THE ADMINISTRATIVE WINDOW INTO THE INTEGRATED DBMS

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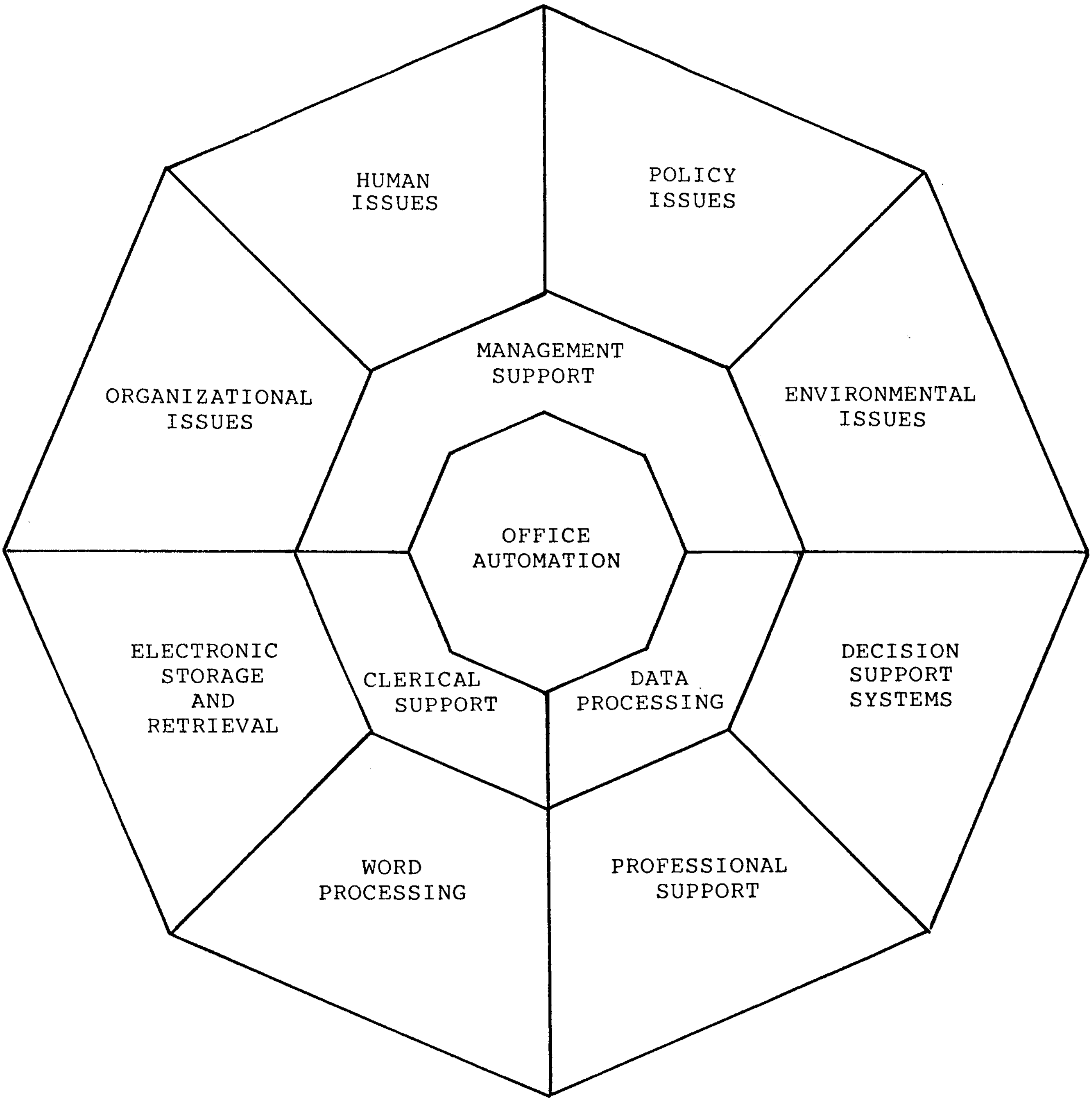
I. Introduction

In parallel to the evolution of Management Information Systems from simple data files to complex data bases, the stand-alone computer systems have been migrating toward fully integrated systems serving the work force. The next major productivity gain may very well be to make these highly sophisticated working level Data Base Management Systems (DBMS) serve all levels of management with reports of varying levels of detail. Most attempts by the DBMS development organization to provide useful information to management seem to bog down in the quagmire of competing working level requirements. Most large DBMS development organizations possess three to five year backlogs. Perhaps Office Automation is the vehicle that brings to pass the Management Information System that really serves management. A good office automation system manned by a team of facilitators seeking opportunities to serve end-users could go a long way toward defining a DBMS that serves management.

This paper will briefly discuss the problems of the DBMS organization, alternative approaches to solving some of the major problems, a debate about problems that may have no solution, and finally how office automation fits into the development of the Manager's Management Information System.

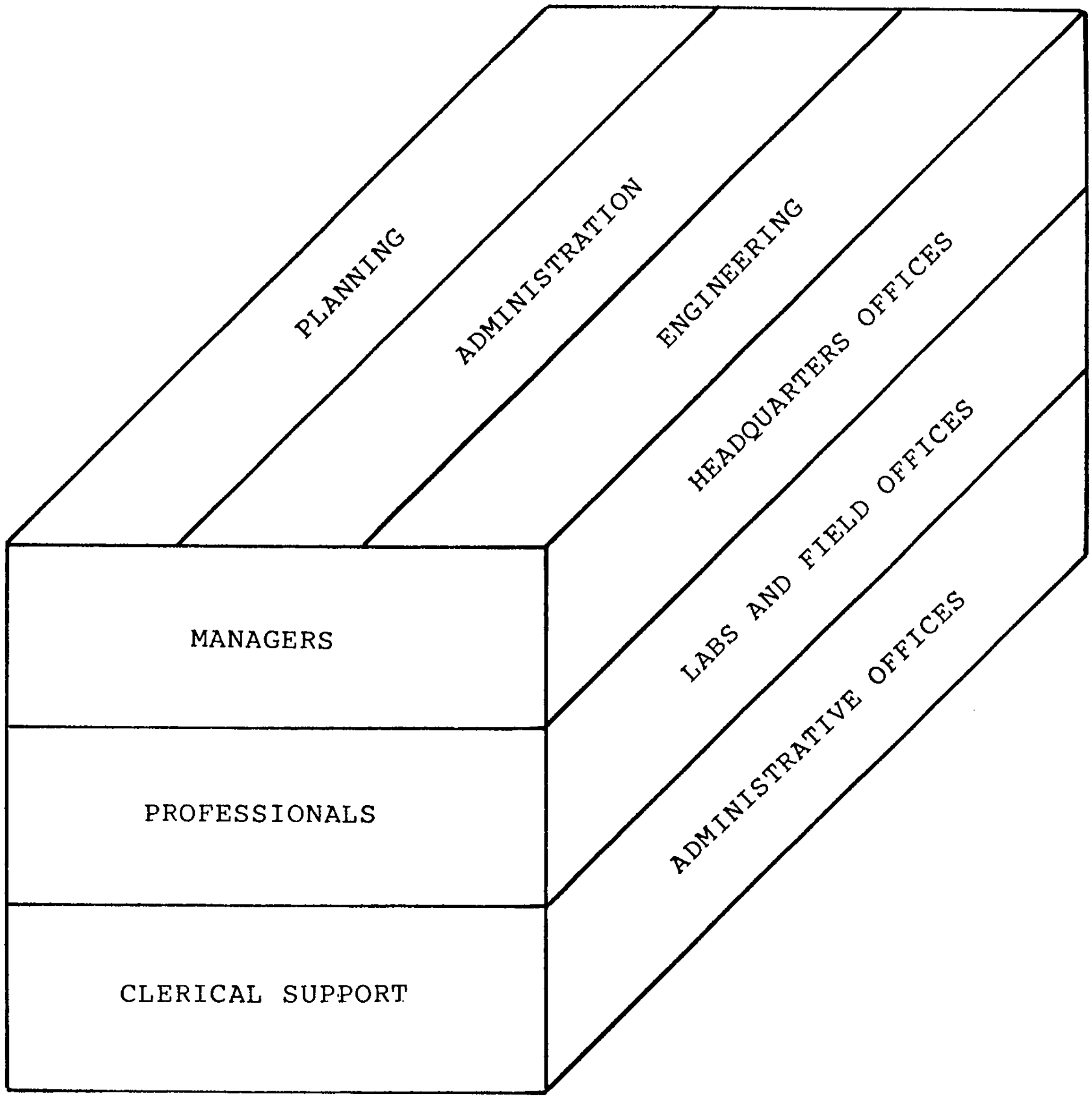
II. What is Office Automation?

Office automation has many facets, but the rise in administrative costs has forced industry to seek more aggressive ways of increasing administrative productivity just as has been done for decades on the assembly line. Of course, office work is not a well defined integrated process with measurable raw material and countable units of output. Therefore, the office productivity axiom assumes that if each office task can be completed faster and with more accurate information, then the composite of all the tasks will result in greater overall productivity. Even harder to measure are the real benefits such as increased profitability or reduced or avoided expenses. At NASA, we measure productivity in terms of more work done by fewer people, but the amount of work is hard to measure. Increasing launch rates are measurable, but the work involved in new space station challenges is hard to compute or even estimate. Even so, it seems logical to assume that an integrated office environment will produce efficiencies similar to the integrated assembly line. The task of automating the office in itself has potential for increasing efficiency, but every facet must be carefully considered to obtain maximum benefit without disruption and to create an atmosphere conducive to the process of favorable change. Since organizations and people tend to resist changes that create confusion and chaos in the work place, a highly structured evolutionary process must be projected. Figure 1 depicts the many facets of office automation that must harmonize for the benefit of the organization through increased productivity. Figure 2 focuses on the office automation environment, Figure 3 lists the office automation components, and Figure 4 depicts the office automation relationship to the total management information system.



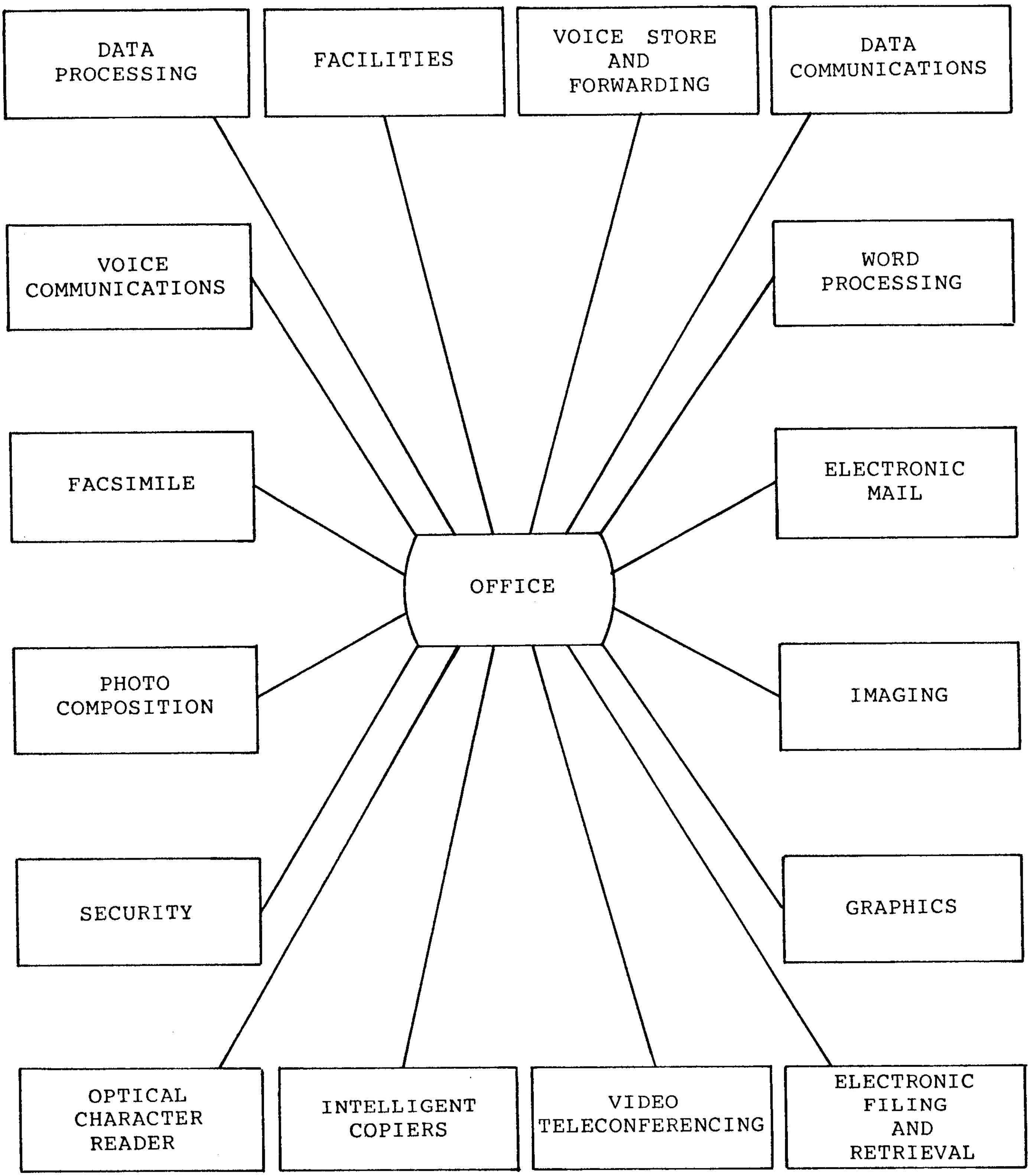
OFFICE AUTOMATION INTEGRATION FACTORS

FIGURE 1



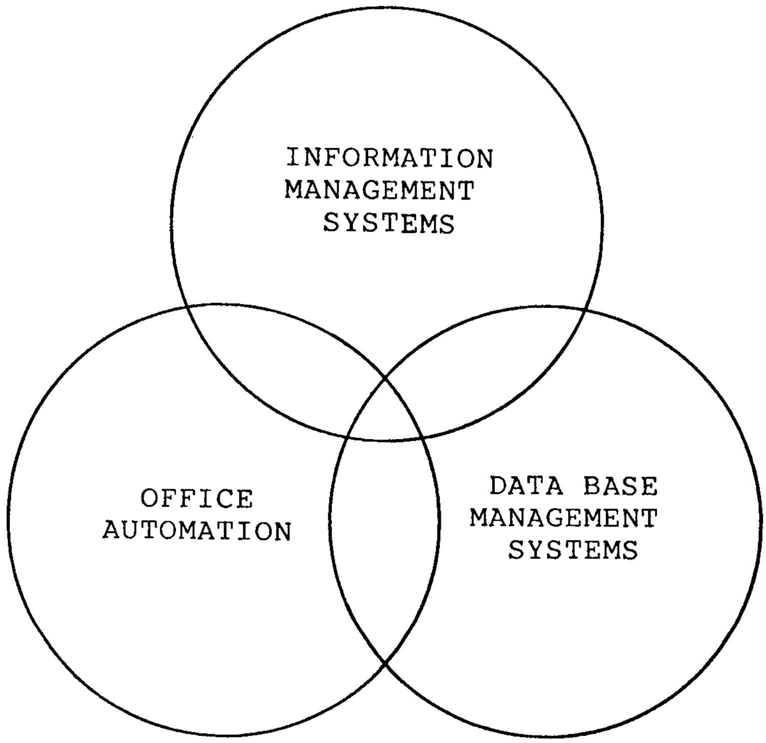
OFFICE AUTOMATION STRUCTURE

FIGURE 2



COMPONENTS OF OFFICE AUTOMATION

FIGURE 3



INTEGRATED INFORMATION SYSTEMS

FIGURE 4

III. Office Automation and the Large Integrated Data Base Management System (DBMS)

A. The Dynamic Evolution of the Large DBMS

It is well known that even the first computers performed simple repetitive tasks effectively. Any process that must be done over and over by the same identical method is a great candidate for computerization. Equally important is the computer's efficient storage and recall of data. Once stored, information can be retrieved, sorted, and reported to highlight important trends that would have been lost in most manual systems. In the simplified model depicted in Figure 5, processing the data can be a complicated mathematical model or a simple procedure that manages data to support an organization performing a job. The computerized mathematical algorithm is rather easy to imagine, but the simple procedure in support of a job can be clarified by example. For instance, the job of performing maintenance on computer hardware seems routine enough for our model of a simple procedure. Figure 6 defines the procedure. The basic information of problem report number, work order number, description, and identification of the hardware component or part provides a history of work performed. Adding dates to the actions provides performance information for the maintenance technician's supervisor and identifies resolved problems and design changes for operations and design personnel. If the organization is relatively large and there are many computers operating in similar configurations, (e.g., the consoles supporting Shuttle vehicle subsystems in KSC's firing rooms), then the technician must be identified and the location of the hardware established. The operations personnel want timely data, so the simple computerized procedure becomes the on-line "Automated Line Replaceable Unit Tracking System." It now keeps track of the location of all spare parts, parts sent to the vendor for repair and expected due dates, etc., etc., etc. It automatically flags the on-line "Problem Reporting and Corrective Action System" when problem reports are closed. It automatically flags the on-line "Configuration Management Data System" when design changes are complete. It automatically flags the "Shuttle Inventory Management System" when the stock of spare computer parts is low. It interfaces with the "Automated Ground Operations Scheduling System" to schedule the work and the needed resources. Two of the systems that are notified of significant events are not on the same computer. The simple procedure has quickly grown into a sophisticated integrated networked system of DBMS's that keep track of hundreds of pieces of information that are entered by people in different NASA

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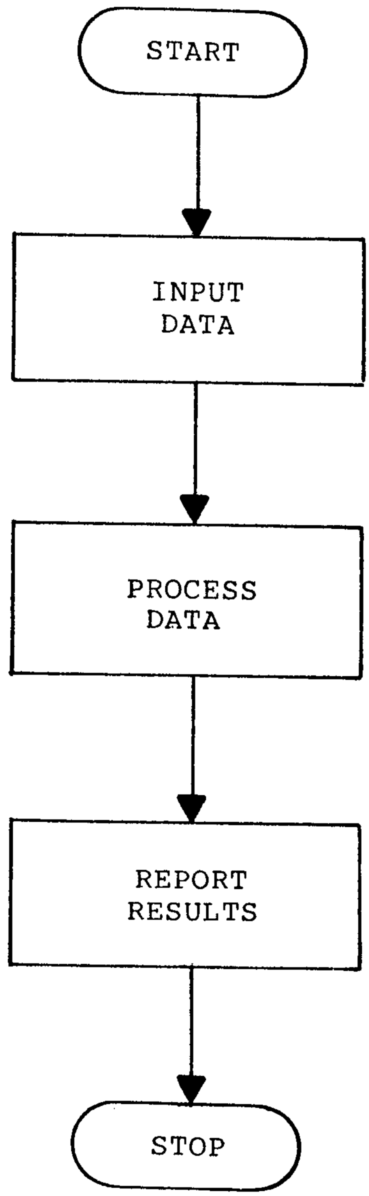
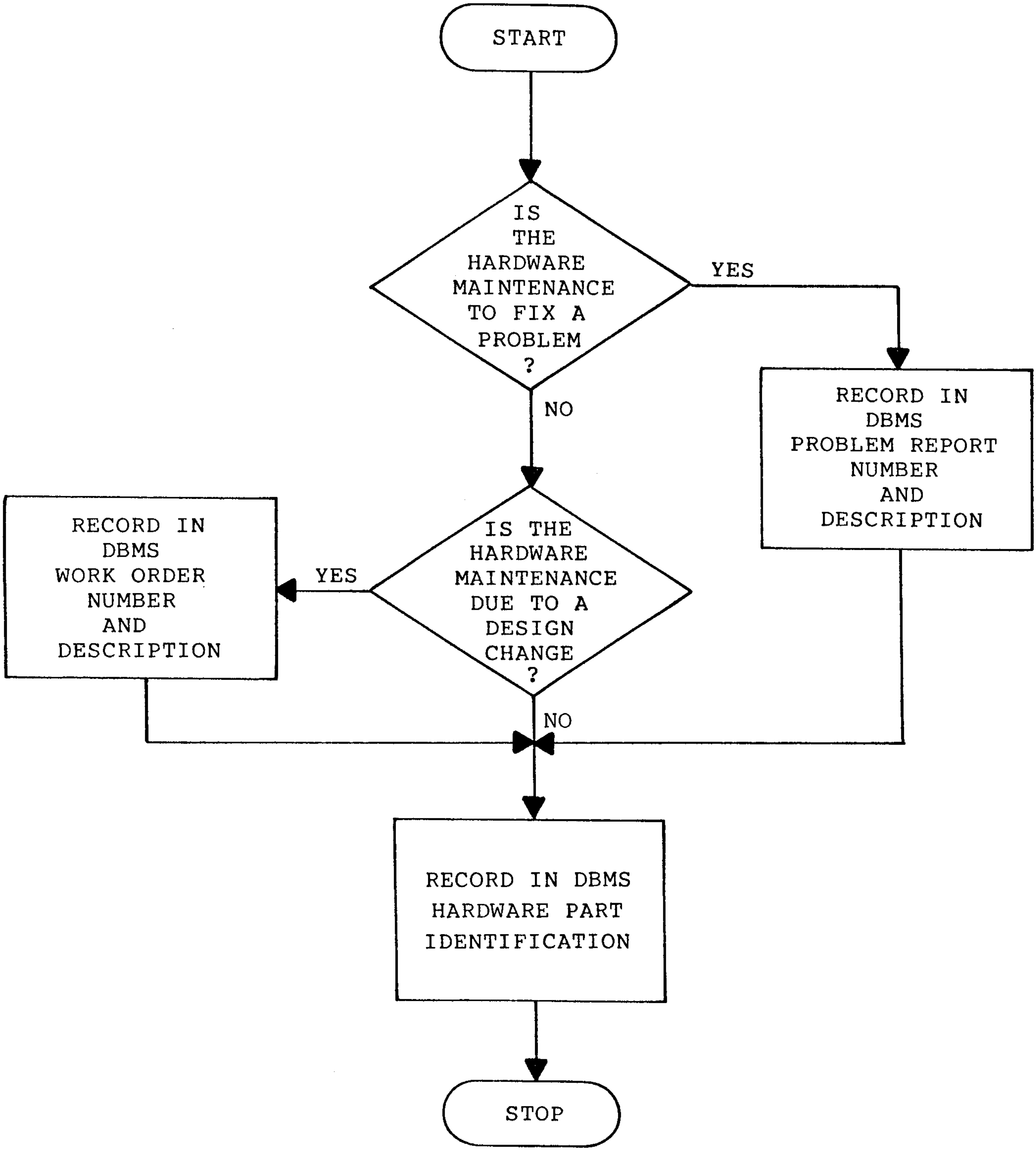
[1]The systems identified in this section are not totally integrated at this time, although long range plans incorporate this approach.



DATA PROCESSING MODEL

FIGURE 5



COMPUTER MAINTENANCE MODEL

FIGURE 6

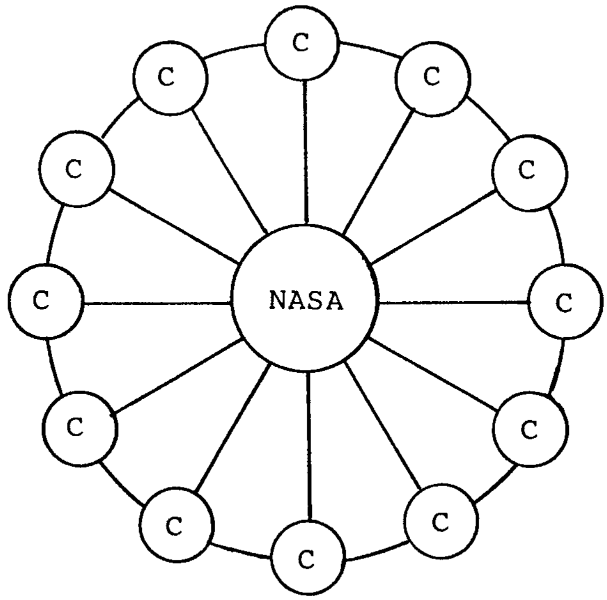
and contractor organizations and are protected by elaborate security procedures that ensure autonomy for the authorized organization. Since these computer programs essentially follow the flow of procedures defined to perform work, they are directly affected by each change to the procedure. Even adding volume with no logical change can affect the computer programs. The complicated mathematical model is beginning to look simple and the simple procedure is beginning to look complicated.

B. The Problems That Resist Solutions

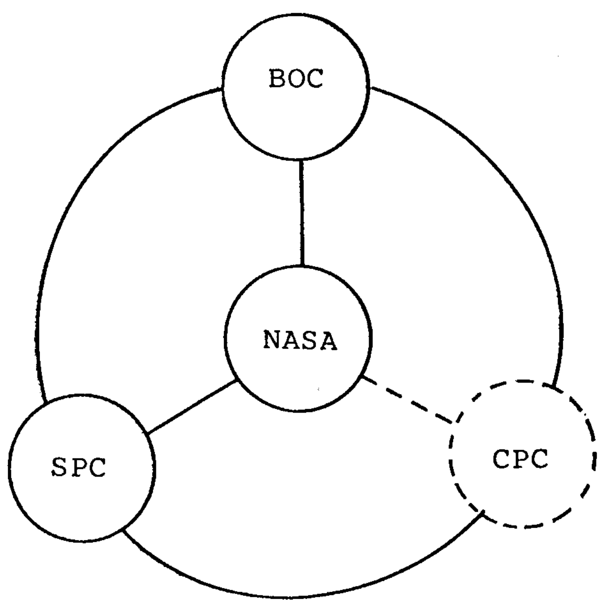
What is the simple solution to large DBMS that cannot keep up with the dynamic nature of work flow procedures? Can we make the work flow procedures less dynamic? Can we increase the computer resources to accomplish more timely modifications? Both approaches are valid but are not simple or easy in a large organization.

Let's examine the approach that controls the dynamic nature of work flow procedures. KSC has just accomplished a major milestone along this path by combining a large number of small contracts into two large contracts for the base operations and the Shuttle processing. A possible third large contract may handle cargo processing. Our model of computer maintenance in the firing rooms involves the first two major contractors. Just as the spokes in Figure 7 are reduced, the work flow procedures are diminished by no longer needing to separate each contractor's part of the job. When responsibilities are concentrated from five or six contractors to one contractor, the computer program becomes simpler. However, it must be changed. Along with the scramble to consolidate, KSC must seize the opportunity to streamline the operation. It seems that we may have so many changes to the procedure that the computer programs may need a major rewrite. In our quest for stable work flow procedures, we have generated a major seismic tremor that will send shock waves through the computer systems for some time. However, as with ground faults seeking equilibrium, a more stable future computer base is the eventual derivative.

The second approach that attempts to pour more resources into the computer department so that modifications can be made quicker and easier, can certainly reduce the backlogs. However, a number of practical issues limit a total solution by using this approach. Buying major upgrades to computer systems is a very time consuming task due partly to the government procurement regulations. Increasing the staff is sometimes even harder due to the shortage of computer personnel. These two constraints prevent sizing the resources to equal the task. As Figure 8 shows, the limited resources applied to the requested modifications tends to flatten the need date



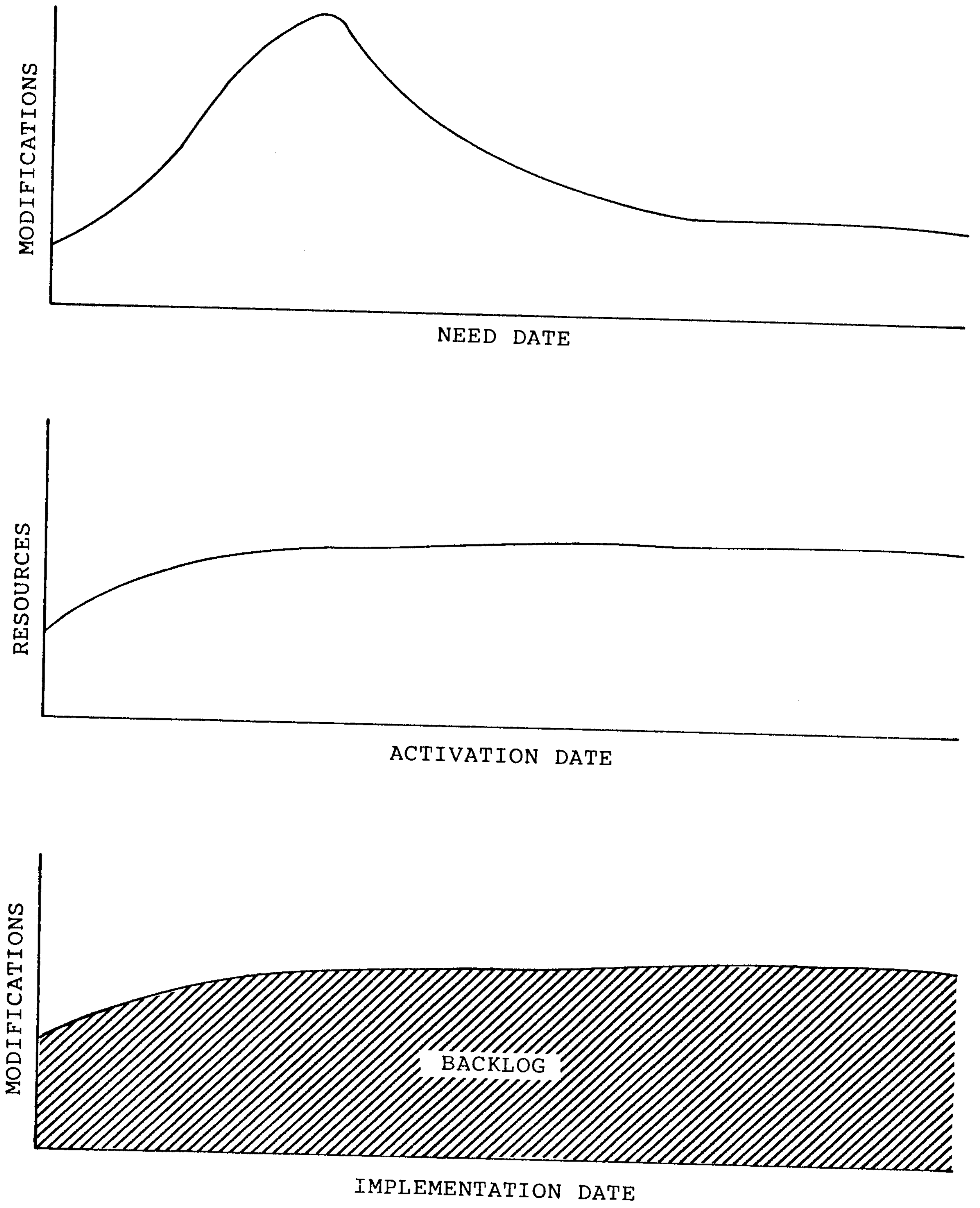
C=CONTRACTOR



BOC=BASE OPERATIONS CONTRACTOR
SPC=SHUTTLE PROCESSING CONTRACTOR
CPC=CARGO PROCESSING CONTRACTOR

INTERFACES TO THE NASA CONTRACTORS

FIGURE 7



MODIFICATIONS > RESOURCES=BACKLOGS

FIGURE 8

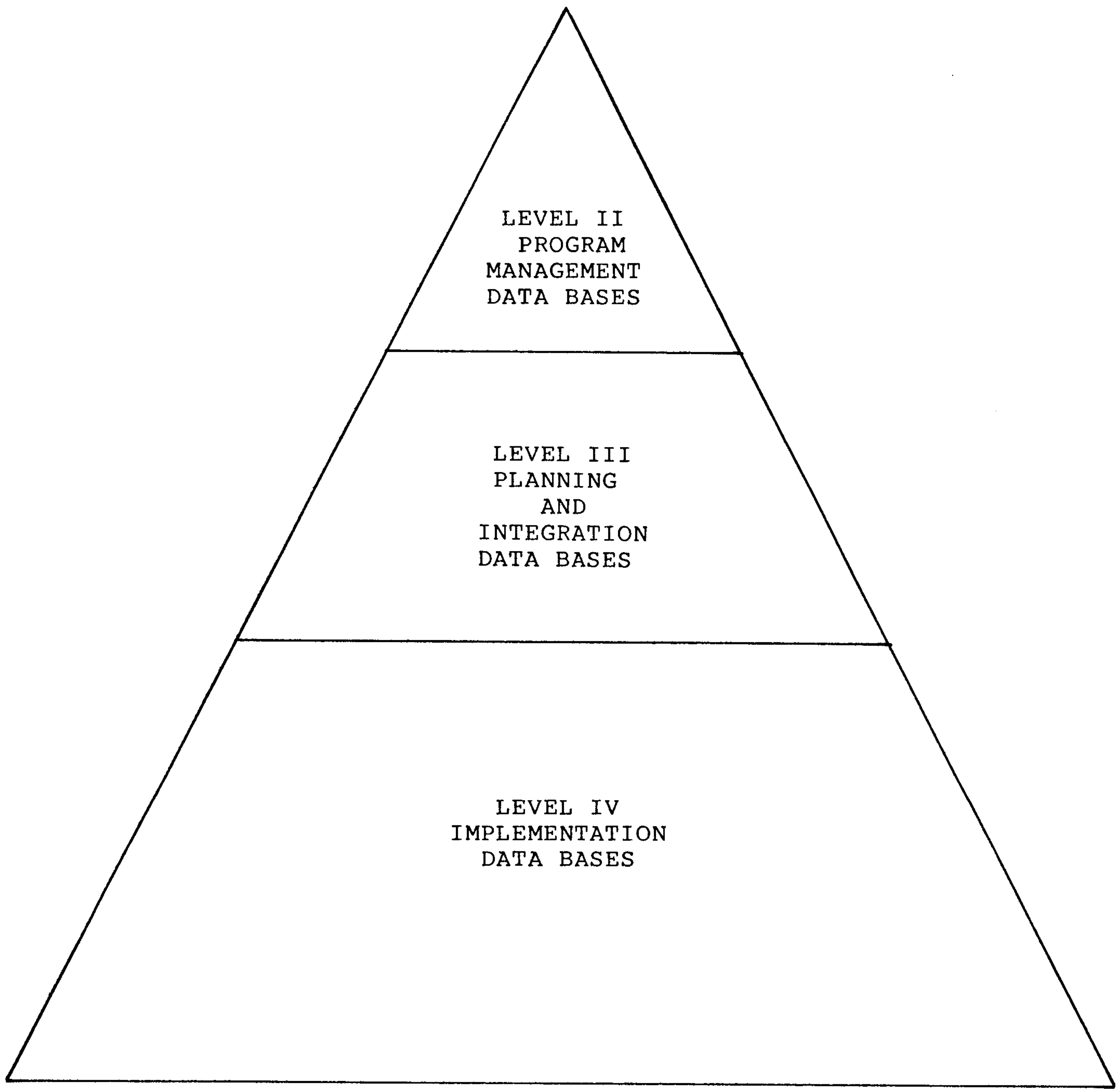
curve into an implementation curve that closely resembles the activations of resources curve. Almost all of the requested modifications become backlogged items.

C. Where Are the Priorities - Where Should They Be?

The computer systems that have been described are Level IV work procedures. Information from these data bases feed computerized systems at Level III (e.g., Artermis schedules) and Level II (e.g., "Inter-Center Problem Reporting and Corrective Action"). Figure 9 describes the Level II, III, and IV relationships. When the computer systems are down, the ability to get the job done is impacted at all levels. When the requested modifications are backlogged, the jobs take longer to perform. Impact to the computerized procedure directly affects the productivity of the work force at each level. The dreaded impact to workforce productivity tends to place a priority on modifications that benefit the work force rather than the modifications that benefit the managers. The reports generated from the data bases provide data to the people who do the work. Reports designed to identify trends that would be useful in making management decisions are not prevalent. Normally, professional and technical people provide management with oral and written reports that summarize progress or identify problems or issues. The data bases that support the work force could also provide valuable information. Unfortunately, these reports in their current state are usually bulky and hard to interpret. Sometimes the information is scattered across systems and computers and is very difficult to integrate. On top of all of these problems, they must be mailed or hand carried. Often the information is badly dated by the time it hits the mail drop.

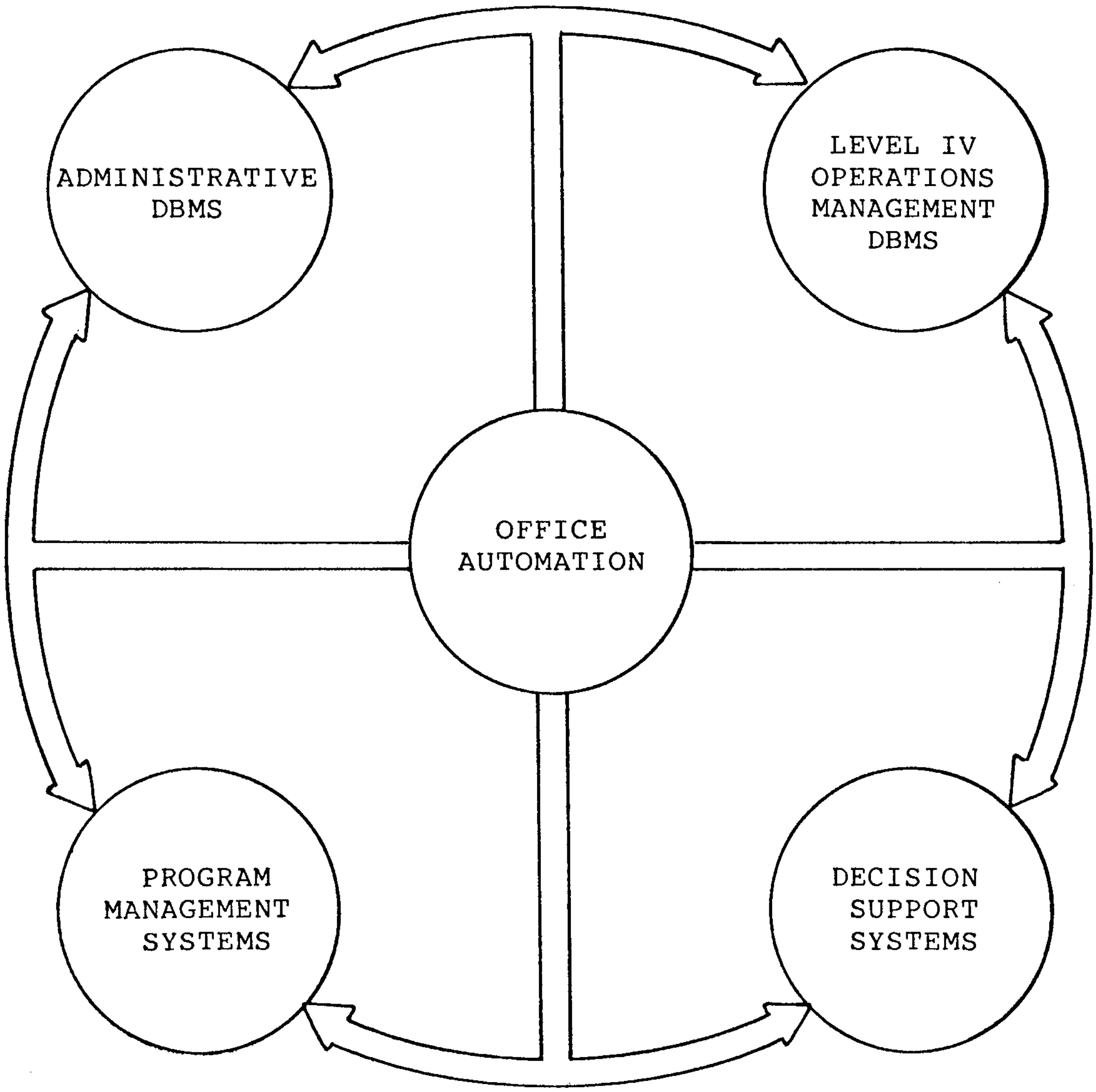
D. The Office Automation Alternative

Office automation may be the answer to the modification bottleneck and the awkward management reporting system. If managers or their executive staffs had access to personal computers equipped with software tools to manipulate data, and these tools were networked to the large DBMS, then reports could be tailored to the individual manager and delivered electronically to the local office printer. As the staff becomes more familiar with the information in the DBMS and learns more about the power of the tools available through the personal computer, ad hoc reports designed by the staff can generate timely responses to immediate requirements for information. By expanding the hardware and software tools, both managers and workers can tap the information to suit their needs without impacting one another. Figure 10 depicts this expanded system.



INTEGRATED SHUTTLE PROCESSING DBMS

FIGURE 9



NETWORKED OFFICE AUTOMATION SYSTEM

FIGURE 10

IV. The Office Automation Solution

A. Two Obstacles That Can Be Eliminated

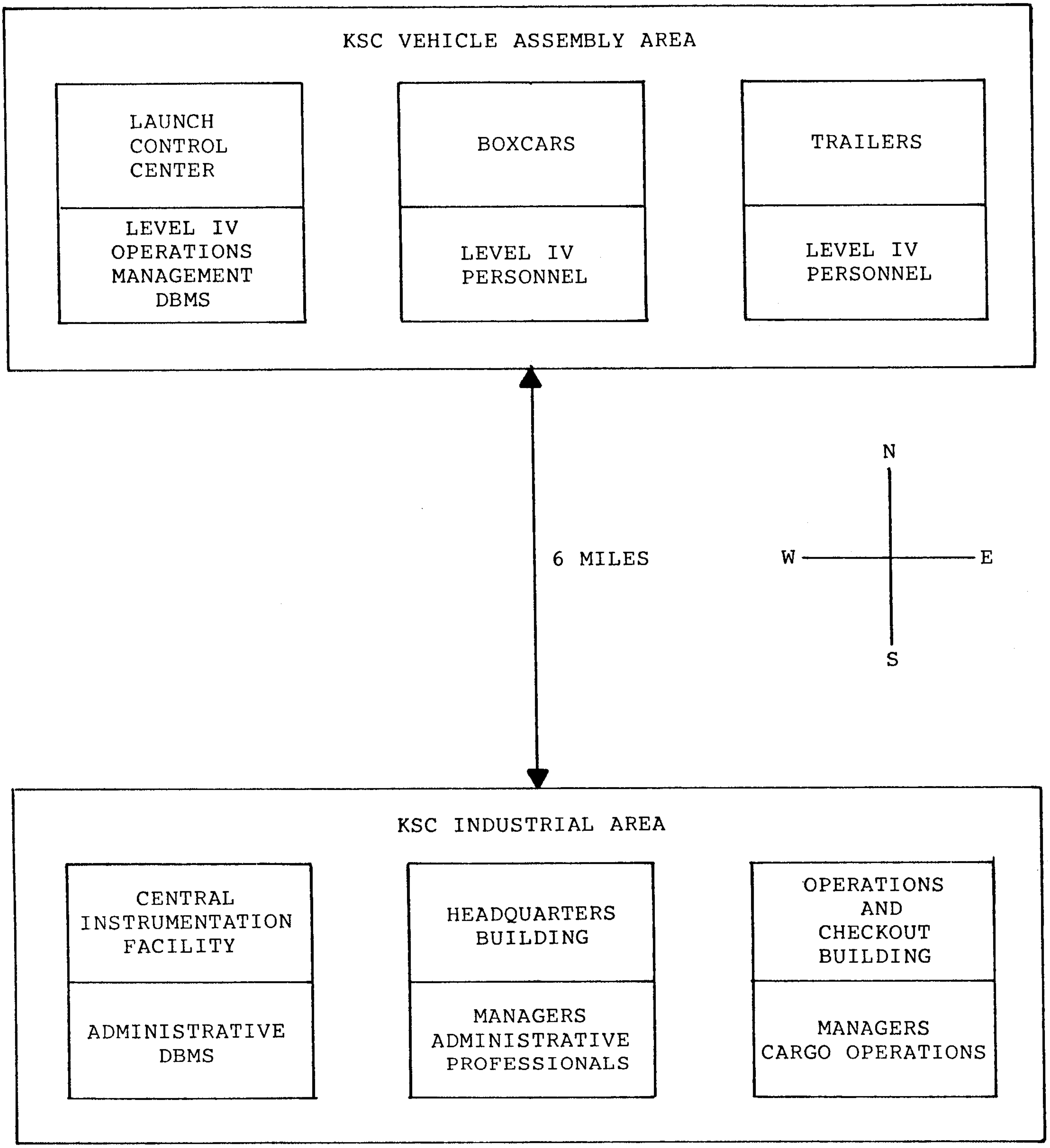
In order to be effective, two major problems outside the office automation system must be solved. First, the various mainframes that host the large DBMS are either currently overloaded or operating marginally during periods of peak utilization. If office automation demands are to be met, then long range mainframe utilization patterns need to be studied and adjusted to accommodate the traffic. The office automation system could provide central hardware that would relieve a portion of the loads on the mainframes. The second major problem that needs a solution is the outmoded KSC communication plant. NASA and contractor personnel are concentrated in two major areas as defined in Figure 11. The Kennedy Switched Data Network (KSDN) that is currently in procurement will provide the communications backbone between the major buildings and population centers. This system is basically a multiplexed twisted pair solution that will maximize the utilization of the existing cable plant. It will serve the communications requirements until growth pushes the center toward a fiber optics replacement. Local area networks within major buildings as part of the office automation system would solve some of the inflexibleness of the KSDN's twisted pair solution. The current 45 day lead time required to attach end user equipment to a twisted pair cable plant could be eliminated by providing local area network outlets in each room. The local area networks within buildings and the KSDN between buildings should network end users to any destination desired.

B. The Goals of Office Automation

There are a number of committees throughout NASA devoting their time toward achieving increased productivity through improved management information systems. KSC's Office Automation Task Team chaired by Dallas Gillespie was formed in March 1983. Figures 12 and 13, from the February 1984, Booz, Allen and Hamilton "NASA Office Automation Planning Study Findings and Conclusions," identifies the NASA Goals and the NASA-wide information system steering groups. Office automation assists in the achievement of all of these objectives.

On the local level, KSC must improve the effectiveness of NASA personnel in order to meet the increasing demands of the Shuttle multi-vehicle processing, Space Station planning, Shuttle/Centaur modifications, and various new support requirements. An integrated office automation system provides for increased productivity through the following general objectives:

- Provides more timely and integrated information access.



MAJOR POPULATION CENTERS AT KSC

FIGURE 11

NASA GOALS

Presented By James Beggs on March 23, 1983

- PROVIDE FOR OUR PEOPLE A CREATIVE ENVIRONMENT AND THE BEST OF FACILITIES, SUPPORT SERVICES, AND MANAGEMENT SUPPORT SO THEY CAN PERFORM WITH EXCELLENCE NASA'S RESEARCH, DEVELOPMENT, MISSION, AND OPERATIONAL RESPONSIBILITIES.
- MAKE THE SPACE TRANSPORTATION SYSTEM FULLY OPERATIONAL AND COST EFFECTIVE IN PROVIDING ROUTINE ACCESS TO SPACE FOR DOMESTIC AND FOREIGN, COMMERCIAL, AND GOVERNMENTAL USERS.
- ESTABLISH A PERMANENT MANNED PRESENCE IN SPACE TO EXPAND THE EXPLORATION AND USE OF SPACE FOR ACTIVITIES WHICH ENHANCE THE SECURITY AND WELFARE OF MANKIND.
- CONDUCT AN EFFECTIVE AND PRODUCTIVE AERONAUTICS PROGRAM THAT CONTRIBUTES MATERIALLY TO THE ENDURING PREEMINENCE OF U.S. CIVIL AND MILITARY AVIATION.
- CONDUCT AN EFFECTIVE AND PRODUCTIVE SPACE SCIENCE PROGRAM WHICH EXPANDS HUMAN KNOWLEDGE OF THE EARTH, ITS ENVIRONMENT, THE SOLAR SYSTEM, AND THE UNIVERSE.
- CONDUCT EFFECTIVE AND PRODUCTIVE SPACE APPLICATIONS AND TECHNOLOGY PROGRAMS WHICH CONTRIBUTE MATERIALLY TOWARD U.S. LEADERSHIP AND SECURITY.
- EXPAND OPPORTUNITIES FOR U.S. PRIVATE SECTOR INVESTMENT AND INVOLVEMENT IN CIVIL SPACE AND SPACE-RELATED ACTIVITIES.
- ESTABLISH NASA AS A LEADER IN THE DEVELOPMENT AND APPLICATION OF ADVANCED TECHNOLOGY AND MANAGEMENT PRACTICES WHICH CONTRIBUTE TO SIGNIFICANT INCREASES IN BOTH AGENCY AND NATIONAL PRODUCTIVITY.

BAH, Feb. 1984

Figure 12

NASA-WIDE INFORMATION SYSTEM STEERING GROUPS

Group	Function
OASG - Office Automation Steering Group	Coordinates and promotes the planning and integration of automated technologies with Headquarters and NASA-wide program activities. The OASG has members from Institutional Program Offices, EIS, and PTMC.
EIS - Electronic Information Services Working Group	Exchanges information for office automation between centers and Headquarters.
PITAC - Planning and Implementation Team for Administrative Computing	Coordinates the development and implementation of Agency-wide Administrative ADP Systems. Membership includes representatives of all center Administrative ADP Managers plus Headquarters ADP Planning, Management, and Resource Management Groups.
AIMS - Action Information Management System Committee	Coordinates establishment of office automation pilots involving headquarters program offices and selected center groups. The pilots are intended to define program support office automation application requirements and specifications.
INC - Intercenter Network Committee	Establishes guidelines and procedures to ensure end-to-end interoperability and security of "non-NASCommunication Networks." This includes coordinating center plans for Program Support Communication Network gateways.
SOAP TEAM - Strategic Office Automation Planning Team	Coordinates the development of an Agency-wide Office Automation plan and OA technology utilization coordination activity.

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Figure 13

- Improves communications between workers.
- Implements a wide range of cost effective office automation technologies and applications.
- Facilitates decision making.

C. KSC's Approach to Office Automation

KSC's approach toward achieving an integrated office automation system has been to focus the activity through the Office Automation Task Team (OATT) which is directed by an Oversight Committee and the KSC Center Director. Since inception in March 1983, the OATT has conducted site visits of installed systems, reviewed the literature, canvassed the KSC community, consolidated the requirements, and defined the specifications. These specifications have been issued to industry and the NASA community for review and comment. The responses have been evaluated and the committee is currently preparing a report for the Oversight Committee and the Center Director.

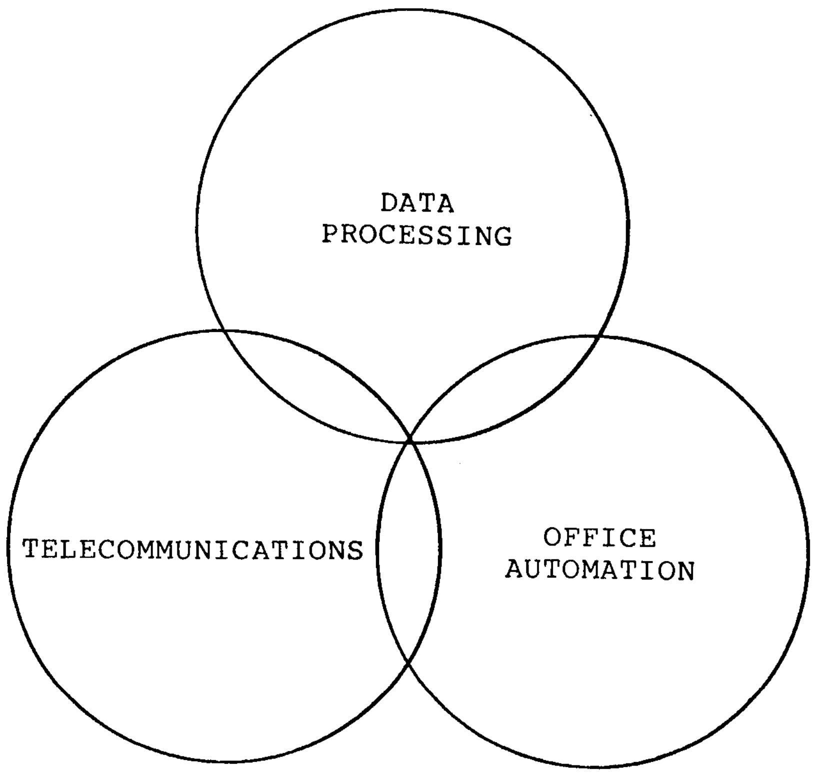
Practical experience with networked office automation systems has been obtained through a leased pilot that is networked as well as connected to a system of data phones in key management areas. A personal computer loan pool has been established to promote the use of automated techniques. As with most government and non-government organizations, KSC has previously spent its office automation dollars on word processors for the office support personnel. Now that communications networking for stand alone units is becoming more available, the future targets for increased productivity are the managers and professionals who account for 80% of the total office personnel costs. While stand alone personal computers can increase the productivity of this group to some extent, the timely integrated reports from the large DBMS will provide a major portion of their decision support system.

Without listing every office automation technology that KSC expects to get, there have been a number of features that have been identified as critical to system acceptance by the KSC community. The office automation system must have a graphics package suitable for generating viewgraphs of moderate complexity, must have an integrated approach to the office systems functions, must be user friendly and responsive, must have a powerful electronic mail and filing system, and must have a comprehensive data base manager and communications capability. A major goal is to provide the networking functionality to our contractor's office automation systems. Adequate training is viewed as a major key to user acceptance and system success.

D. Office Automation Expectations

Integrated information (Figure 14) serving all levels of the work force and management is KSC's expectation. Planning and reporting are expected to shift from "anticipatory" to "on demand." Planning will shift from analysis to simulation. Reporting will shift from historical trend projections to real time control. Information will become more accurate, more detailed, and more available. People at all levels will become more productive.

On the other hand, the management of expectations is a critical success factor for office automation. How fast can new technologies be absorbed without disrupting the work force. Technology is a moving target - there will always be more tomorrow. There is a critical need to promote the acceptance of lags between the creation of technology and its implementation and lag between commercial availability of technology and meaningful user absorption. The KSC implementation plan seeks to avoid disruption, protect investments, secure acceptance, justify costs, provide functionality, and prevent obsolescence. Office automation is a process rather than a project. The office automation user for the first time will have the opportunity to solve the cumbersome manual procedure through automated methods. As the work force experiments with the tools that are available through office automation, they, the end user, will invent the office of the future through the natural selection of the useful features.



INTEGRATED INFORMATION

FIGURE 14