes new cables must be ordered to allow a particular layout to work. The delivery time for these cables must be considered in move planning.

Another consideration is the power cables to the computer. The connectors must be properly specified and installed. Power cables must also be measured and placed near where they will be used. All circuit breakers must be labeled. All circuits must be checked out at the power panel. All power cables must be tested for polarity, current, voltage, etc.

As the layout is being finalized, the actual position of the machine legs must be synchronized with the supports for the raised floor. There

will be floor cutouts for cables under each machine. This will weaken the floor panel; and to compensate for this, extra support pedestels will be needed. There may be some shift of the layout to make the floor cutouts right.

Needless to say, there is alot of redesigning and rearranging of the computer configuration. This is the time to find errors in the layout because it is impossible to stretch a 2 inch cable or to try different layout combinations at the last minute with machines whose weight ranges from 200 pounds to a ton. The success of the move depends on everything working right the first time.

Pre-Move Testing

Although planning and follow-up in facility preparation is important, only when the finished product is tested is it clear that everything is ready to support the computer being moved in. There are many ways to do testing. The closer the test parallels actual operating conditions, the better. The following are examples of what could be done in selected area. Imagination and need will aid in developing tests matching particular situations.

Environment Control Test

The overhead air conditioning system for the data center will operate alone for one week without failure.

Each floor air conditioning unit in turn will be put into operation alone without the overhead system. Each will run for no less than four days without failure.

When all units have been tested alone, all floor units and the overhead system will be turned on and will continue to run without failure until the computer move.

All air conditioning units and related equipment will be checked periodically for water leaks and electrical overloads.

All floor units should be switched over to the backup system. The units should run this way for no less than two days.

Chilled Water Test

The liquid chilling package should be started along with all supporting cooling towers, pumps, and controls. This test should run for no less than one week. All pipes, valves, and connections will be checked for leaks and malfunctions.

It should be shown that the backup system to the Power Coolant Distribution Unit has the proper pressure, flow rate and temperature to support the Power Coolant Distribution Unit in the event the liquid chilling package fails.

After the computer has been installed and is operational, the chilled water system will be switched over to the backup system and will run that way for no less than 4 days.

Computer Power Tests

Voltage Regulator

A load will be placed on one of the regulated circuits and the voltage level will be recorded continuously for no less than 7 days.

The circuit will be switched over to nonregulated power and the test repeated.

Motor Generator Set

The MG set will be started up. It will be verified that the MG set is in good working order. It will continue to run for no less than 2 days.

A load will be placed on the MG set and it will run that way for no less than 4 days.

The MG set will be turned off for one day. After that time the MG set will be turned on again.

120 Receptacles

All receptacles will be labeled as to if they are on the emergency backup system.

Each receptacle will be tested to verify that it is operational.

The emergency backup power generator will be turned on and each receptacle on the backup system will be tested to verify that it is operational.

Emergency Generator

The emergency generator will be turned on and all circuits will be tested that feed the motor generator, the voltage regulator, the air conditioning and the chilled water equipment for the data center.

After the computer has been installed, the emergency generator system will be put into operation and the data center will run on the emergency system for 24 hours.

Branch Circuit Test

All branch circuits will be tested for phase rotation.

All connectors will be checked by the computer vendor to assure proper connector selection and proper installation. All connectors will be tagged for later identification.

All circuit breakers will be checked by the computer vendor for accuracy and for proper installation with computer power cables.

Extra circuit breakers will be made available. There should be one for each circuit in the data center.

Extra connectors will be made available. There should be one for each computer power cable.

Emergency Tests

Emergency Power Off Switch

All systems will be put into operation and the emergency power off switch will be pulled. A check will be made of all utilities and circuits to determine if power was completely removed from the data center.

Computer Room Control Panel

It will be proven that each indicator on the computer room master control panel operates under the conditions it was designed to

monitor.

As all of the other tests are performed, the computer room master control panel will be checked for proper indication of conditions being tested.

Emergency Lighting

The building lighting will be turned off and the emergency lighting will be turned on. A check of all areas relating to the data center will be checked to be sure there is adequate lighting present.

Fire Protection Tests

Fire Detectors

All fire detetors will be tested to verify their proper operation.

The computer room control panel and the Halon control panels will be checked for proper handling of the signals from each detector.

Control Sequence

The fire control sequence will be tested up to but not including the final discharge of the Halon for each zone of the data center.

The abort sequence will be tested for no less than 5 cycles for each zone of the data center.

For all fire tests, proper signals must be received in the Control Center.

A check will be made to verify that air conditioners and air circulation stops at the proper point in the fire control sequence.

Fire Prevention

A test will be performed to verify that the water heads will activate and turn off at the proper time.

A full test will be performed in the Computer Room using a Halon substitute (Halon 122). The detectors will sense a simulated fire. The fire control sequence will run with one abort attempt, and the Halon substitute will be discharged.

The folowing conditions will be checked during the test:

1. Did all signals and alarms operate properly?

2. Did the control sequence act as expected?

3. How long was there a concentration of greater than 5 percent?

4. Was the concentration ever greater than 10 percent?

5. How long did it take to reach a density of greater than 5 percent?

6. A multipoint concentration test recorder will be used for this test.

7. Discharge analyzer strip charts will be made and used as test documentation.

Security Tests

Card Key System

All features of the card key security system will be tested. The features are: (listed from specifications and requirements)

The system will be turned to backup mode and the appropriate features will be tested at each card reader.

All power will be removed from the security system and each door will be checked to be sure all doors will remain in the locked condition.

Closed Circuit TV System

Each camera will be tested for depth of field and area of visibility.

Each monitor will be tested for clear visibility and proper operation.

Switching systems will be checked for proper operation.

Access Floor Test

A spot check will be made of areas under the raised floor for cleanliness.

All floor tiles will be checked for rockers.

All edges will be checked to be sure they are filled in tight against the side walls.

All cutouts will be checked for size, location, and final finish.

Extra reinforcing pedestals will be checked and floor panels that are greatly cut away will be checked to be sure they have been secured to the pedestal.

When the heat is high during the environment tests, the carpet will be checked for static using the CRI shuffle test (I. F. Walker method) at 20 percent relative humidity and 70 degrees F. The results should

show less than 1 kv.

Extra pedestals, panels, air grills, air grill cutouts, 120 power panels and power panel cutouts will be made available.

Move Path Tests

A model of the largest piece of equipment to be relocated will be moved through the Move Path. This will verify that the computer equipment will fit into the elevators and through doorways along the move route.

The elevators will be tested to verify that they will lift smoothly at least 2,500 pounds.

The elctrical trenches along the Move Path will be tested to verify that they can support 2,500 pounds distributed on four 4 inch wheels.

CHAPTER 10 - COMMITMENTS AND AGREEMENTS

It is one thing to organize, plan, schedule, and test; but all is for naught if individuals do not actually perform the tasks they are responsible for on Move Day. When communications was described earlier, it was mentioned that active and detailed communications between members of the Move Team would lessen the chance of misunderstandings and erroneous or inconsistent activities.

It is extremely dangerous to assume that a conversation in the context of a planning session represents an agreement to commit resources or to prepare to perform some task. Remember, for a successful computer move nothing can go wrong. There is just not enough time nor flexibility in activities to rethink or call up unprepared individuals and resources to fill the gap caused by the misunderstanding of intentions.

Commitments represent those formal or semiformal detailed discussions regarding resources, both human and material, that will be directed toward and used in the completion of a particular task in a prearranged plan at a mutually understood time. These discussions must be carried on by individuals who have the authority to direct resources and who will be held accountable if the task is not properly completed. These decision makers representing different organizations must not promise to deliver more than is reasonably possible. One commitment will build on another and all links in the chain must be depended on equally.

Agreements are similar to, and in some cases synonymous with, commitments. Agreements have the additional meaning of outlining methods by which organizations will deal with each other under different circumstances that may take place in the future. An agreement may take the form of working within the rules of a union contract during the computer move in which workers may be required to perform duties that conflict with the basic contract. An agreement could also include the possible commitment of additional resources by an organization to the move tasks in the event of an emergency.

It seems important again that all commitments and agreements should be in writing and represent the complete understandings of all parties involved.

The following will be a discussion of some representative areas where commitments and agreements are involved. Once again this is not an exhaustive list.

Regulation

The world is filled with regulations from building codes to ICC rules for interstate transportation of equipment. OSHA will have rules and regulations involving the safety of workers. The FIA and the insurance carrier will have rules and regulations involving the safety of the equipment. Auditors may be involved and regulate what can and cannot be done. The Move Manager must be aware of all of the regulations that

will impact on the move. Surprises on Move Day in this area are disasterious. The important point here is that regulations restrict the flexibility to some extent of move planners so the regulations must be understood in the very early stages of move planning.

Unions

This will not be an attempt to evaluate the value of unionism but there are a lot of important constraints on move planners that emenate from a union presence.

One of the first considerations is the possibility of a union action before the completion of a new computer facility. A long strike could bring the move planners to Move Day without a finished facility. An analysis should be done to list all related contract due dates and the probability of expected labor action. These possible delays must be considered when choosing an expected Move Day.

The other major consideration here is territorial boundaries. Move planners must assess what labor group will be involved in the move and must fully understand the work boundaries and the interaction with other union or non-union labor groups.

No move can afford to be delayed by jurisdictional disputes arupting among the trades. If there is a foreseeable conflict, it should be settled before the move and formal agreements must be reached between

the parties as early as possible. It is a wise idea to have union management available on quick notice during the move just in case.

Selecting the Movers

The computer vendors will supply the manpower to disassemble and reassemble the hardware, but one of the biggest and most important jobs in the physical relocation is performed by the mover. This area is also one with a high risk factor when considering the success of the move. A component can be damanged by being jarred. A cable connector can have its pins bent and damaged. The truck carrying the equipment can be involved in a traffic accident. Each of these examples will impact the outcome of the move and is under the responsibility of the mover.

There are many moving companies who can adequately perform the duties required. How can the best one for the job at hand be selected? Experience, resources, and cost are the key to the selection. Before bids are requested, all of the potential candidates must provide the following information about their companies:

Address of mover
Applicable tariffs
Number of full-time employees
Average length of service of employees
Variety of experience of supervisory personnel
Number of trucks owned by type of truck

Other types of equipment available

Description of warehouse facilities - size, location, physical features

Insurance coverage

Number of men available to be used on this job

Description of equipment available to be used on this job

List of other moves which presented similar problems

Names of customers with similar moves

Dun and Bradstreet report

Union affiliation

Once this information has been reviewed, the list of possible movers should be reduced with only the most qualified remaining.

A meeting should be held with qualified representatives of all potential moving companies. The move should be outlined, accenting what is to be moved, when and across what route. The date for formal bids to be returned should be clear and understood by all. The advantage here is that everyone receives the same information and should submit bids on an equal basis.

Cost need not be the sole deciding factor. Regulations and competition will reduce the range of cost differences. Quality of expected service, specifically in moving sensitive electronic data processing equipment, is the most important decision parameter.

Contracts and Other Written Agreements (1,4)

Anyone participating in the computer move will add to or help decrease the level of risk associated with the move. If things go well no one will care what written agreements existed between the participants. If things go poorly, there will be large damages that must be borne by someone. For this reason, the ultimate is to have legal, binding, written contracts for all participants spelling out exactly what is expected of them at move time. Of course this is impractical in practice. On the other hand, the spirit of this idea is not out of the question.

No one will sign a contract making them liable for the full cost if the move goes badly and the organization is no longer able to perform its function. This is particularly true for computer vendors, movers, and contractors preparing the facility.

It is reasonable to expect participating organizations to sign contracts describing what they are expected to do, including when they will be on the job, how many men of what type will be committed to the move, what will be the charge for their services, what will they do in detail, what equipment will they bring with them, who is liable if an employee is injured on the job, how long is their job expected to take to complete, what documentation or blueprints will be prepared, and so on for as many items and at whatever detail is required to completely and clearly describe what is expected from supporting or participating organizations.

The single most important statement that must be agreed to by every participant is what is the definition and the conditions by which each particular responsibility will be deemed completed and acceptable. This is critical when dealing with the computer vendor and the contractor responsible for preparing the computer facility. When does the data processing organization take over the responsibility for the equipment? Time spent on this issue will reduce the haggling after the move and may provide the force that will keep the parties involved actively working on the job until it really is completed successfully and to the standard of quality required.

In some cases contracts as such will not be appropriate. There are still several tools available by which the data processing organization can gain the high level of attention required of such agreements. A letter of intent can act as a binding document. A memorandum covering the required points can be used, and the published minutes of meetings where agreements were reached will all act to bind the organizations together.

Insurance

Insurance carriers will not cover the real cost to an organization if a computer move gets into trouble and paralyzes the functions an organization is required to perform. Once again there is a very definite place for extra insurance during a computer move. The most

important is coverage for injury to personnel involved in move related activities. Special attention should be given to employees performing functions that require the use of their own automobiles such as carrying data or reports to and from backup locations.

Extra coverage should be provided for damage to the equipment. There is a higher than average risk that a computer component will be damaged during the move.

The computer disks and tapes should be insured not for the true physical value but for the cost required to regenerate or recreate the information on them. After all, that will be the real cost if a disk is lost or damaged during the move.

Extra insurance should also be obtained to cover the expense of running the data processing operation in a backup location for an extended period of time if the move gets bogged down and contingency plans must be used. All of this extra coverage can be arranged to cover a limited period of time, particularly the Move Window. Once again the insurance is not needed after the move has been successfully completed so the coverage can be directed only at the risk period.

Funding

We will not discuss financial planning here. What will be described will be the interface between financial planning and the computer move

itself. All of the equipment, products, services, and work that must be done to prepare the facility and to relocate the computer will cost money. There are no surprises here for sure. The important point is that all of these costs must be budgeted and approved early in the move planning cycles. Arrangements for backup and emergency services must be completed early. So then, the allocation of funds to pay for them must also be completed early.

Many times all of the funds required for a computer move project must be presented as a group for approval. There is a lot of time expended trying to forecast future expected and unexpected costs that will become more measureable as Move Day approaches. On the other hand, approval cannot be delayed too long because some funds will be needed long before Move Day to pay for required services.

At least two points should be remembered here. One is that move project budgeting and approval must be done early and to as great a detail to assure reasonable cost estimates. The second point is that a fairly large contingency fund should be made a clear part of the budget but set aside for those costs not anticipated.

A move plan cannot be sloved down or delayed because of lack of funds. Even more disruptive is the last minute rush to get emergency funds aspproved by upper management. Once funds are allocated to the move project, they should be controlled using standard project accounting techniques and the Move Manager must be aware of actual expenditures as

compared with the budgeted plan at all times.

New Positions and Procedures

As mentioned earlier, if new positions will be instituted after the computer move, the individuals involved should be part of the Move Team in order to gain valuable experience.

The first hours and days of the start up after the move will be more effective if any new job positions or procedures are well documented and understood by all involved before Move Day. In a new facility just about everything is new and the smooth continuation of the responsibilities of the data processing organization depend on familiarity and understanding. Some of the questions that must be answered before Move Day are: How will the physical work flow change? How will new jobs interact with old jobs? Who will perform these new jobs? Are the individuals currently available or must they be hired? Are they trained? What exactly will they do? When do employees eat meals, smoke, and relax; and where are these activities restricted? What new security realted requirements will be placed on employees? Who can and cannot go where and why? Security zoning, employee identification and training must be completed and tested before Move Day. Reasons must be provided for new or controversial policies or procedures. What new safety and emergency procedures are needed? What must be known about the fire detection and prevention system?

There will be a lot of activity and some confusion after the computer has been successfully moved. This will not be the time to rethink job assignments or to attempt to develop new work related policies.

CHAPTER 11 - PUBLIC RELATIONS

It goes without saying that with the many people involved either as members of the Move Team or as outsiders assisting in the preparations for Move Day, that information about the move will get out. The major concern in this chapter is what is the quality and content of the information? Is all the proper information getting to the right people? Are rumors confusing the issues? Is there too much information getting out? All of the skills of advertising and behavioral science will come into play here. People are generally curious and like to be in the know. With a computer move that could greatly impact the future of the organization, it is worth being analytical to some extent about who should receive what information and when.

Early Stages of Planning

In the very early stages of planning, very little information should reach the individuals outside of the Move Team for the obvious reason that there is very little fact at this point in time. On the other hand, as mentioned earlier, communications within the Move Team must be free, reliable, and active. There will be a lot to do in a short period of time. It is extremely important at this stage and any stage of the planning to keep rumors from misinforming people. There will be many alternative plans discussed in the early stages and some will be downright out of the question. All of these plans must be discussed to gain a fuller understanding of the dimensions of the task at hand. If

an extremely controversial plan is discussed and it gets into the rumor mill, outsiders may question the integrity and capabilities of the Move Team. This will cause valuable time to be wasted explaining away the bad rumors.

The Move Team should include in its planning the strategy for the dissemination of information about the move. At what time and in what way will individuals and groups be informed. The plan must include all aspects from the very general overview down to the very detailed responsibilities groups will have during phases of the move.

First Notice

In all phases and levels of communication it is important to keep the story honest and consistent. There is a lot at stake here and a Move Team does not need to get bogged down in an audit or an executive review session due to intentional misinformation or repetitive conflicting stories about the upcoming move.

Three or four months before the planned Move Day, the first wave of information should go out. It should be in a written form to minimize misinterpretation. It should be sent to persons with overall management responsibility with the understanding they will use discretion as they pass the information along to their people.

At this time the general plan should be laid out. What is going to

happen? At what alternative times might the move begin? How long may the move take? What contingency arrangements are being made? Who can be contacted if need be? What plans are being made to handle the ongoing workload?

Initial Communications

Also at three to four months before Move Day, information should be distributed within the organization responsibile for electronic data processing activities for the organization. At first it should cover the topics listed in the paragraph entitled "First Notice". It should then go on to explain in general terms what the move will mean to the data processing activity. What will the facility be like. How they will participate in the move. What plans must they begin considering. The move objective and move strategy can be outlined along with some of the responsibility assignments.

At this time a discussion should be held with management level employees in the electronic data processing organization to inform them of the risks associated with the upcoming move. It should also be stressed that this is highly sensitive information and must not be released at this time. In light of the risks, planning must begin consistent with the contingency planning that should be well underway by now. Critical computer applications must be identified, prepared to continue running under the conditions dictated by the contingency or backup plans. Methods for interfacing with these systems running in a backup mode must

be discussed and planned without causing undue alarm in the community outside the electronic data processing organization. A higher state of awareness must be developed to spot potential problems that may develop during the computer move.

Detailed Facts

One to two months before Move Day, a document should be published that describes in some detail the facts about what is going to happen, such as: when is Move Day, facts about the computer equipment being moved, facts about the amount of time the move may take, facts about the move plan, responsibility lists, the operations schedules for the move period, special processing or preparation requirements and activities, a discussion in some detail of the major contingency plans and capabilities.

All employees of the electronic data processing organization must have a good understanding of this information because to keep computer users from becoming uneasy from this time on, their questions must be answered quickly and satisfactorily.

From this time on responsibilities of each department or organization must be clear and consistent with the Macro Move Plan. Feedback must be sought to uncover plans that will not synchronize well with the Macro Move Plan so that corrections can be quickly made.

Move Day Briefing

This information session will happen between a day and an hour before the move will actually begin. All plans are done and everyone should know what to do. The information that will be presented or handed out here will take the form of reminders about critical issues, tactical adjustments consistent with the Macro Move Plan, the final selections among several possible alternatives within the Micro Move Plan.

Key people should be introduced so that they can be easily identified. Fact sheets should be handed out to everyone involved. This sheet should include: important phone numbers, instructions for summoning help, the locations of rest rooms and first aid assistance, schedules for meals and shift changes, times and locations of progress meetings.

Follow Up

A successful move goes very quickly and with an unbelievable amount of concurrent activity. After it is over there is a great tendency to forget about the vast amount of personal effort that went into the move.

The last information distributed is a follow up account of what happened, including statistics of performance, chronology of events, and goals achieved. This will enable each individual to share in the personal satisfaction of being part of the larger team. This also provides good documentation about one of the more significant events in

the life of the organization.

CHAPTER 12 - THE BIG DAY

The planning is completed. The arrangements are made. The people are trained. All that is left to do is to begin. Move Day is a symbol representing the actual time during which the computer is being moved. Move Day begins an hour or two before the computer is powered down and lasts until the computer is back up in full operation again.

Jobs

All of the job assignments discussed in the organization chapter must be ready to do their assigned task flawlessly. It will be important to spot check the readiness of key individuals. A question/answer session on procedures or a what-if dialogue is a good way to test the depth of an individual's knowledge regarding assigned duties.

It will be important to be aware of any sickness or other unexpected situation that will keep individuals from performing their responsibilities. Every key job must have a person who has been cross trained so that they can take over in an emergency.

All Move Day jobs should be reviewed in detail just before the start of Move Day. Things will go fast and there will be little time for going back over notes. This situation is similar to a football coach going over key plays just before the team goes onto the field.

One last point on organizatiion: as the people responsible for the physical movement of component equipment arrive on Move Day, they should be organized into four-man groups. They should appoint a leader who will be the person to whom instructions are given by the Move Control Individuals. This Move Group Leader will, after receiving instructions, see to it that his group carries out the task. The Move Group Scheduler is responsible for seeing that computer components and their related items leave the data center in the proper sequence, based on prearranged move logistics schedules. The Move Group Scheduler will assign Move Groups to devices that are ready to go. The Move Control Individual will then instruct the Move Group on the move related characteristics of the item. When the item arrives at the new location, the Data Center Coordinator will direct the Move Control Individual who, in turn, will direct the Move Group as to the final placement of the item. This sounds all very formal and it is. This approach will minimize confusion and misunderstanding and will eliminate time-wasting errors. This method of passing orders and controlling activity has been used successfully by the military for years. After all, a computer move is not that different from a well planned military operation when compared in abttract terms.

What is the Move Manager doing during Move Day? He is observing. His work is done. If he has performed his duties thoroughly, there will be nothing for him to do. The people he has trained and the plans he has made will unfold as the day progresses. If he has overlooked something, this may be the worst day of his life.

Information

On Move Day there could be several hundred people ready to participate in move activities. It will be important at the beginning and during the move to be sure that accurate and current information is in the hands of participating individuals.

Before the computer is powered down, a briefing session should be scheduled for all participants. This will insure that everyone starts together. There is the possibility that the starting time will need to be delayed. If everyone attends the briefing session, everyone will know that the schedule has been shifted and by how much. Any last minute changes can be announced and discussed if need be. Final selection of alternative Move Paths can be announced. Key move control people should be introduced so that everyone will know who they are and what they will be doing. The more this large group knows about each other, the more cooperation and team work will result. At the briefing session, rules and regulations affecting the move and the work being done should be reviewed. Safety information and the procedures for obtaining first aid help should be made clear. If meals are to be served, the times, places, and who goes on what shifts must be discussed. After the briefing session, even the newest participants in move activities should know exactly what they are expected to do and when.

At the beginning of the briefing session, fact sheets should be passed out to everyone. This sheet should have emergency phone numbers, meal schedules, special instructions, and any other information that should not be dependent on memory.

Signs should be placed on all areas that must be quickly recognized. Destination locations should be referred to in a consistent manner and the sign indicating the room or floor location should be easily recognizable. Machine locations can be marked out with masking tape to insure proper final placement. Maps showing locations and routes should be made available. The Move Path itself should be marked with arrows and signs. Hazards and special Move Path instructions should be marked clearly with descriptive signs along the route of movement whenever possible. The more individuals can do for themselves, the less need for close supervision and instructions.

Control

Of all the things that happen on Move Day, probably the most essential to the success of the move is controlling the events and activities. All of the plans and schedules call for the continuous coordination of interdependent activities. If one area goes faster or slower than planned, synchronization will be lost, resulting in confusion and wasted time and effort.

The first requirement is to have a team of individuals assigned to

monitoring the predetermined schedules of events. This group of individuals is made up of coordinators and schedulers whose task it is to observe the events and to report back to a move control center. The move progress can be followed on elaborate GANT charts, CPM or PERT diagrams. Probably more useful will be simplified charts and lists on which progress can be indicated. The communications network will be essential for this task. The Move Control Center and the Communications Command Center should be located near each other. As tasks are completed, the progress should be noted on the schedules. The expected time of completion and the actual time of completion should be noted. If the time difference is great, actions should be taken to either speed up or slow down activities in order to cause subsequent events to fall closer to the planned schedule. As this control feedback loop is completed, reasons for delays should be discovered and analyzed to determine their criticality. If a problem is the cause, corrective action must be taken immediately. Any problem that will result in repetitive delay must take first priority until it is resolved and the flow of events can continue.

As the schedules are being monitored, so too should the inventories of items to be relocated be updated accurately as items arrive at their new location. If an item is late in arriving, an effort should immediately be made to locate it and to determine the reason for the delay.

A difficult but essential part of move control centers around the Move

Path. A few hours before the move is expected to begin, move control individuals should travel the length of the Move Path and any alternate paths, checking for anything that is out of place or hazardous to the move. There are many things that can influence the use of the Move Path: a last-minute detour, a traffic accident, snow or ice, a broken elevator door, a large shipment blocking a loading dock. The Move Path should also be checked regularly during the move to be sure conditions do not change in some way.

The Move Path should be closed off if possible an hour or two before the move begins. This will minimize the risk of danger to bystanders and to move personnel alike. During the move, control of traffic on or near the Move Path must be maintained. If the Move Path goes through congested areas, security personnel or police should escort the items being moved to help in clearing the path ahead. The risk of traffic accidents, delays or injuries to personnel must be minimized while the computer components and other critical items are in transit.

Communications

The communications network on Move Day must be continuously available, fast, accurate, and not over loaded. The methods and capabilities for Move Day communications have been planned and put in place before Move Day. The network must be thoroughly tested and refined right up to the start of move activities. A break in communications once the move is underway is a serious matter and could directly influence the outcome of

the project.

An assistant Move Manager is responsible for maintaining the communications network throughout the move. Exception reporting, in addition to prearranged progress status reporting, should be all that is discussed through the communications network. This will keep the system free for emergencies if they occur.

A Communications Command Center must be staffed 24 hours a day once the move begins. All communications devices and methods should be accessible from this point. The person in charge of the Communications Command Center must be knowledgeable in move activities and must be familiar with where key individuals are expected to be at any time during the move. This center must be able to reach anyone participating in or supporting the move at any time. This includes being able to contact stand-by specialists located in temporary local lodging as well as key individuals and facilities needed to execut backup or emergency plans.

From the Communications Command Center, individuals responsible for emergency backup support or on-going operations support during the move will be kept informed as to the progress of the move. The more these support sites know about how the move is going, the faster they can swing into action if their services become needed.

Decisions

Although there will be no time for planning once the move has begun, there will be the on-going need for decisions to be made. If planning has been complete, most of the decisions will be predetermined based on anticipated events and conditions. Nevertheless, some individuals must be responsible for seeing that the proper decision is made at the right time. As mentioned earlier, the authority to make different levels of decisions can and should be delegated to other members of the Move Team, but the responsibility for all decisions rests with the Move Manager. It must be clear at all times exactly who is responsible for what decisions.

As the events of the move unfold, there will be the need for tactical decisions of all types. The most important decision will be when events necessitate shifting from one predetermined plan to another. It is important that all changes to the primary course of actions stay as close as possible to predetermined plans and schedules that everyone is familiar with. The more familiar people are with what is expected of them, the better job they will do.

One of the most difficult decisions that may arise during the move is the resolution of finger-pointing. Finger-pointing occurs when each of two people think that the other is responsible for some common problem. This type of situation must be resolved quickly because while the arguing is going on, no constructive work can. The resolution of this situation is one of firm diplomacy, probably performed by the Move

Manager or his assistant. At this time it is not important to determine who is at fault for that is not the real issue at hand, but what is important is to find an acceptable method by which each person can work with the other to determine what is really wrong and then correct it together.

At different points in time throughout the move, it will be required to determine if a task has been completed before another task can begin, before a technician can be released, or before responsibility is passed to another group. If this type of formal acceptance is truly required, it should be known ahead of time and the details of acceptance fully understood and documented. Move plans should include the time and procedures needed to prove out each of the points. Acceptance of this type should not be done quickly or compromised under pressure. A lot of headaches result from the acceptance of improperly completed work.

CHAPTER 13 - A CASE TO TIE IT ALL TOGETHER

To this point we have been exposed to the theory or the abstract requirements needed to approach any computer move. As mentioned earlier, each move is unique and different, dependent on many local situations. To show the validity of this method of approaching the problem of relocating a data processing installation, just described, an actual experience where this method was used will be presented.

The case study will deal with a large computer, critical to the health of the organization, being moved under high risk in a very short period of time. (6)

The proof of the method is in the doing.

CASE INTRODUCTION

It was midsummer of 1974 and the Management Information Department at Air Products and Chemicals, Inc. was deeply involved in the design of a new data processing center to be completed early in 1976. The data processing capability had grown at the same dynamic rate as that of the company and now office space for employees and floor space for computer equipment was bursting at the seams. Air Products data processing equipment evolved to the current IBM 370 Model 165 with two megabytes of memory. The computer supported the tranditional data processing activities along with daily order entry and customer billing, extensive

remote job entry utilization and national remote batch teleprocessing applications.

The new data center was part of a general expansion of the corporate headquarters. The most current data center design technology was being integrated into this new facility. The new data center was three times the size of the old one, and the layout had been designed to facilitate a smooth transition to future data processing capabilities and services at Air Products. A design project manager was assigned to the planning and building of the facility, and a committee of technical consultants and Air Products computer operations personnel was formed to assure that the planning and the design were consistent with all interrelated areas of data processing.

The Study of How Other Companies Moved Large Computers

As the physical planning continued, the task of relocating the 45 boxes and 200 cables that made up the 23.4 ton IBM 370/165 computer was approached. The facility design committee put on another hat directed toward moving the computer into the new data center once it was completed.

A study of companies that had recently moved large computer systems was performed. There were five commonly used strategies employed by others when relocating large machines.

1. Many large companies had two computer configurations. One would be moved at a time while the other remained supporting the company's data processing requirements until the computer being moved was up and running. Then the second would be relocated while the first would support the load.

2. Some companies, although having large computers, did not have severe daily commitments. This allowed a longer acceptable relocation period.

3. Another method was to rent extra computer equipment during the move to minimize the number of devices that had to be relocated at any one time. This extra gear was returned once the move was completed.

4. Relocation and machine change outs were often combined. The new computer was to be delivered to the new facility, installed, and tested. The operations would be switched from the old to the new machines, and the old machine would be removed.

5. Some smaller firms relied on time-sharing services to support their computer applications during a relocation.

Several planning guides emerged from this study.

1. There were few examples of moves involving large computer systems that did not have another computer system supporting the workload during the relocation period.

2. All moves had some form of emergency backup planning in case major problems occurred getting started in the new facility.

3. At least one man year of planning preceded all successful relocation endeavors.

4. Final move plans were detailed, comprehensive and documented.

5. Most moves were completed in three or four days if no unusual problems were evident.

Setting Move Objectives and Understanding the Risk

The planning committee for the computer move began by setting five general objectives.

1. Relocate the computer and the Air Products data processing opertions quickly.

2. Minimize the risk to the corporation of being without the data processing capability for an extended period of time.

3. Minimize the cost of extended downtime to our users.

4. Provide for coverage of our critical teleprocessing and remote job entry applications.

5. Minimize the cost of relocating the computer.

Another list was created itemizing the potential problems and risks that would have to be fully understood and evaluated.

1. The date for the move to the new building is not definite.

2. There may be problems debugging the new building utilities.

3. The corporate Master Move Schedule is not available at present, and the actual plan will be flexible.

4. The data center area of the new building will be finished first, so we may be asked to move first.

5. As with the new building utilities, the data center utilities (power, air conditioning, and chilled water) will have to be debugged.

6. Unforeseen problems will occur no matter how complete the plan is.

7. The rapid growth of the data processing department's services may foster a currently unknown application that will have to be treated with special care at move time.

8. Everything in the data center will be new and unfamiliar. This will cause delays and some time-consuming errors.

9. There is a reasonable chance that there will be several hardware bugs caused by dismantling, moving, and reconnecting the computer equipment.

10. There is an outside chance that a major component of the machine will be badly damaged causing extended downtime.

With the overall objectives set and the known problems and risks fully understood, the committee's next task was to develop alternatives for moving the computer that would achieve the ojectives and minimize the risk.

Selection of Alternatives

The committee reviewed many alternative plans for moving the

computer matching each with the key objectives mentioned earlier. The following were rejected after the initial study:

1. Install a new computer in the new building and sell the old one after the move is completed.

2. Install a new computer in the new building and keep the old one for future needs.

3. Move the computer across an extended holiday so that user downtime would be minimized.

4. Buy all support equipment and move the Central Processing Unit (CPU) and memory only.

5. Buy equipment needed for the future now.

6. Trade key elements of the computer after the move by using a second machine temporarily.

These alternatives either did not meet the basic objectives or were not possible due to timing or other restrictions.

The feasible alternatives that met the objectives carried different levels of risk, incurred several variations of cost and had different probabilities of success over a variable time frame.

The five acceptable alternatives were:

1. Plan to move the computer in as short a period of time as possible, doing everything possible to minimize risk of damage and error. No backup would be necessary due to the expected short period of time needed for relocation.

2. Use the IBM 360/65 for our British subsidiary, Air Products Limited (APL), via the satellite communications link as a backup to support only the most important applications on a short-term basis.

3. Find a nearby company who would let Air Products use their computer to run critical applications during the move.

4. Find a time-sharing firm who would let Air Products run critical applications during the move.

5. Rent a computer on a short-term basis that would be installed in the new data center before the move. Critical work would be transferred to the new machine, and would support the applications until the move was complete.

Detailed Discussion of Alternatives

1. No Backup During the Move

Advantages:

1) Simplest and easiest to plan for.
2) Minimum cost.
3) Least amount of downtime.

Disadvantages:

1) Little room for error and unforeseen problems.
2) Maximum impact on our users if major problems develop.
3) Complete exposure if a major problem occurs that keeps the computer from processing again.

2. Air Products Limited to Support Some Users

This alternative could be used as part of the no backup, time-sharing, and shared-computer alternatives.

Air Products Limited has an IBM 360/65 which would allow the Data Processing Department to run their critical work during the move. Users would see little change in service. We would transmit the program libraries and procedures to Air Products LImited before the move.

3. Use a Nearby Company's Computer

Teleprocessing (TP) and remote job entry (RJE) hardware would be installed at their data center. Files, data sets, and libraries would be copied to tape, and all master files would be duplicated ready to be transported to the data center. Jobs would be delivered with the inputs data via courier and output would be returned. Data Entry schedules, control procedures and output distribution would have to be adjusted to meet any run schedule restrictions. Nearly all data processing services could be performed during the move. Process engineering work could be done by our shared company's data center or by APL.

Fourteen companies were called from Reading to Easton to see if they could help in this move, and an insurance company in Easton was willing to handle 15 to 20 hours per day.

Advantages:

1. The insurance firm had a very positive attitude and would work toward a successful arrangement.
2. The firm was just a 45-minute dirve from Air Products so courier service could be arranged.
3. They had a large installation and could off-load to New York for a short period of time.
4. Air Products data processing department

had worked with the insurance firm in the past and had established a good relationship with their management.

Disadvantages:

1. The length of time Air Products could stay on this type of service was limited because of their monthly cycle.
2. Due to the insurance firm's growth plans, Air Products could be given too little computer time.
3. Air Products must install some hardware in their center for teleprocessing.
4. There would be some technical problem in running with their operating system and standards.
5. Manpower would be required to run work at the insurance firm's data center that will also be needed to move the computer.
6. They did not have double density discs. Our data sets would have to be converted to single density before the move. This could take from 8 to 16 hours of computer time and may be a source of error once we begin operations at the insurance firm's data center.

4. Commercial Time-Sharing Firm

Technical adjustments would be made to incorporate our TP and RJE work. Files, data sets and libraries would be copied to tape, and all needed master files would be duplicated ready to be transported to the time-sharing data center. Jobs could be submitted through RJE terminals or directly to the data center via courier during the move. Output could be printed on the RJE terminal or returned by courier. Data Entry schedules, control procedures, and output distribution would have to be adjusted to meet these requirements. The Process Engineering work could be done by the time-sharing data center or at APL. Several time-sharing companies were called to measure the feasibility of this alternative.

The Boeing Computer Service and The Service Bureau Co. were large enough to warrant continuing study.

Advantages:

1. Air Products could buy any service needed for as much time as required.
2. There was a reasonable chance that Air Products could not be bumped at the last minute leaving no backup.
3. There was a lot of hardware available, increasing flexibility.

Disadvantages:

1. The cost was high for this service as were preparation costs.
2. There were some technical problems that might have been too expensive to solve
3. Manpower must be diverted from the task of relocating the 370/165, putting a lower probability of success on the total project.

5. Rent Duplicate Equipment

All Air Products data processing services could be provided without major impact on users. TP and RJE lines and modems would be duplicated for a short period of time, but continuous coverage during the move would be provided.

Several companies were consulted about providing a short-term lease on an IBM 370/155 or an IBM 370/158 computer. Through these companies, smaller dealers were approached. All except one gave the same response: too expensive. They could not charge less than the IBM monthly lease charge, nor could they make a commitment until within three months of the data needed. There were very few uncommitted 370 or large 360 computers available.

IBM was the only company able to arrange a rental agreement. This agreement required that Air Products issue a letter of

intent seven months before expected delivery.

Advantages:

1. Virtually without risk, renting allowed the greatest flexibility in scheduling the move.
2. Renting placed the least burden on the operational groups for preparation of jobs and data to run at an alternate site.
3. Movement and reassembly of the critical pieces of equipment could occur at a pace more consistent with the vendor's estimates.
4. Air Products could "debug" the utilities in the new building.
5. In case of extensive damage to critical pieces of Air Products computer equipment during the move, the rental period on the backup equipment could be extended until the damaged equipment can be repaired or replaced.
6. Control of the situation would be placed entirely in the hands of Air Products.
7. The entire system could be relocated with no perceptible reduction of service to the user community.

Disadvantages:

1. Cost: The entire operation could be accomplished for $140,000 in out-of-pocket

rental expenses, plus about $2,500 worth of systems programming time for SYSGEN and systems debugging. The cost of duplicate lines and modems would be necessary regardless of the method used to move the computer.

Exposure Time

A study was conducted of other large computer moves to determine the range and distribution of computer downtime. After contacting IBM, professional computer movers and others with firsthand experience moving large computers, an elapsed time frequency distribution was compiled. This distribution considered total elapsed downtime including takedown, transportation, setup and debugging. Information on major component failures as well as machine damage was incorporated in the data.

At this point, the critical path of the move activities was analyzed by studying the events of the relocation process. Several bottlenecks were uncovered, and we gained a much better understanding of the needed elapsed time.

After consulting our vendors, we agreed that with additional men and equipment and more precise planning and coordination, the move time could be shortened. Figure A is the final work/time analysis chart showing the expected critical path of the move activities. Figure B shows the two final probability distributions. One curve is the average

move time frequency distribution from our study and the second represents the results of the critical path planning to shorten the move time.

The Move Window

The help minimize the potential impact of downtime on the corporation, we conducted a study to find the longest period of time when the computer would be least used. We found that our production requirements are at a minimum between the 13th workday of the month through the last workday of the month. Development work could be rescheduled to free up this period of time, if needed.

In this study, we also wanted to find which month had the most number of days in this slow period of time. The new data center was scheduled to be finished by January 1976, at the earliest. The move should be completed as soon as possible after that to minimize the impact of two new complicating applications due to become operational in the late spring of 1976. A list of possible move windows was prepared as follows:

Month	Days in Move Window
January	12
February	11
March	14

April	11
May	12

As a result of this analysis, Air Products' management decided to move the computer starting the 18th of March 1976.

The Cost of Each Alternative

To evaluate the alternative strategies for achieving the move objectives, a comprehensive effort was made to quantify the marginal costs associated with each alternative. As the alternatives were analyzed, three types of costs emerged.

1. Direct out-of-pocket costs - Those direct costs for an alternative that would be seen as corporate expenses on the income statement.
2. Indirect costs - Those costs seen as corporate expenses on the income statement, but not totally identifiable with an alternative.
3. Opportunity costs - Those indirect costs incurred by diverting resources from original use because of an alternative. These costs may never show directly on the income statement.

Direct out-of-pocket costs were obtained from quotations, price lists, past history, and actual calculations for the following costs:

1. Computer equipment rental needed during the move, or to overlap

the move.

2. Computer time charges for known work to be run at a time-sharing firm, or at a local company's data center.
3. Test time and preparation cost.
4. Transportation to and from a remote backup location.
5. Overtime incurred by department staff.

Indirect costs were estimated by direct calculation, past history, interviews, questionnaires and personnel knowledge for the following:

1. Idle people during the computer downtime.
2. Suboptimal cash, inventory and operations management caused by delayed computer reporting.
3. User overtime needed to cover computer-based operations during downtime and catchup.

Opportunity costs were approximated by interview, personnel knowledge, and gut-feel of knowledgeable people for the remaining costs:

1. Cost of idle computer equipment when information and solutions to problems are needed.
2. Cost of disrupting the operations and information flow of a large corporation.
3. Interest cost of unbilled receivables.
4. Resources needed for move preparation redirected from other projects.

All costs were prepared individually using from one to 30 days of possible downtime. Thrity days was considered the longest time the computer could be inoperable because of any possible risk. These 30 days cost strings were grouped together by alternative to give a complete picture of the direct, indirect, and opportunity costs.

Risk Analysis

After the data was collected, a computer simulation program was written to develop a risk curve for each alternative available to Air Products. The risk curve tells management the probability of various costs being less than a particular dollar amount for different alternatives.

The simulation model required the following data input:

1. Will the backup alternative be used?
2. If the backup alternative is used, what is probability that it will work? What will be the cost of using this alternative?
3. What are the costs of not having computer service by day of outage for the backup case and for the no backup case? What is the accuracy of these estimates?
4. Will we be using IBM's normal or fast moving plan?

The simulation program performed the following procedure 2,000 times

for each alternative considered.

1. Determine if backup equipment will be used and if so, will it work.
2. Determine if IBM's fast or normal moving plan will be used. Simulate the number of days to accomplish the move for this realization.
3. Determine the cost of lost work for this realization. If the backup works, a sample is taken from the cost curve appropriate to the backup alternative. If the backup does not work, the sample is taken from the cost curve appropriate to the no backup case. The cost estimates are then modified to reflect the uncertainties associated with these estimates.
4. The fixed cost of an alternative is added to the costs developed in step 3 to give an estimate of a possible cost for an alternative.

The costs for the 2,000 iterations were reported as a risk curve.

A typical risk curve output might appear as follows:

Probability of the Cost Being Less Than A Particular Dollar Amount	Dollar Amount (in thousands)
.00	14.5

.10	23.2
.20	30.1
.30	36.7
.40	43.2
.50	50.6
.60	58.7
.70	68.2
.80	78.2
.90	100.7
.95	152.4
.99	201.3
1.00	226.3

Expected value = 65.9

This risk curve tells the analyst that the expected cost would be $65,900 and that the cost will never be less than $14,000 or more than $226,300. In addition, 95% of the time the cost will be less than $152,400. This also means that there will be 5% chance that the cost will exceed $152,400. The results of the Simulation Analysis are shown in Figure C. The use of rental equipment and "Fast IBM Service" was not considered because the rental equipment must backup the operation for three months. Therefore, the premium that must be paid for the "Fast IBM Service" would be wasted.

Implications of the Risk Analysis Output

The risk analysis output was first analyzed to determine if any alternatives dominated any others. This analysis lead to the following conclusions:

1. Fast IBM move service is preferred to normal move service.
2. The use of the Air Products Limited backup to supplement No Backup, Local Backup, and Commercial Time Sharing is preferred.
3. Local Backup is preferred to the use of Commercial Time Sharing.

After the dominance analysis only three feasible alternatives remained.

They were:

1. No Backup using "Fast IBM Service" and APL backup.
2. Local Backup and APL backup using "Fast IBM Service".
3. Rent duplicate equipment.

These remaining alternatives were ranked according to various decision criteria that Air Products management might consider:

1. Minimize the expected cost of the move.

Local Backup and APL	(74.5)
No Backup and APL	(103.4)
Rent	(142.5)

2. Maximize the probability that a particular decision will yield the smallest cost (this result was derived from a more detailed output than shown in Figure C).

No Backup and APL	(.70)
Local Backup and APL	(.22)
Rent	(.08)

3. Minimize the worst-case dollar loss caused by this decision.

Rent	(142.5)
Local Backup and APL	(601.2)
No Backup and APL	(1,309.4)

4. Minimize the out-of-pocket cost of the decisions.

No Backup and APL

Local Backup and APL

Rent

5. Optimize the utility of money spent on the move. Considering the magnitude of the dollars involved in this decision relative to total corporate revenue, the utility curve for Air Products is approximately linear. Therefore, the result is the same as for "minimizing expected cost".

Local Backup and APL

No Backup and APL

Rent

The analysis was turned over to Air Products' management for final decision.

The Decision

The alternative of renting backup computer equipment during the move period was discarded because of the large out-of-pocket expense for the short-term utility.

The total expected cost and the maximum exposure each have cost components representing cost elements that are usually overlooked in decisions such as this. By their nature, these costs are estimated and impossible to identify clearly. For this reason, the management of Air Products used the criteria that minimized the out-of-pocket costs and maximized the probability that a particular decision would yield the smallest cost for moving the computer.

The decision was made to use the No Backup and APL alternatives in moving the Air Products computer. Primary efforts would be directed at moving the computer equipment and the operations section in as short a period of time as possible while minimizing the risk of damage to the machine.

Move Day

During the early morning of March 18, 1976, the results of many hours of

planning were already unfolding. The Computer Operations Setion was well into their accelerated production schedule and the move window was clear. All production was completed by 2:00 a.m. and the major file backup work was done by 4:00 a.m. The movers and the move team foremen got their final detailed instructions and equipment checkout at 8:00 a.m. A final briefing session was held at 8:30 a.m. for nearly 200 people including movers, customer engineers, move control and coordinating personnel, construction engineers and building utility representatives.

The actual computer relocation began one half hour ahead of schedule. Work was overlapped to maximize the productivity of every minute after the computer went down. Short wave radios were used by the move control individuals to bring help to any area that needed it without delay. Every activity had a time to begin and a time when it had to be completed.

By 9:43 a.m. the first piece of equipment rolled into the new data center and at 2:30 p.m., March 18, 1976, all of the 49 boxes and 168 cables and hoses that make up the IBM 370/165 computer were located in the new data center. During the time one team of computer customer engineers was taking the computer apart in the old data center, another team was assembling the computer in the new data center as the components arrived.

After some initial startup and balancing problems with power and chilled

water utilities, the computer was powered up at 12:00 p.m., March 18th. Work teams were scheduled in shifts, around the clock, bringing different mixes of specialized skills to each phase of the installation process. Other skilled individuals were standing by at local lodgings to be called in when and if they were needed.

During the evening, a major component was discovered to be damaged. A messenger had to be sent to a parts depot 2 hours away and return before further installation could be continued. Many high risk parts had been brought in as standby spares but this was of no help in this case. Time had been set aside at several key stages for expected problems. Up to this point the extra time had not been needed.

Diagnostics began as soon as the damaged component was replaced and tested. At 8:30 a.m., March 19, 1976, 23 hours after the move began, the computer was alive and well. It was planned that as much testing as possible would be done, both of the computer and of the support systems and utilities. A fire drill was held. The procedure that switches over to backup power and chilled water was tested. Final instructions on the new data center procedures and equipment were reviewed with all operating personnel.

By 5:00 p.m., March 19, 1976, 31-1/2 hours after the computer move had started, all systems were tested and operating smoothly. The computer began live processing at that time. The move went so smoothly, with such little impact on the flow of information, that some users thought

we had called off the move at the last minute.

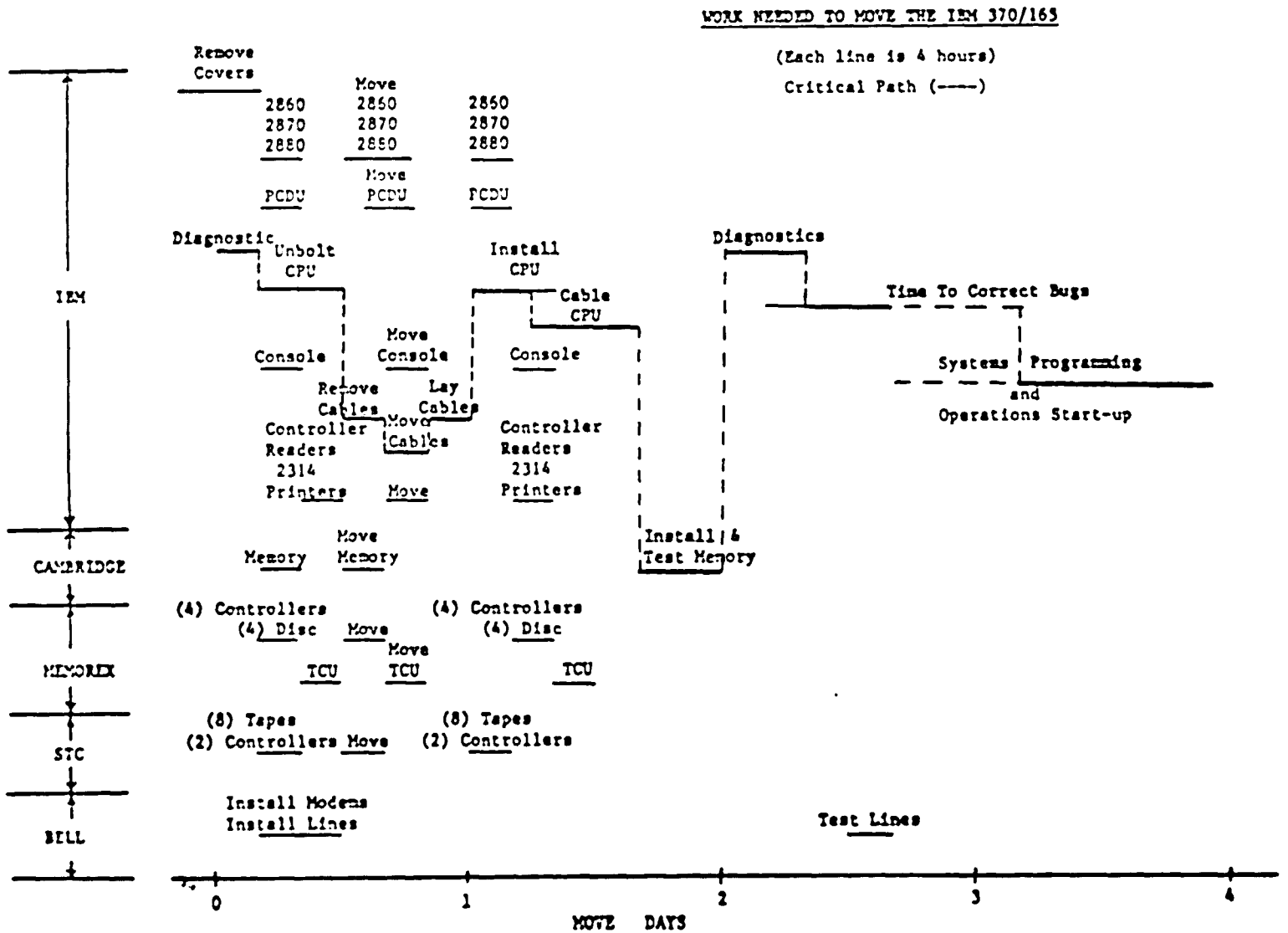
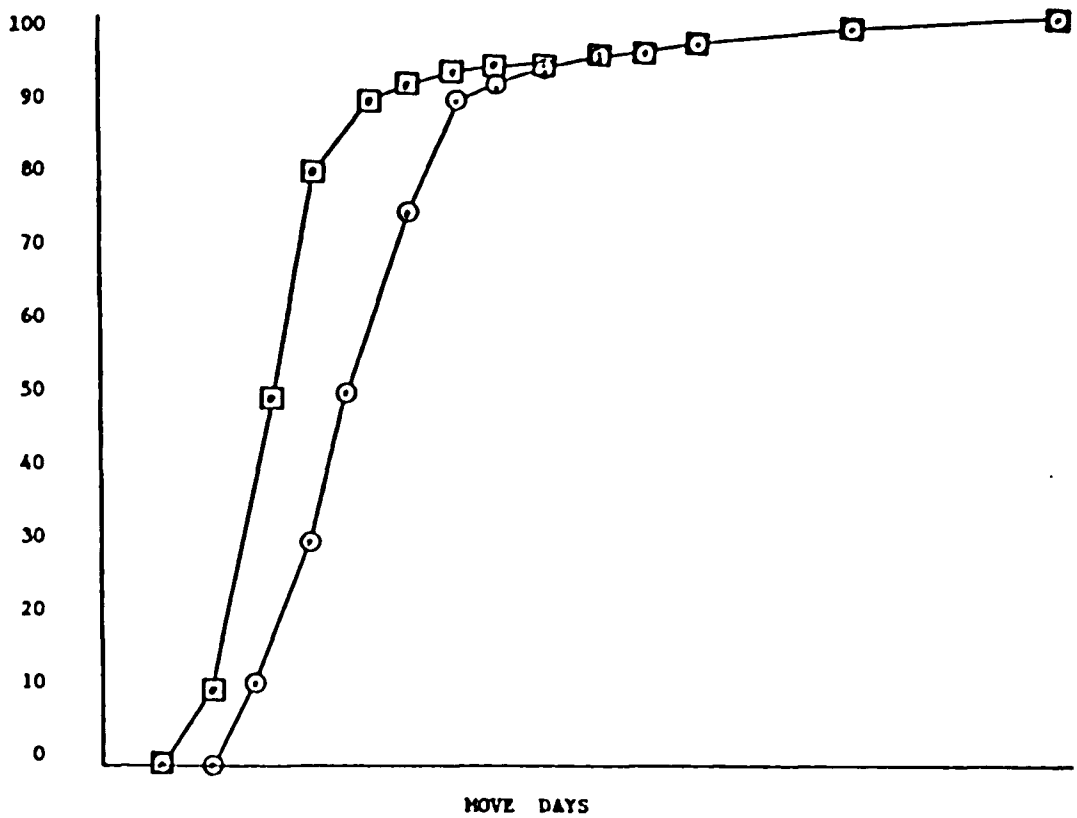

WORK NEEDED TO MOVE THE IBM 370/165
(Each line is 4 hours)
Critical Path (----)
Remove Covers
2860
2870
2880
PCDU
Move
2860
2870
2880
Move PCDU
2860
2870
2880
PCDU
Diagnostic
Unbolt CPU
Move Console
Console
Remove Cables
Move Cables
Lay Cables
Controller
Readers
2314
Printers
Move
Install CPU
Cable CPU
Console
Controller
Readers
2314
Printers
Diagnostics
Time To Correct Bugs
Systems Programming and Operations Start-up
IBM
Move Memory
Memory
Install & Test Memory
CAMBRIDGE
(4) Controllers
(4) Disc
Move
TCU
Move TCU
(4) Controllers
(4) Disc
TCU
MITCHREX
(8) Tapes
(2) Controllers
Move
(8) Tapes
(2) Controllers
STC
Install Modems
Install Lines
Test Lines
BELL
0
1
2
3
4
MOVE DAYS

Figure A

Figure B

PROBABILITY OF COMPLETING THE MOVE
OF THE COMPUTER IN X DAYS



Average Plan

Day	Success	Failure
1	0	100
2	0	100
3	10	90
4	30	70
5	50	50
6	76	24
7	90	10
8	92	8
9	94	6
10	95	5
11	96	4
12	97	3
15	98	2
30	99	1

Fast Plan

Day	Success	Failure
1	0	100
2	10	90
3	50	50
4	80	20
5	90	10
6	91	9
7	92	8
8	93	7
9	94	6
10	95	5
11	96	4
12	97	3
15	98	2
30	99	1

Table
Risk Analysis of Alternatives
for Moving APCI's Computer Facility

	FAST IBM SERVICE						NORMAL IBM SERVICE					
	Expected Value	Prob. That Cost Will Be ($ 000)					Expected Value	Prob. That Cost Will Be ($ 000)				
		50%	85%	90%	95%	99%		50%	85%	90%	95%	99%
No Backup and APL	103.4	48.7	94.7	156.4	354.2	1,309.4	140.5	101.9	169.2	201.3	313.6	1,439.8
Commercial Time Sharing	106.7	86.8	113.8	126.9	205.1	806.7	136.6	114.2	154.3	168.8	215.1	768.2
Commercial Time Sharing and APL	102.9	84.7	110.9	123.9	182.2	650.2	133.0	109.3	144.7	159.1	213.1	942.2
Local Backup	79.5	50.6	66.8	77.0	121.0	816.6	95.5	65.0	113.6	142.2	195.9	733.8
Local Backup and APL	74.5	51.2	62.1	76.1	117.5	601.2	95.6	66.7	108.7	135.6	190.7	640.6
Rent Duplicate Equipment	N/A	N/A	N/A	N/A	N/A	N/A	142.5	142.5	142.5	142.5	142.5	142.5

Figure C

CHAPTER 14 - FUTURE STUDY

The case study showed that the method described in this paper was effective in improving the chances for success for that computer move project. One case example does not rigorously and exhaustively prove the method. It will take time and the results of several computer moves to prove that this method is superior to others that could be used.

Areas that should be studied further are described below.

No Downtime Move Examples

Most of the move examples seen so far will allow some amount of computer downtime. As computer applications become a more integral part of control and operations, there will be less time that the computer can be out of action due to a move. The extreme end of this class of move projects is when no downtime can be experienced.

Opportunities to use this method for approaching the problems of relocating a data processing installation should be sought out and the results of these moves should be studied and documented.

Installation Debugging

There are many reasons why a computer may not come up again after it has been moved. Move planners expend large amounts of time and money in

guarding against worst case situations. Most of the time, to the joy of everyone, the worst case does not occur.

Research must be done to more fully understand this type of problem area. What types of problems have been experienced? What caused them? How long did it take to correct them? How could they have been prevented?

Computer Moves That Ran Into Trouble

As mentioned earlier, there are few documented accounts of computer moves that ran into trouble. Without knowing better, this leaves the impression that all moves are successful. This is not the case. The inventory of knowledge must be made more complete by describing these events and discovering the cause of the problems. Once this type of information is available, it is a relatively easy task to comment as to what could have been done differently to avoid these problems. People learn not only by successes, but also by failures.

Use of Backup Locations

As the criticality or number of applications increases, the ease of using another computer to support the processing load during a move becomes more difficult. Research could be done to find examples of backup sites being used to support large processing requirements during move time. The conditions, tasks, and flexibility needed for success

could be generalized so that others can more easily prepare for backup operations.

Alternative Strategies

There were many move strategy and backup alternative models discussed in this paper. Move projects should be documented, providing case study examples for as many strategies as possible. This will be a great help to future computer move planners.

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BIOGRAPHY OF CANDIDATE

Mr. H. William R. Townsend is the Technical Assistant to the Manager of the Management Information Department at Air Products and Chemicals, Inc., Allentown, Pennsylvania. He has worked for Air Products since 1968 holding a variety of positions and responsibilities.

Mr. Townsend is married with two sons and lives in Allentown, Pennsylvania.

Mr. Townsend graduated from Drexel University with honors in 1968 with the degree of Bachelor of Commerce and Engineering and again in 1969 with the degree of Masters of Business Administration. In 1978 Mr. Townsend graduated from Lehigh University with the degree of Master of Science in Industrial Engineering.

Mr. Townsend is a member of the following national honorary fraternities: Sigma Rho, Pi Nu Epsolon, Beta Gamma Sigma, and Phi Kappa Phi. Both he and his family have travelled extensively throughout the United States and Europe.

Mr. Townsend is a Deacon at the First Presbyterian Church of Allentown and is the chairman of the Data Processing Advisory Committee of the Lehigh County Vocational-Technical School.