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Defense Systems Management School

May 1976

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# DEFENSE SYSTEMS MANAGEMENT SCHOOL



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## PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

MANAGEMENT INFORMATION SYSTEM FOR  
THE U. S. ARMY  
SATELLITE COMMUNICATIONS AGENCY

STUDY PROJECT REPORT  
PMC 76-1

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GS-12            DAC

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MANAGEMENT INFORMATION SYSTEM FOR THE  
U.S. ARMY SATELLITE COMMUNICATIONS AGENCY

Study Project Report  
Individual Study Program

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Edwin L. Cross  
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May 1976

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LCDR Susan Anderson

This study project report represents the views, conclusions, and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School, the U.S. Army Satellite Communications Agency, or the Department of Defense.

## FORWARD

This report has been prepared with two objectives in mind. The first is to satisfy an academic requirement of the DSMS to pursue an Individual Study Program in some area of management, and thus it has served as a learning instrument for the author. The second objective, however, is to develop some management techniques which may prove beneficial to the author's employer, the U. S. Army Satellite Communications Agency (SATCOMA). The problems outlined and solutions proposed in this report are believed to be applicable to any program or project office involved in the acquisition of defense systems. The use of SATCOMA as an example provides a convenient real-world frame of reference, and it is not the author's intention to criticize specific policies at the Agency. In any event, the report represents solely the author's views, conclusions, and recommendations, and does not reflect the official opinion of the Defense Systems Management School, the U. S. Army Satellite Communications Agency, or any other activity of the Department of Defense.

## Executive Summary

This report describes the potential benefits which would accrue from a central computerized Management Information System (MIS) installed at the U.S. Army Satellite Communications Agency, and how such a system might be developed. An Agency which routinely operates in the forefront of high technology should naturally aspire to the use of the most modern management tools in the accomplishment of its mission. A computerized MIS would greatly assist the Project Manager and his staff in collecting, organizing, and displaying the facts needed for reports, briefings, and critical management decisions. Since many equipment development and acquisition projects are proceeding simultaneously, considerable time and effort is expended in maintaining timely and accurate project status information. A MIS would speed the information flow, improve its accuracy, and allow more time for other vital management functions. Although there are many pitfalls in the course of developing an effective MIS, with careful planning, such a system can be achieved. A thorough system study will focus management objectives and lead to an accurate definition of the desired system. Human factors must be carefully weighed throughout the MIS development process to insure that the system is fully accepted by the managers it is intended to serve. The Agency's organizational structure and the mission of each functional element must be fully

considered in the development of the data base. Once system requirements are defined, detailed cost/benefit analyses must be made for each of the viable system acquisition alternatives to determine the best approach. Numerous regulations and directives provide the procedures for MIS acquisition, but AR 18-1 is most significant, especially in view of its recent change delegating greater approval authority to DARCOM. The potential benefits of MIS at SATCOMA are immeasurable, and in the author's view, indispensable in light of recent trends toward tighter budgets, more controls, and increased complexity in the defense systems acquisition business.

DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE: MANAGEMENT INFORMATION SYSTEM FOR THE  
U.S. ARMY SATELLITE COMMUNICATIONS AGENCY

STUDY PROJECT GOALS:

To describe the potential benefits and outline the procedures for development of a central computerized Management Information System (MIS) at the U.S. Army Satellite Communications Agency (SATCOMA).

STUDY REPORT ABSTRACT:

This report examines the flow of project status information within SATCOMA, and shows how such management information can be processed quickly and economically using computer techniques. A detailed literature search is made to ascertain the impact of MIS on an organization, what constitutes an effective MIS, and what is involved in developing such a system. Interviews with key Army MIS officials were made to determine the status of current Army MIS policies and directives. Typical MIS problem areas are identified, and a checklist of tasks and cost factors involved in developing a system are provided. One possible MIS configuration for SATCOMA is postulated, but the report emphasizes the need for further studies to determine the best MIS approach for the Agency. The report focuses the attention of management on the need for MIS, and will hopefully serve as a catalyst for future MIS studies at SATCOMA.

KEY WORDS: Management Information Systems

MANAGEMENT CONCEPTS INFORMATION SYSTEMS COMPUTERS PROJECT MANAGEMENT

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## 1. Introduction:

A management information system (MIS) is a communication process which provides management with the facts it needs to monitor the process of its programs, and to measure performance, detect trends, evaluate alternatives, make decisions, and take corrective action as required. <sup>1(\*)</sup> The MIS should perform this function as efficiently, effectively, and economically as possible. At the U. S. Army Satellite Communications Agency (SATCOMA), management receives its information through a traditional system of written and oral reports, reviews, and briefings. In view of the dynamic and complex environment in which SATCOMA must operate, it appears prudent that the Agency review its management information requirements to determine whether or not the criteria of efficiency, effectiveness, and economy are satisfied. If present techniques are found wanting, the possibility of implementing a central computerized MIS should be considered as a means of streamlining the flow of information. An organization which routinely operates at the forefront of high technology should naturally aspire to the use of the most modern management tools in the accomplishment of its objectives. The remarkable evolution of computer design in the last several years has made powerful and sophisticated information processing systems available even to activities of modest means. This report

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\* Refer to Bibliography for reference sources identified by superscript throughout this report.

examines the potential role of computerized MIS at SATCOMA from a management viewpoint, and attempts to describe what would be involved if such a system were to be implemented. The prime objective is to filter the prodigious array of available MIS reference material, and provide the Project Manager with a concise rationale for further MIS studies. No firm recommendation for implementing a computerized MIS is made, for no such conclusion can be justified without a thorough and detailed analysis of requirements. Even if subsequent studies fail to indicate a need for computerized MIS, they will serve the Agency well by identifying weaknesses in the present network of information flows. To quote Albert Einstein,

"The formulation of the problem is often more essential than its solution, which might be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advance in science." }

## 2. The Current Management Information Scheme

### 2.1 The SATCOMA Mission:

As the executive agent for the development and support of tri-service satellite communications ground terminals, SATCOMA receives daily vast quantities of data from a multitude of sources. This data includes test results, user requirements, new development tasks, budget information, contractual data, scientific studies, schedules, and directives. This data

must be routed to the proper staff members, evaluated, processed, reduced, stored, correlated, and combined with other information to provide the Project Manager (PM) with the information he needs to make program decisions. The same information must be routed to subordinate managers and technical personnel to be used in developing information for higher headquarters, users of SATCOM equipment, contractors, and other external agencies and services. All of this seems obvious, but we sometimes overlook the fact that providing information is an implicit part of the Agency's far reaching mission. It is imperative to SATCOMA's reputation as a leader in satellite communications development that all data furnished is timely, accurate, and in the form most useful to the recipient. This task is now accomplished with limited automatic data processing (ADP) support, and most will agree that the SATCOMA information product has been generally satisfactory. However, "satisfactory" will not be good enough in the years ahead, as the Agency's resources are stressed for more information on larger numbers of development efforts with greater accuracy and timeliness. Greater emphasis on development costs, environmental factors, survivability, and detailed testing will require a larger paperwork burden, but it is unlikely that new personnel allocations to support the increased workload will be authorized. As the procurement environment gets more complex, the Project Manager will experience an ever increasing difficulty in assimilating the

data he needs to make key program decisions. It is clear that some assistance will be needed to handle the anticipated information explosion.

## 2.2 Project Management and the Organizational Structure

In order to place internal information flow in perspective, it will be helpful to examine the SATCOM organizational structure as it relates to various development efforts in progress. It is basically a functional organization, with nearly every element playing some role in the acquisition process for a particular item of hardware. Individual responsibility for a given product in each functional element, as well as overall responsibility for the item is not implicit in the organizational structure. Generally, a member of the Engineering Directorate has overall cognizance of a hardware item, and although those immediately concerned with the project know who he is, others in the Agency may not. The Project Manager and other Agency personnel may require a series of time consuming inquiries to determine who in Programs or Test and Evaluation is working on Project XYZ. Aside from wasting time, this situation inevitably results in some critical bit of information bypassing the person who needs it most, perhaps causing a costly error. An obvious solution is the publication of a project personnel roster, but this would be cumbersome because constant updating and distribution would be required. There are so many projects that any given roster issue would probably

be obsolete, and besides the last thing we wish to advocate is another report. The point we are making here is the need for quickly establishing responsibility and accountability for any project in the Agency. A centralized MIS is probably the only effective means for providing this information on a real-time basis. A little psychological serendipity may be a by-product as well, for how often do we fail to ask that question because it was too much of a bother to find out whom to ask?

### 2.3 Information Flow Within the Agency:

A veritable blizzard of paper exchanges hands daily at SATCOMA, followed up by phone calls and a constant stream of "He's not here", "he's on travel", "he's on vacation", etc. It is clear that the Project Manager and key staff personnel have a difficult time keeping each other informed as to what action each is taking on a particular effort. The disposition form (DA 2496) and memo routing slips (SF 41) account for the bulk of internal correspondence. Typically they are drafted, typed, coordinated and distributed to several staff elements.

Invariably someone will wish to add comments or endorsements along the way, and by the time the item reaches the last man in the distribution sequence (probably the one who needs the information the most), the information is obsolete. Telephone coordination has its problems too, and some managers prefer to "get it in writing" in order to establish accountability. As we indicated in paragraph 2.2 above, a centralized MIS can take care of the accountability problem and speed the

distribution of information with time value. In today's fast moving acquisition environment, the time value of information will become nearly as significant as the time value of money. Consider how much time and man-hours of effort are consumed on routine internal correspondence, while external agencies wait for the information they requested. Chances are the information the customer (or higher headquarters) needs is in queue awaiting typing, coordination, or administrative action long before the time it is dispatched from the Agency. It will be shown in paragraph 3 below how a MIS might alleviate this problem.

#### 2.4 Information the PM Needs (But Doesn't Always Get):

The Project Manager must be aware of the current status of all projects in the Agency, and he obtains this information by a variety of means. These include large quantities of written reports, verbal reports, telephone calls, and briefings by his staff. Thus a substantial part of his time is taken up in this updating process. Some of the staff briefings are quite formal, requiring considerable advance preparation, as in the case of "mini" and "maxi" reviews. These are all valuable (and essential at present) management techniques, but they consume much of the PM's time which he might prefer to spend in planning and decision making. Of course we must also consider the time and expense required by the staff to prepare the aforementioned reports, briefings, view-graphs, etc. In spite

of this elaborate process, does the PM get exactly the information he needs? It is likely that considerable redundancy exists in the material presented, so additional time is needed to filter out the desired facts. Since the same information may arise from more than one source, conflicting facts will appear occasionally and require further inquiry. If the PM wishes to manipulate facts and figures to view them from various perspectives, more tedious format changes are needed. We have a management information system, it is true, but it could be more systematic, better organized, and as we shall try to show in this report, it can be automated to a large extent. Above all, we wish to conserve the PM's time, a goal well chosen if we are to agree with the renowned management theorist, Peter Drucker, who states:

"Everything requires time. It is the only truly universal condition. All work takes place in time and uses up time. Yet people take for granted this unique, irreplaceable, and necessary resource. Nothing else, perhaps, distinguishes effective executives as much as their tender loving care of time." 2

### 3. The Benefits of a Centralized Management Information System:

#### 3.1 Accountability for Information:

As we indicated in paragraph 2.3 above, with a manual system, it is difficult to establish accountability for information in the data base. With a computerized MIS, it is feasible to apportion records in the data base among the various functional elements of the Agency so that one and only one individual

actually enters and updates the block of data for which he is responsible. Responsible individuals would be assigned appropriate access codes so that data could not be altered in unauthorized areas, and a permanent record of all updates and who made them can be recorded automatically by the computer. Thus the PM and his staff can quickly determine the source of any information in the data base. Since it is relatively easy to restrict access to the computer for data entry, it may be tempting to restrict those who may view the data as well. Such a restriction, however, would severely limit the value of the entire system. All staff engineers and managers must have access to the data base (for viewing), and if data is considered too sensitive for everyone's eyes, it doesn't belong in the data base. In developing a MIS, we must be cautious to avoid the very same filtration mechanism which makes the present manual communication scheme ineffective.

### 3.2 Focus on Critical Areas:

Information stored in a computerized data base, while it may be quite voluminous, can be highly structured so that any element of any record can be quickly recalled, compared with other data, and displayed exactly in the format desired by the manager. Thus the computer can zero in on and correlate only those data items the manager needs at a given moment. Such information might include:

- A ranking of problem areas by criticality.

- An indication of potential trouble spots.
- Anticipated schedule slippage.
- Cost overruns/underruns.
- A means of determining where management can withdraw.
- Focus on areas going out of control. 5

It might take days of staff work to correlate the data items of critical concern which can be detected and displayed by the MIS in seconds. We all know of cases where the tedium of paper shuffling completely obscured the problem, and the results can be explosive indeed. The manager, especially the PM, can get a new insight into solving the Agency's problems once he has a terse display of critical information at his command.

### 3.3 Streamlining the Information Flow:

Let us assume that all of the Agency's engineers and management personnel have access to the data base via a convenient terminal. Complete information on the status of any project in the Agency can then be displayed on the terminal by keying in the index identifier for the particular data desired. The source of the data is identified as well. The systems engineer will be able to examine the entire spectrum of a project without wasteful inquiries of each participating functional element. Each functional element, in turn, can scan the entire array of projects while concentrating on the aspects pertinent to them. Interfaces between the functional

elements, formerly rather nebulous, suddenly become quite obvious. In order to automate the flow of information, we are forced to carefully define and structure data requirements and organizational relationships. (In fact we may find that the system analysis we employ to design the MIS will significantly improve intra-agency communications even if a computerized MIS is never installed). It may even be desirable to create a "scratch pad" in the data base, where problem areas can be identified for all to see. The PM would find such a file most helpful in directing his attention to the hot-spots. It is easy to see how the project status files just described can cut down on the flow of paper in the Agency. Most important, the MIS will save time for all Agency personnel so that greater resources can be devoted to the important problems of the day.

#### 3.4 Interface With External Agencies:

As we indicated previously, the information which SATCOMA provides to DARCOM, DCA, TRADOC, USACC, and the numerous other agencies with whom we deal, should properly be treated as a significant part of our overall mission. The Agency's reputation is on the line with every report, every phone call, every piece of correspondence to one of our "customers", and therefore it is vitally important that all information furnished is timely, accurate, and consistent. This is the reason for "staffing" most correspondence through the

functional managers for concurrence before it is sent on its way, and we all know what a time-consuming chore this process can be. If we assume that all personnel responsible for entering data in the MIS data base keep the information accurate and up to date, the fear of transmitting misinformation will be greatly diminished, not to mention the staffing bottleneck. Callers will be pleasantly surprised when their inquiries are answered on-the-spot, thanks to a MIS terminal next to a telephone. The MIS can be programmed to generate a wide variety of complete reports directly from information contained in the data base. Such reports can be produced in any format desired, and it is even conceivable that the system might produce transparency (view graph) masters. Regardless of the output media, the PM can be assured of having accurate and consistent facts for his RECAP and other high-level briefings. How can we be sure of accuracy in view of the "garbage in-garbage out" phenomena so prevalent in the computer world? Every element of information in the data base can be traced to an individual who put it there, and with this insurance and professional pride, accuracy should not be a problem.

### 3.5 Time and New Opportunities:

For all of the benefits described for a centralized MIS, time savings is the underlying factor. Albeit a frustrating process, additional funds can usually be found someplace in the

bureaucracy, but time consumed is gone forever. To justify a sophisticated MIS on cost savings would be futile in this report with so many unknowns to be resolved, and yet it is likely that significant cost savings can be demonstrated in subsequent system studies. It is time savings which we wish to emphasize here; time saved from processing stacks of internal correspondence; time saved from searching out sources of information within the Agency; time saved in rearranging the same facts in several different formats to satisfy external requirements. And what shall we do with these additional hours hewn out of the day? We shall perform the role for which the Agency was created, that is, to develop state-of-the-art-ground terminals which are effective, economical, and delivered on schedule. We will have time for creativity, time to get the most out of the lean budgets ahead, and time to keep SATCOMA in its rightful place as a world leader in the art and science of satellite communications.

#### 4. Developing an Effective Management Information System:

##### 4.1 The Objectives of Management:

In the foregoing discussion, we have printed a rather rosey picture of the wonderful things that will transpire at SATCOMA once a computerized MIS is installed. An effective MIS can indeed provide the benefits described and many more. The road to achieving such a system, however, is long and tedious with many pitfalls along the way. It is important to

ask the question right at the outset: What are the objectives of management which would be served by an MIS? Once these objectives are established (and this is not an easy task), they should remain the driving force throughout the system analysis, justification, design, and acquisition of the MIS. The system should facilitate the accomplishment of objectives, prevent failure to reach objectives, and correct conditions which hamper the fulfillment of objectives.<sup>1</sup> This being the case, it is management who must define the need for the system and play a major role in its development. Unless the manager participates in its development, the MIS tends to evolve into a toy of the systems analyst or computer expert, either of whom would be more than delighted to define everything from requirements to outputs. In pondering his objectives for MIS and trying to decide if MIS is really needed, the manager would do well to consider the following assumptions which frequently lead to deficient systems:

- Most managers operate with a critical deficiency of relevant information.
- The manager needs the information he wants.
- Organizational performance improves by better communication between managers.
- If a manager has the information he needs, his decision making will improve.
- A manager must understand only how to use a MIS, not how it works.<sup>20</sup>

In those five points, there is food for hours of philosophical discussion, which might be heartily recommended to the managers as they define system requirements. The benefits envisioned in paragraph 3 should be regarded as suggestions for system definition; it is the manager's conception of the system which will determine its success.

#### 4.2 The System Study:

Regardless of the manager's preliminary thoughts concerning MIS, whether pro or con, it would still be highly beneficial to proceed with a system study at SATCOMA. Such a study could be conducted by an external agency or commercial firm, but certainly there is sufficient talent in the Agency to make this an in-house effort. Some experts feel the study is best conducted by outsiders who will have an unbiased perception of the Agency's activities, but it seems considerably more important that the analyst have an intimate knowledge of the Agency. The system study will examine in detail the present management information inputs, outputs, intra-Agency processing, internal memos, and the flows of information throughout the organization. The analyst will interview directorate, division, and branch chiefs as well as other potential MIS users to determine what information each needs. These needs will then be examined to determine the extent to which the present system provides the required information when and where it is needed. For the sake of economy, it would

probably be a good idea to limit the scope of the study, perhaps to only those activities directly connected with the equipment acquisition process.

To be successful, the system study requires the full support and participation of the Project Manager and key managers in the Agency. Whatever the outcome, these are the ones who will benefit the most by a good study; conversely, a shallow study or a study which is based on less than candid assessment of information needs can produce disastrous consequences if used as a basis for a computerized system. When completed, the study report should clearly define the shortfalls in the intra-Agency communications process. Even if no computerized system is subsequently installed, the study can lead to substantial improvements in the efficiency and effectiveness of information flows. Hopefully, however, the system study will become the key requirements document necessary for the justification, design, and acquisition of a computerized MIS.

#### 4.3 Criteria for an Effective MIS:

Assuming the system study indicates a requirement for a computerized MIS at SATCOMA, we should now look to the design of the system. We have a reasonably good idea of what we want the MIS to do for us, but before we get down to the nuts-and-bolts of design, we should examine those factors which make the systems successful. Literally thousands of MIS installations in government and industry have yielded a small army of

authors with publications describing the pitfalls of MIS design. The following is a reasonable synopsis of their findings on how to achieve a well designed system:

- Keep outputs brief and simple.
- Concentrate on results and goals instead of methods and processes.
- Suppress trivial or irrelevant data.
- Insure that output formats are usable without translation.
- Define needs thoroughly.
- Consider functional relationships in the organization.
- Plan for the future.
- Above all, keep the Agency mission and goals foremost. 1, 20

These are simple and straight-forward principles, and yet there are numerous examples of MIS which failed because one or more of these criteria were ignored in the design.

#### 4.4. The Human Factors:

The MIS is not merely a collection of data processing machines and a vast array of facts stored away in a data base. The "system" includes the people that use it and the people that make it work. Thus the human element is probably the most critical factor in the design. It is common for many managers to strongly resist MIS for a variety of reasons, and since the very same managers will be instrumental in defining the system, conflicts frequently arise. Argyris, the noted author

and management consultant, sums up the problem nicely:

"Management will exhibit certain forms of emotional reaction when faced with MIS, namely: (a) diminished feelings of essentiality; (b) limited freedom; (c) psychological failure; and (d) decreased executive power. MIS specialists cannot yet deal with the emotional problems caused by the impact of MIS and they generally react 'overrationally', which is an emotional response. They have difficulty coping with their own and the executives' feelings and behavior." 10

The MIS proponent is likely to oversell the system, and then when it fails to live up to all the glowing expectations, it is regarded as a total failure by the managers. The point we wish to emphasize here is the need for both the MIS designer and the manager to recognize these very normal psychological responses and consider them in their plans. The people putting together the MIS must never forget that they and the system they are creating serve no other role but to aid the manager. As a matter of fact, it may be prudent for the MIS proponent to deliberately undersell the system and give it time to be successful and accepted.

#### 4.5 The Data Base:

The data base is simply the sum total of the information stored in the MIS. In the present manual system, it consists of the collection of files, reports, books, and documents found in numerous repositories throughout the Agency. Naturally we can put only a small fraction of this information in a computerized data base. The system study, however, should

lead to the definition of certain categories of information which have considerable time value, are changing constantly, and are required frequently by the PM and his staff. This is the kind of information we want in our data base. Let us assume that the principal role desired for our MIS is the maintenance of key status information on each of the equipment development efforts. The PM may wish to include the following data on each program:

- Schedule (possibly a PERT network).
- Key project personnel (action officers), in-house and external.
- Budget status.
- Identification/location of key documents.
- Work breakdown structure.
- Problem area summary.
- Summary of contractual terms.
- Summary of test results.
- Status of current reports and correspondence.
- Work measurement summary.
- Logistics support analysis items.
- Configuration management data (ECP's, for example).
- Deployment data.
- Summary of equipment characteristics.
- Interface information.

Whatever elements of information are chosen, the displays

should be compact. If the manager must sequence through frame after frame looking for the information he needs, he might as well not have an automated system.

Displays and reports generated by the MIS need not be confined to a single program, however. The system can correlate information relating to the whole spectrum or any desired combination of programs. For example, an overall Agency budget status report can be produced, with the MIS correlating the necessary data from each area. The PM may want display of just the problem areas listed in order of criticality, or he may want a report of those programs which have exceeded established budget, schedule, or performance thresholds. Thus data will be continually updated and entered in the data base from any number of locations (depending on the number of terminals in the system), and each element can be traced to its source. The information is manipulated and displayed in any format desired by the manager, or it can be converted to hardcopy for external reports.

The project status reporting role postulated for MIS at SATCOMA should be sufficient reason for proceeding with further feasibility investigations. There are a variety of other information categories, however, which might also be included in the data base. Each category is worthy of an

explanation, but this is far beyond the scope of this report. A listing of these possibilities, however, is provided in Appendix A.

#### 4.6 Imposition of MIS on the Organizational Structure:

Once the contents of the data base are decided upon, organizational responsibility for each category of information must be fixed. We cannot have more than one organizational element trying to update the same data item. Figure 1 shows how responsibility might typically be allocated, and of course, a further breakdown to division level may be appropriate. This illustration does not necessarily represent the best responsibility division, but is intended to show how a matrix technique might be used to assist in organizing the data base. Ideally the PM, technical director, each directorate and division chief should have their own terminal for access to the system. If this is not economically feasible, it is suggested that one terminal per directorate would be adequate initially. The terminals should be located in convenient proximity to the manager's offices, but they must also be accessible to staff personnel. Most management oriented individuals are reluctant to sit in front of a keyboard because they feel this is somehow demeaning. Managers must learn to overcome this somewhat outdated tendency, for the MIS requires direct manager involvement to be effective. The more data that the manager is willing to read directly from a

One Possible Subdivision of the  
SATCOMA Data Base

		PROJECTS →		
		AN/TSC-86	AN/FSC-78	GPS
ORGANIZATIONAL ELEMENTS	Engineering	Studies Equipment Characteristics		
	Programs	Budget Schedule Cost Analysis Contracts WBS		
	Test & Evaluation	Test Data Satellite Status Test Resources		
	Mission Support	Deployment Data Operational Status Supply Records		
	Development Operations	In-house Test Data Test Equipment Status		
	Systems Development	Interface Data Configuration Management		
	Production Engr/Product Assurance	RAT Data Parts Lists Production Drawing Index		
	Administration	Work Measurement Correspondence Documents Personnel Visitor Control		

Figure 1

display screen, the less paper needs to be handled, and this after all is what we are striving for. Figure 2 shows one possible MIS configuration which might serve SATCOMA's needs. Of course the number of possible combinations of equipment is almost limitless.

#### 4.7 System Acquisition Alternatives:

Defining the requirements for MIS and developing the data base organization are probably the biggest hurdles in achieving a successful MIS. Coming up with the hardware/software package to do the job is also a rather formidable task. There are many alternatives to choose from and many paths to a successful system. Cost is by far the biggest factor, and methodical cost/benefit tradeoffs must be made for each possibility. The relative availability of various equipment and data processing services must also be considered. The voluminous array of regulations, directives, and policy restrictions on MIS, a source of frustration to both the manager and system designer, will be covered in detail in paragraph 5 below. Meanwhile we will look at some alternatives which might be available at SATCOMA. These approaches must be evaluated in terms of cost, benefit, and availability, a task far beyond the scope of this paper. Let it suffice for our purposes to briefly describe each alternative and cite some obvious pros and cons.

- a. We can buy or lease a complete hardware/software

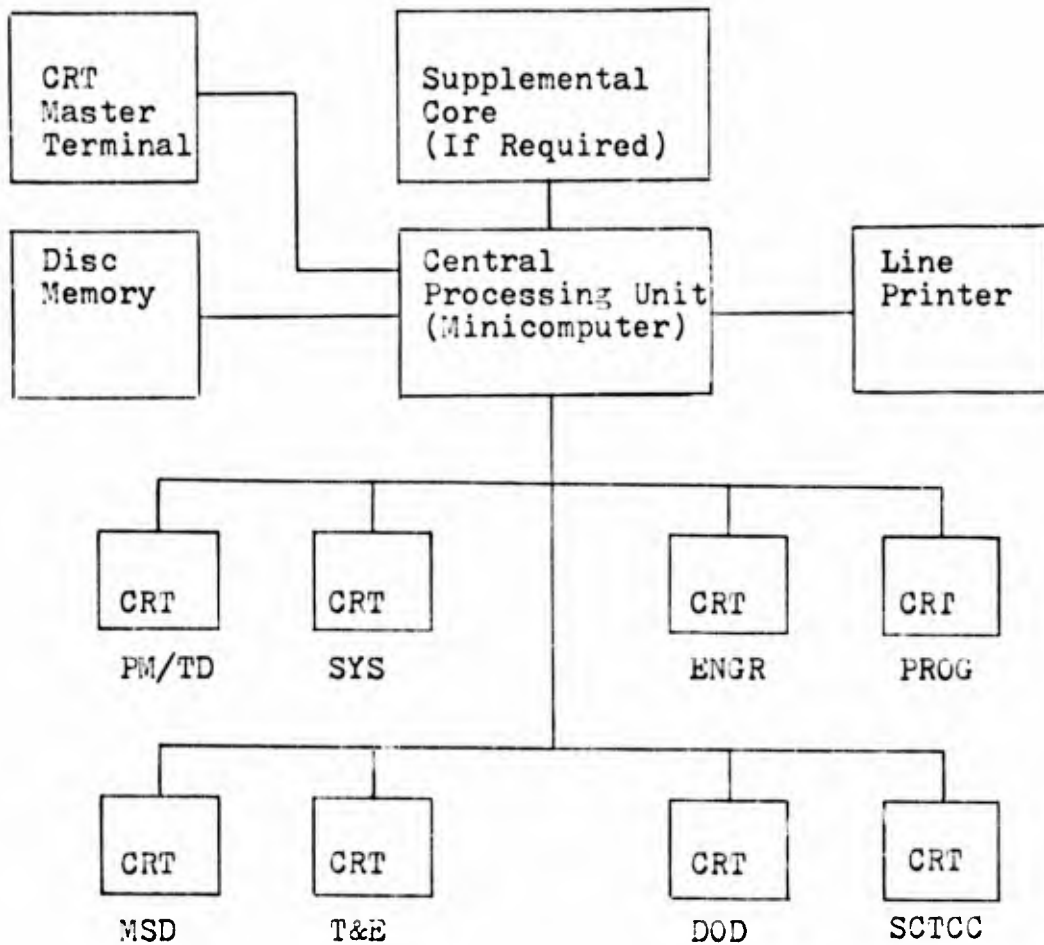


Figure 2

One Possible MIS Configuration for SATCOMA

package from a single commercial vendor. Such a system can be tailored exactly to SATCOMA's needs and there will be no hardware/software compatibility problem. This is an expensive approach, and will require the long process of justification and approval from higher headquarters.

b. We can contract for a GSA-authorized commercial time-sharing service. This approach is very flexible and avoids the problems of computer ownership. It is costly, however, and still requires an extensive approval cycle.

c. SATCOMA might connect its MIS terminals to an existing government computing facility such as that located at Electronics Command. This would be contingent upon the capacity of such facilities to handle the additional load, and the willingness of the operating agency to accept SATCOMA as a subscriber. Considerable funding would also be necessary to support computer usage for the MIS we have postulated.

d. A MIS can be assembled from a variety of in-house resources which include the Honeywell 316 computer used with the Data Acquisition Facility and the Hewlett Packard 2100 computer used with the HP-8580 automatic spectrum analyzer. This may be a less costly approach, but there are several obvious disadvantages:

- The 316 is old and of limited capacity.
- The HP 2100 would have to be taken off line when needed for a test mission.

- The purchase and integration of necessary peripheral equipment would be a formidable task.
- Considerable software development would be needed.

e. A rudimentary MIS can be assembled in-house from microprocessor components. These devices are rivaling the minicomputer in capability with costs an order of magnitude lower. It may be possible to assemble a workable system with a total cost which is low enough to be exempt from provisions of the MIS regulations. Such an approach would require considerable time, expertise, and software development, however.

#### 4.8 MIS Tasks and Expenses:

There are so many factors to consider in making MIS cost/benefit studies that one or more may be overlooked. The following list of tasks and expenses involved in MIS design and operation is included here as a checklist for the manager and systems developer. Note that not all of these items are applicable to every system.

- Establishing data elements, codes, file formats.
- Designing data base contents, characteristics.
- Selecting languages.
- Establishing output formats.
- Designing the reporting system.
- Controlling the dissemination of reports.

- Establishing data base in machine processible form.
- Formulating/defining problem.
- Designing the MIS.
- Designing the required computer system.
- Actual coding and programming.
- Selecting equipment.
- Preparing site for equipment.
- Selecting and training operating personnel.
- Developing a control system for the using organization.
- Developing a standard operating and cost control system.
- Actual operating costs (electrical, materials, paper).
- Equipment costs (rented or ammortization of purchase).
- Personnel costs of programmers and operators.
- Direct cost of de-bugging.
- Direct cost of compilation.
- Space costs. <sup>8</sup>

## 5. The Impact of Current Regulations and Directives:

### 5.1 Background:

We have summarized the steps in the development of a computerized MIS, drawing heavily from many examples of commercial experience. Department of Defense agencies, however, must comply with numerous regulations and go through a lengthy process of justification and approvals for system acquisition.

Many of the existing policies and regulations were promulgated before low cost minicomputer-based MIS equipment was available, but progress is being made in updating Army regulations. Throughout the federal government, officials are concerned about the proliferation of computers and computer systems, and justifiably so. For many years, computer resources were poorly managed, and this abuse was the driving force behind the current array of strict controls on computer usage. These hurdles are not insurmountable, however, and they should not hinder SATCOMA in its efforts to develop an effective MIS.

#### 5.2 Regulatory Authorities:

Responsibility for the management, acquisition, and utilization of federal government Automatic Data Processing (ADP) systems is given to the General Services Administration (GSA) by Public Law 89-306 (Brooks Bill). The GSA has established federal ADP policies in Federal Management Circular 74-5, Management, Acquisition, and Utilization of Automatic Data Processing, dated 30 July 1974. DOD and Army regulations and policies comply with this GSA document. The Director of Management Information Systems, Office of the Chief of Staff, Department of the Army, is responsible for the determination of overall objectives, requirements, specification review and evaluation, system integration, and approval of Army MIS. The U. S. Army Computer Systems Support and Evaluation Agency (USACSSA), under the provisions of AR 10-8, serves as the

technical arm of the Director, MIS, and provides technical support services to the Army Staff and major commands. <sup>18</sup>

The developers of MIS at SATCOMA should consult with USACSSEA to insure that their system meets all applicable GSA, DOD, and Army directives. USACSSEA can also provide considerable technical help in avoiding some of the MIS pitfalls described in this report. <sup>24</sup>

### 5.3 Army Regulation 18-1:

AR 18-1, Management Information Systems: Policies, Objectives, and Responsibilities, <sup>16</sup> is the principal Army MIS guidance document. This regulation applies to ADP equipment, services, software, performance evaluation, and maintenance services. It spells out in great detail the procedures for acquiring a MIS, and will no doubt be the most important document for SATCOMA MIS planners. AR 18-1 was reissued on 22 March 1976 with some significant changes over previous editions. <sup>23</sup> Of primary interest to SATCOMA are the new higher dollar thresholds for which the U. S. Army Development and Readiness Command (DARCOM) has been delegated ADP acquisition approval authority. DARCOM can now approve the acquisition of a computer (CPU) which does not exceed \$50K in purchase cost or annual lease. DARCOM can approve peripheral equipment acquisitions which do not exceed \$500K purchase cost (or \$200K annual lease) and software acquisitions up to \$50K. <sup>24</sup> This essentially eliminates the need for direct Department of the

Army approval for most minicomputer-based systems, a change which the SATCOMA MIS planner should find welcome indeed.

#### 5.4 Other Regulations:

The Army MIS Master Plan <sup>18</sup> requires six pages simply to list all of the regulations and directives applicable to MIS. It is recommended that the Master Plan be used as guidance for placing this multitude of documents in their proper perspective. Some of these will apply to SATCOMA, but many will not. Next to AR 18-1, perhaps the most important regulation for our purposes is AR 235-5, Management of Resources: Commercial and Industrial Type Functions. <sup>17</sup> AR 235-5 establishes provisions for new starts and regulates whether ADP requirements will be satisfied in-house by an Army agency or by a government contractor. The provisions of AR 235-5 must be examined for applicability before proceeding with any Army MIS project.

### 6. Evolution of the System:

#### 6.1 Design for Growth:

Both the manager and the MIS designer must constantly look to the future when planning today's system. The organizational structure of SATCOMA, its mission, the external support it receives, and the nature of satellite communications technology are all subject to change. The MIS must be designed to resist "future shock" with built-in flexibility and growth potential. This means that hardware and software must be carefully chosen to allow incremental upgrades of portions of the system as

needed. The data base should be sufficiently flexible to accommodate future expansion and organizational changes without a complete redesign. No matter how carefully the system hardware/software is chosen, however, a cheaper and better system will be on the market by the time the MIS is installed and operational. This is the nature of computer technology evolution, but if we keep waiting for the ultimate system to come along, a MIS will never be installed. The manager must therefore examine current needs and anticipated future needs for management information; when today's MIS technology is affordable and provides the required capability, it would be best to buy the system today. The cost of ineffective information handling is compounded daily while the decision to invest in MIS is pending.

#### 6.2 Avoiding the Toy Syndrome:

Once the trials and tribulations of bringing the MIS on line are passed and the users are happy with the product, the MIS operators will probably encounter a flood of suggestions for improving or modifying the system. Like children with a new toy, users will come up with endless new "games" for the system to play. It is important that a firm SOP be established for the operating MIS to regulate its modification and growth. Changes should be approved only by the PM, and after a consensus of the key staff members verifies that such a change will be beneficial. Uncontrolled growth can turn an orderly

efficient MIS into a ponderous octopus which fails to satisfy any of the user's requirements. Computer capacity is finite, and the system should not accommodate "nice-to-have" schemes which dilute overall performance.

7. Conclusions:

There can be little argument that a well designed MIS can be of immense benefit to SATCOMA. Further cost/benefit analysis will be necessary to establish the feasibility of such a system, and funds for such investments will be scarce. Nevertheless, the author feels that sooner or later, a computerized MIS must become a reality at SATCOMA. The continually increasing complexities of project management will be the forcing function, but the fringe benefits which accrue will ensure a future of advancement and accomplishment at SATCOMA. MIS is a visionary tool continually opening new opportunities and horizons. When put to use by capable managers, MIS generates the insight that is the chief ingredient of progress.

## APPENDIX A

### OTHER POTENTIAL MIS APPLICATIONS AT SATCOMA

1. Satellite status - location, condition, look angle
2. Site coordinates - location of all SATCOMA terminals
3. Test access authorization schedule - time, frequency, bandwidth
4. TDY/Travel - location of personnel
5. Status of suspense items
6. Index of in-house reference publications
7. Equipment nomenclature index
8. Supply/property records - hand receipts, serial numbers
9. Frequency compatibility analysis programs
10. Classified documents register
11. Leave/vacation schedules
12. Work measurement
13. Visitor control
14. Job vacancies
15. Calendar of meetings, briefings, conferences
16. Training information/records
17. Historical files
18. Logistics Support Analysis (LSA), formal implementation
19. TWX message preparation and formatting
20. Remote terminals for access from TDY locations
21. Tie-in with other MIS systems
22. Multi-incentive contract analysis

## BIBLIOGRAPHY

### Books

1. Coleman, R.J., and Riley, M.J.; MIS: Management Dimensions, Hayden-Day, Inc., 1973.
2. Drucker, Peter F.; The Effective Executive, Harper & Row, 1967.
3. Einstein, Albert; The Evolution of Physics, Simon & Shuster, 1961.
4. Head, Robert V.; Manager's Guide to Management Information Systems, Prentice-Hall, 1972.
5. Kelly, Joseph F.; Computerized Management Information Systems, Macmillan, 1970.
6. Li, David H.; Design and Management of Information Systems, Science Research Associates, Inc., 1972.
7. Lyon, John K.; An Introduction to Data Base Design, Wiley, 1971.
8. Martino, R.L.; Information Management: The Dynamics of MIS, McGraw-Hill, 1968.
9. Jones, McKeever M.; Management Reporting Systems, Wiley-Interscience, 1971.

### Periodicals

10. Argyris, C.; "Management Information Systems: The Challenge to Rationality and Emotionality," Management Science, Vol. 17, 1971.
11. Brown, W.F., et. al.; "Planning for the Future Computer Complex," Computer Decisions, January 1970.
12. Farwell, Richard; "Operating Systems: The Key to Mini-Computer Systems," EE/Systems Engineering Today, August 1973.
13. Flynn, Robert L.; "A Brief History of Data Base Management," Datamation, August 1974.
14. Maier, Robert J.; "Glossary of Information Retrieval Terminology," IEEE Transactions on ENS, September, 1970.

15. McIntosh, Stuart, and Guffel, David; "Data Management for a Penny a Byte," Computer Decisions, May 1973.

#### Government Publications

16. Army Regulation 18-1, Management Information Systems: Policies, Objectives, and Responsibilities, March 1976.
17. Army Regulation 235-5, Management of Resources: Commercial and Industrial Type Functions.
18. Army Management Information System Master Plan, 1976; Director of MIS, Office of the Chief of Staff, Department of the Army.
19. AD-A009-647, A Study of Critical Factors in Management Information Systems for U.S. Air Force; Colorado University, for the USAF Office of Scientific Research, 31 March 1975.
20. AD-781-749, Technical Literature Review Concerning Management Information Systems, Texas University, for USAF Human Resources Laboratory, May 1974.
21. GSA FPMR 11.5, Records Management Handbook: Source Data Automation, GSA National Archives and Records Service, 1965.
22. LMI Task 69-28, Introduction to Military Program Management, Logistics Management Institute, for Defense Systems Management School.

#### Interviews

23. Arntson, Jack; Deputy Director, Management Information Systems, U.S. Army Development and Readiness Command.
24. Holleran, Owen; Office of the Director of Management Information Systems, Headquarters, Department of the Army.