

NOAA Administrative Information Systems -- An Evolutionary Strategy

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MBO: Determine the feasibility of mounting a special agency-wide effort to improve NOAA management information, data handling, and communications capabilities within the present budget climate and, if feasible, proceed with the development of a specific action plan.

This paper proposes an evolutionary strategy designed to respond to user need, recognize the rapid change in technological opportunity, and to give special emphasis to the needs of senior levels of NOAA management. It will provide the basic framework within which a specific action plan may develop.

The recommendations are individually modest but together signal the beginning of a program to guide NOAA through a period of significant administrative change.

This report was prepared in response to a NOAA MBO assigned for action to the MB Office of Information and Management Services (MB/IMS)

Note:

The term "information systems" is used in this paper to mean the combined technologies of traditional data processing systems, office automation, and administrative telecommunications; it should be viewed as incorporating both management and administrative information systems.

The term "office automation" is used to mean the automation of office tasks including, for example, document preparation, word processing, filing, maintaining calendars and schedules, mail and distribution, and business calculation.

NOAA ADMINISTRATIVE INFORMATION SYSTEMS
---AN EVOLUTIONARY STRATEGY

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I. Executive Summary

NOAA is intensely involved in myriad actions to improve data handling, communications, and information systems. The skills, interest, and funds to invest in up-to-date facilities are all present; progress is being made. NOAA however, lacks an organized, unified program to realize the full potential of the new information technologies. NOAA needs to establish organizational preparedness and to create capabilities which will over time permit us to make fundamental improvements in the agency's mode of doing business.

Individually, the recommendations made here are modest; taken together they mark the beginning of a major program to guide NOAA through a period of challenging and important change. The recommendations central to this new direction are:

- The confirmation of an information systems "umbrella" incorporating data processing, office automation, and related telecommunications.
- The establishment of a top level policy committee to set NOAA's information systems direction.
- Establishing a new organizational focus within IMS which places all administrative information system responsibility under single management.
- Forming a new unit within IMS designed principally to support NOAA managers in accessing and processing information.
- Installing a formal planning process to identify the information and support requirements of NOAA management and to propose developments to meet those needs.

- Inaugurating a NOAA-wide office automation program to work in support of the information systems plan and prepare us to exploit office automation technologies.
- Creating a substantial incentive fund to give substance to the direction and plans set for information systems and to encourage development within a common NOAA framework.

These proposals form an evolutionary strategy intended to improve corporate information and data flow and to facilitate work at the operating level. The recommendations are based on statements or requirements obtained through interviews with NOAA managers, analyses of available organizational resources, a literature survey of trends in the information systems industry, and consulting support to identify an appropriate response. A prerequisite to success in implementating the improvements recommended is a strong, explicit top management endorsement of the general strategy outlined in this report and recognition of the need for a specific information systems plan to channel future systems investment.

A. In greater detail, the long-range information systems program recommends that NOAA:

1. Establish an Information Systems Policy Committee to set direction and frame policies, to offer guidance on the development of the information systems plan, and to identify issues requiring resolution by the Office of the Administrator.

2. Direct MB/IMS to develop an information system plan, including:

- Specific policies regarding information systems responsibilities;
- Information requirements and development priorities;
- A framework for NOAA information needs;
- Systems architecture;
- Staff, equipment, software and other resource requirements.

The initial plan will be submitted for Policy Committee recommendation and forwarded for the NOAA Administrator's review and approval in December of 1982 and updated annually thereafter.

3. Establish an Office Automation Project Team to pool available expertise, develop a plan for the future of NOAA office automation development, share best practice, develop prototypes, and assist in systems selection and installation.

4. Reorganize MB/IMS to focus resources on administrative information systems priorities and to enlist cooperative participation of MLC systems staff.

5. Designate up to \$0.5 million of funds as an AIS Incentive Fund to be managed by MB/IMS, subject to the guidance of the Policy Committee, to:

- Acquire communications resources,
- Encourage acquisition of compatible equipment,
- Permit equipment upgrades to meet standards,
- Acquire prototype equipment and software,
- Assist in meeting initial start up expenses,
- Obtain contractor assistance with planning or prototyping.

B. Recommended actions in response to short-term needs:

1. Continue with equipment acquisition to extend communicating word processing to key NOAA Offices.
2. Establish a single interim communications network to handle inter-office word processing traffic.
3. Extend the use of existing interactive administrative data systems (FIMA and personnel).
4. Review the Controlled Correspondence System and revise if necessary.

II. Introduction: The Challenge of the New Information Technologies.

The intersection of pressing administrative need and technical opportunity have brought to the process of management two periods of revolutionary change.

The first began at NOAA in the 1960's when a necessary centralization of resources permitted us to begin the development of administrative data systems. This change brought major new tools to management. In the process, however, program managers lost a significant part of their ability to control or change the procedures of their own organizations; they became dependent upon the new data processing service, which was struggling with a challenging new technology, and which could not always be responsive to the desired degree. Even if need and technology were relatively stable, there would be a great deal of work still required in this "traditional" NOAA data processing to further exploit the best it has to offer... but such stability is not present! New requirements and the opportunities and challenges of 1980 now cause us to focus on a new set of information technologies.

The second major change, overlapping the first, began quietly at NOAA in the 1970's. "Word processing" emerged, a few mini and micro computers were applied to administrative needs and increasing amounts of administrative data moved over telephone communications channels. We did not recognize at the outset that this process would impose upon us new and dramatic changes. We are now clearly offered great promise of increased productivity and of the return to line managers of much of that control over resources and processes lost in the earlier growth of centralized data processing. On the other side of the same coin are the seeds of significant

on-the-job behavioral change for those in the NOAA administrative structure; such changes may be particularly difficult to accommodate.

NOAA has a good start into this second revolution in information systems but has not yet established a formal program to control the direction it takes. The process is inevitable and made possible and encouraged by developments in electronic technology and systems understanding.

This period of change will be characterized by:

- ° Increasing dependence on data processing systems,
- ° A rapid growth in office automation systems,
- ° Increased end user responsibility for information systems,
- ° Major improvements in administrative telecommunications.

This process of change seems to have come "just in the nick of time;" large organizations (and certainly the Federal Government and NOAA) are experiencing major problems and pressures to which the new information technologies seem to respond. Demands for accountability and responsiveness continue to grow, but the resources to meet them are shrinking; the limits on positions and dollars which have developed in recent years appear here to stay; the need for productivity improvement is urgent, particularly in the process of management and administration, and recent experience suggests that we have been only barely able to keep up with the new requirements of the bureaucracy.

These needs are compelling and the new information technologies are seductive in the promises they contain. What's more, it seems certain that we will have one or another version of "the office of the future," as it is sometimes called, and well within the working lives of most in the 1982 work force. Unfortunately, as with all changes of major significance

this one contains major obstacles which can not be avoided by doing nothing while we wait for greater clarity and understanding to develop.

Do something we must! but just what is it when such great uncertainties exist about the evolution of technology and when the other ingredient ... systems understanding, lags well behind the availability of equipment and component applications. That's what this paper is about. The steps proposed here respond to obvious current need and establish incentives for sharing and mutual support while encouraging increased information systems responsibility among end users. The proposal deals with planning and the incorporation of existing activities under a new information systems umbrella which recognizes essential mutual relationships. A critical component of the recommendations deals with organizational preparedness and management focus.

The initial steps are small, conventional, and clearly needed. When taken together, however, these modest recommendations signal an undertaking of extraordinary consequence. The acceptance of the proposals will mark the beginning of a program to guide NOAA through a major and fundamental change in the methods of administration and in the tools and workday lives of office employees. A meaningful commitment of top management support must accompany acceptance of these proposals with the expectation of ongoing involvement and future resource commitment. Within the NOAA information systems organization, a new management focus is essential.

III. An Evolutionary Strategy

A. Philosophy

NOAA's response to the new information technologies and the improvement of administrative information systems must be need based and evolutionary. Neither we nor the industry supplying component resources are prepared to describe late 1980's tools in full detail. It is essential that we maintain the flexibility to respond to ongoing rapid changes in both user need and technology.

While details will change, we can describe in general terms, the kind of environment which would be productive and desirable for NOAA at the end of the decade. Even as this objective environment changes in detail, it will provide us with consistent and appropriate direction. The steps taken now should move us toward this objective environment. A preliminary description of this environment appears in Section IV following.

The program we establish must provide incentives, opportunity and where necessary, standards for sharing, compatibility, interconnection and integration. (Examples of areas where standards may be necessary include definitions of common data, procedures to insure data security and integrity, and common communication protocols.)

NOAA should support the increase in information systems responsibility of the line managers who are system end-users. This will imply changes in the nature of the central information systems organizations which must focus on both the provision and support of end-user tools, and on the maintenance of NOAA-wide core data bases and systems.

If we are to move productively to exploit the new information technologies, there are several imperatives. We must increase our focus on management and administrative systems which have thus far received less attention

than and lagged behind NOAA's scientific systems. In increasing this focus, one objective will be the establishment of organizational preparedness to support the end-of-the-decade environment. Finally, we must incorporate under a single information systems umbrella, three major technologies: data processing, office automation (including word processing), and administrative telecommunications; it is in the integration of the three that major productivity opportunities are found.

B. Prerequisites

A new management focus on information systems is a critical factor if the proposals made here are to succeed. This focus must be actively promoted by the Administrator's office, the information systems organization, and the NOAA management hierarchy. Some explicit steps can be taken to initiate such focus but, to become fully effective, it will require ongoing attention and nurturing.

The Administrator's office must play the key role in establishing the focus. Only this office can confirm the "umbrella" which recognizes that data processing, office automation, and administrative telecommunications are components of the appropriate 1980's view of information systems. It must assign and make clear the responsibilities for guiding NOAA's programs for the new information technologies, including responsibilities in the Administrator's office, those of a policy committee, those of IMS and those which must be accepted by line managers throughout NOAA. As programs are established for office automation and information planning, the Administrator must make clear that these are NOAA-wide programs in which effective participation is required.

C. Recommended Actions

The actions to begin implementing the strategy proposed here are presented in two groups.

The first and most significant group proposes several actions with long range importance which are intended to better prepare NOAA to respond to the new information technologies. All reflect the special concern for the information (and support) needs of senior managers. These actions are or can be independent of each other; we recommend strongly however, the acceptance of the entire group which forms a comprehensive NOAA information systems response.

The second group in Part D of this section of the report contains actions which respond to short-term needs expressed repeatedly in the interviews made in preparation for the report. Some activity is underway on two of them, and all are consistent with the more general proposals of the first group.

ACTIONS TO ESTABLISH A LONG TERM INFORMATION SYSTEMS PROGRAM:

Action 1 - Establish an Information Systems Policy Committee (ISPC)

An Information Systems Policy Committee should be chartered by the Administrator to consider major issues of direction, policy, planning and priority. The committee should be an active group; its members should be knowledgeable about operational requirements and sufficiently senior to direct resources and obtain the commitment of their organizations. The committee should be comprised of Deputy Assistant Administrators, chaired by MB, and provided with technical staff support by MB/IMS. The committee should report annually and as needed on the status of the AIS program to the Administrator and other senior NOAA Officials. It should propose appropriate NOAA-wide information systems policy to the Administrator's Office. During the early formative period of the committee it will be important to discuss and understand the relationships between the policy

and planning roles of the committee, those of the NOAA Administrator's Office, and the operational and management responsibilities of MB/IMS.

The committee will serve as the review and confirmation group for the work products of the information systems planning process. Those products include specifically; office automation plans, administrative telecommunications plans and plans for major data processing systems development. In this later context the committee will consider and establish priorities for major development projects. The committee will forward plans with comments and recommendations to the Administrator's Office. These plans and priorities will serve as a guide to IMS in the formulation of short range work plans and in the scheduling of implementation activities. While the Information Systems Plan is intended principally to document the direction of NOAA systems and provide a framework for implementation activity, it will also provide information appropriate to the existing NOAA and Commerce Long Range ADP planning process.

The committee will work to assure broad commitment throughout NOAA to the implementation of plans and will work to facilitate the active line management participation which is required for success. It will encourage the development of data systems, office automation and administrative telecommunications within a common information systems framework. The committee will review policies proposed by IMS and others and will initiate policy proposals which will support the NOAA administrative information systems program. It will discuss and establish the appropriate balance between NOAA-wide and local information systems activity and will work to identify the appropriate common interest in local, decentralized or distributed systems.

Action 2: Administrative Information Systems Planning

It is proposed that MB/IMS develop a formal information systems planning process dealing specifically with administrative systems. The planning process requires a decision concerning methodology for the information requirements planning. A second issue concerns a schedule which will relate appropriately to other planning activities. IMS should offer proposals on these two topics for review and approval by the Information Systems Policy Committee. It is likely that formal information requirements planning will be sufficiently time consuming that it will not be used to formulate a December 1982 plan.

The Information Systems Plan should address the following topics:

1. Specific policies governing information systems responsibilities and addressing issues of data administration, security, storage and communications;
2. The information and support requirements of NOAA management;
3. The systems development priorities which will address the information requirements;
4. The information systems architecture which should guide new system development;
5. The requirements for staff, equipment, software, and other resources;
6. The impact of office automation on the worker and identification of the behavioral issues involved;
7. A conceptual data base design to provide a framework for meeting NOAA information needs.

The initial plan will be provided to the Information Systems Policy Committee for review and recommendation and will be forwarded in December of 1982 to the Administrator's Office for final approval.

The initial plan in December of 1982 will be a beginning, and will not be comprehensive in all seven areas above. A long term commitment to successive annual updates is essential to obtaining the maximum benefit. The plan must include an assessment of systems developed by user organizations and incorporate the most useful of them. These systems fulfill a vital role for several user organizations and the planners must determine a way to incorporate them with the least disruption feasible.

While the plan must consider all NOAA information and support needs, including those for office automation, three specific areas must be covered without fail in the initial plan: financial systems, personnel systems, and telecommunications. The proposal for a NOAA Management Information Systems (NMIS) program offered by MB at the February 1982 Program Review is a base from which to proceed. The difficulty of planning for information needs should not be underestimated. The process has proven difficult for all who have undertaken it; in addition, the agency faces a changing environment on several fronts. NOAA is being reorganized. At the DOC level, actions are underway to consolidate certain systems and to intensify review and approval procedures for others. The basic unit of accounting for personnel is changing. A major restructuring of the budget is contemplated. Furthermore, the systems supporting administrative process are absolutely critical to NOAA's operation; one cannot be imprecise or casual in addressing planning in this field. An inventory of relevant "cuff systems," office automation equipment, contracted services, and telecommunications services should be made to use as a basis for estimating resources required and to be used to determine questions of compatibility .

NOAA has in place a relatively large number of basic administrative data processing systems. They process, for example, personnel actions and

payroll, purchases and expenditures and record and report them by time period and organizational unit. They are fundamental and we could not do business without them. At the same time, they are generally old systems which have been maintained and modified through the years and which are in need of redesign to meet new needs. They are often viewed as being too far behind in the reporting of transactions for day-to-day management use and they do not incorporate some of the data which would be needed for this purpose. They also require technological upgrading so that they may be more readily maintained and offer the more responsive, productive services available from on-line, data base structured systems.

One result of current system shortcomings is their relegation to the status of the monthly bank statement against which managers must reconcile. For their management purposes "desk drawer" or "cuff" systems are often used and required. The maintenance of these multiple and duplicate systems (some of them computerized) is costly, the reconciliation process is annoying, and the adjustments needed for data delayed somewhere in the processing pipeline is extremely frustrating. The tasks ahead for NOAA include therefore both the upgrading of basic systems and the provision of capabilities and specifically designed systems to meet management needs for information. To do these things well, it is essential that we proceed on the basis of a plan which clearly and specifically identifies management information needs.

Action 3 - Establish a NOAA-Wide Office Automation Program

It is time for NOAA establish a mechanism to meet office automation needs and exploit the developing technology. An Office Automation Project Team is proposed to plan, to prepare the agency for the exploitation of office systems developments, and to enlist the participation of the major organizational units.

Some team members should, on a voluntary basis, come from the NOAA organizations with the greatest experience, need, or potential for early payoff. Those selected should be sensitive to the personal needs of office workers and interested in avoiding or minimizing the impact of behavioral problems and issues which may arise. (The topical literature on office automation identifies behavioral considerations as a major stumbling block to widespread acceptance of the technology.) IMS will contribute to the membership of the team, will provide a senior staff member as team leader, and will provide technical and clerical support resources. These IMS contributions are a part of its existing responsibility for office automation. The initial working team should consist of about five individuals with a full time commitment to Office Automation of not less than one year nor more than two. While assignments will be with the team, the services of members from NOAA MLC's will not be lost to their home organizations for they will work on the development of current and future support for their home units, but within the framework and with the support of a NOAA-wide program and resources.

The Project Team, with Information Policy Committee guidance will identify needs for automation support in the NOAA organization, will prototype systems with the potential for general use, and will support appropriate implementation. The team will plan and develop a coordinating framework designed to encourage sharing and to enhance the contribution potential of applications and ideas developed throughout the organization. The team will

charged with encouraging and facilitating the use of office automation where it offers a significant productivity opportunity, with developing techniques for its smooth integration into the office fabric, and with measuring the savings and benefits achieved. Each program area is encouraged and invited to participate.

As we begin an office automation program, there are two critical caveats: The early benefits of office automation must not be oversold. The long-term benefits and the complexity of managing the office automation transition must not be underestimated.

The short-term office automation effort will seek improvements in many small processes (e.g., typing and distribution.) On a local scale, these improvements will not automatically reduce personnel costs but will allow NOAA to choose the appropriate balance between cost and personnel reduction, and the ability to handle additional work or to assume new tasks. Additional benefits will be sought in the provision of better information, available more rapidly to NOAA management.

When large administrative systems were first automated, savings in personnel accrued not so much from increased productivity of individuals doing the same tasks but from the changing of the tasks which workers did. The benefits of office automation may be equally subtle; initially, many tasks may remain the same though each will be done more efficiently. In the longer run, these tasks will change as we learn to use the equipment more imaginatively and intelligently.

Quantitative requirements, benefits and costs for the office automation components of this proposal would be premature in the absence of the plan and experience of the program proposed here, and because the full benefit can be realized only when applications are interconnected into a fully mature organization-wide system. An objective of NOAA's longer term office automation program will be both clerical and professional productivity.

The firm of Booz-Allen and Hamilton recently completed a study of fifteen organizations and their goals for office productivity gains through automation. The study assigns to a carefully planned office automation effort potential savings with an opportunity value of perhaps 15% of administrative expenses. The study concludes that the productivity gains and savings in time and staff are real and substantial, but only available to organizations which have strong top management support, are prepared to commit sizable resources, are able to manage change, and have a thorough process of top-down planning with a disciplined program to measure the gains. These are not insignificant requirements and certainly they are not now in place in NOAA even though we do have the beginnings of office automation activity in several locations. We accept the findings of the report with that degree of certainty required to justify a program of serious study of the needs for office automation support at NOAA and of preparation to exploit current and future opportunities for cost reduction and productivity gain.

Action 4: MB/IMS Organizational Changes

a. Strengthen Administrative Information Systems Management.

Within the Office of Information and Management Services, the new administrative information systems focus will be recognized by organizational change. Specifically, a senior management position will be established with responsibility for administrative information systems. Among the functions of the Administrative Information Systems (AIS) organization will be the provision of staff support to the policy committee and the leadership of the automation and information planning programs proposed in this report.

This change in structure at a high level in the IMS organization is critical to the success of the strategy proposed here. It recognizes the new information systems "umbrella", assures the commitment of AIS resources to a consistent program, and it frees this management position to concentrate exclusively on AIS issues.

b. Establish an Information Resource Center

An Information Resource Center is proposed as a separate unit within the IMS structure. The purpose of this unit will be to support NOAA managers and staff in accessing NOAA data and in developing ad hoc and independent systems to meet local needs. A secondary but important purpose shall be to contribute to productivity improvement in the IMS applications development process and to achieve a reduction in the development backlog.

The Information Resource Center is a major step in support of an increase in the information systems responsibility of end-users. It will provide tools, software, and training in the most effective procedures for accessing data or developing local systems. The Center's offerings will not focus exclusively on large computer systems but will specifically include assistance with microcomputers and personal computers where these are appropriate. When priority, user need, and preference dictate, the center will provide a programming service, (dependent on the same end-user tools) to fulfill needs for reports or ad hoc systems; in general such services will be directed to high priority needs or to cases where end-user training and experience are a coincident objective of the service offering. The Center will achieve maximum effectiveness only if the majority of its resources are concentrated in the tool providing activities which offer high leverage.

The Information Resource Center is also proposed as a major tool for improving system development productivity and providing prototype software and systems. New programming tools becoming available today promise perhaps

a five fold or greater improvement over NOAA's traditional COBOL techniques while preserving flexibility for future system changes and aiding in the important documentation process. Some of the same tools may offer equally large gains in the design phase of systems development by enabling a prototyping approach to systems design.

It may be appropriate for the Center to establish a place where users can come to acquire information resources. NOAA geography complicates this matter but the "center of mass" of information need may be such that a specific place will be appropriate. Such a location could house special resources not generally available in administrative offices, such as graphics terminals, and could offer a direct consulting and assistance staff in addition to a library of current reports and standard access equipment.

The Center can be in place within four months with its initial activities devoted to support of currently available tools and to the evaluation, selection and development of a full complement of resources for the longer term. The development of a fully functioning Center will require eighteen to twenty-four months. The IRC will require the assignment of three or four permanent positions. Candidates would come appropriately from the ranks of programmer/analysts and technical support staff within IMS and from knowledgeable end-users in NOAA line organizations. All three backgrounds would be appropriate providing that all are committed to the objectives at the IRC and possess superior communications capabilities.

In addition to staff costs there are other significant costs, which are not explicitly provided for in the IMS budget. One of these is the cost of the software resources needed by the center. An ongoing annual software budget of \$50,000 seems in the appropriate range for planning purposes with an additional \$100-150,000 of one-time costs for software acquired during a twenty-four month start up period.

Action 5 - Establish an AIS Incentive Fund

A plan becomes a reality only as specific actions are taken to achieve its implementation. In NOAA's present changing environment, mechanisms are needed which will encourage among managers, a continuing interest and commitment to the AIS plan and which will recognize the need for updating and flexibility. An approach which will provide meaningful but flexible incentives for collaborative action to implement an AIS plan is to establish an incentive fund. Such a fund is proposed here and would be used, for example, to:

- Acquire communications resources
- Obtain contractor assistance with planning or prototyping activities
- Encourage acquisition of standard equipment
- Permit equipment upgrades to meet standards
- Acquire prototype equipment
- Assist in meeting initial start-up expenses.

MB is prepared to capitalized this fund by designating up to one-half million dollars which will become available if current trends continue as a result of savings in FY82 ExAd and Common Services functions. A major share of the costs will continue to be borne by the operating units; however, some costs can and should be assumed for NOAA as a whole. The purposed fund will provide a clear, positive and welcomed "carrot" incentive in an environment which already contains many "sticks" to bring about change in the form of directives and regulations. Usage of the fund will be optimal when used to provide for the general benefit of NOAA by taking advantage of opportunities beyond the reach of individual units or of usual resource capabilities.

D. Other Recommendations

This section recommends specific actions to be taken by IMS in response to short term needs:

1. IMS should actively assist NOAA organizations in selecting and acquiring appropriate word processing systems while minimizing unnecessary diversity. The number of offices with urgent need is small and there is only minor exposure to loss through premature acquisition of non-standard systems. Most of those who expressed urgent needs associated them with a requirement to expedite controlled correspondence.

The interviews which preceded this report tell us that most major administrative units do feel a need for word processing improvement including, in some locations, the ability to communicate among devices. In some quarters the processing of controlled correspondence requires more effective support and in a few locations there is an apparent need for correspondence tracking. These are the initial statements of need and they exist on top of the support already in place including many word processors (some communicating), and electronic mail experience for some users both through communicating word processors and the use of CONFER under NOAA's time sharing contract.

A word of caution - communicating word processing equipment should not be viewed as a panacea for controlled correspondence problems, particularly those associated with clearances. They will help the document preparation process and may shorten some "mail" channels but the final package of background, clearances, and commentary must still be assembled and sent much the same way as it is now.

2. It is proposed that NOAA establish and promote the use of a single interim administrative communications network so that messages and mail can be sent quickly and easily to involved parties. This will allow more rapid communication to major NOAA locations in the U.S. and will help overcome the problems associated with the geographic dispersion of NOAA offices in the Washington area. The ADP Network Systems (ADPNS) network is available for use now and is already used by NMFS and EDIS. Several commercial services are available which could support the extension of these capabilities.

3. IMS should make more widely available the interactive systems for FIMA and Personnel which are now in use. This should include training, documentation, and comprehensive support--especially for those who have little or no experience with interactive systems.

4. A study should be undertaken to determine if the controlled correspondence tracking system is meeting needs. Procedures for handling controlled correspondence and the software being used to track the documents have changed during the preparation of this paper. If those steps have not reduced previous problems to acceptable levels, we must proceed at once to acquire procedures which will.

IV. Eight Years Hence

This section offers speculation on an end-of-the decade environment; it is blue sky and not a specification. It is, however, intended to indicate a direction in which we should travel.

Well managed agencies and corporations will conduct internal business in a far less paper-dependent way in 1990. The costs of information storage and processing will have dropped to the extent that many new kinds of computer applications will be cost effective. The variety of telecommunication services including advanced local networking will be much increased and interchangeability will have improved in part as the result of international standards. Traditional distinctions between communications equipment and data processing equipment will no longer hold.

By 1990, a wide range of office tasks will be supported by versatile workstations. These tasks include telephone, dictation, scheduling, tracking, typing, filing, document preparation, retrieval, copying and interchange, and access to resource data and report tools including graphics. Many common tasks will be voice activated. By 1990, workstations will be common and installed for every few, perhaps five or ten, administrative and professional employees. (Systems are available in 1982 which are at the threshold of supporting all the listed services; they are, however, in initial non-integrated form and at costs too high to consider for truly widespread installation.)

At NOAA, administrative data systems will have approached a 100% on-line, transaction processing status; their files will be up-to-date and accessible at each administrative level which requires it. Data entry as we know it today will be obsolete; the need for "desk drawer" or "cuff" systems will be minimized. Access to data processing systems will be available through the same workstations used for word processing or office automation. The re-

sponsibility of line managers for data and for systems development will be greatly increased and the existence of local systems to augment NOAA-wide capabilities will be common.

Office automation systems will be in widespread use and integrated to the extent that the transition from one "application", for example document preparation, to another, like the distribution of the document, will be smooth and natural. The functions on the list above will be generally supported. The distinction between data processing and office automation systems will have blurred. One result of the broader information systems approach will be the capability to conveniently incorporate information from DP systems into the text of documents and to access computational resources when needed in document preparation.

Information systems equipment will be distributed and hierarchical, a high proportion of the devices involved will communicate through local networks and via network gateways to other local NOAA nets and to external networks. Communications will, in general, be digital, with digitized voice communications sharing a network in common with data. This will facilitate new techniques of filing and processing voice data. Where cost and time saving dictate, use of the network will replace some kinds of face-to-face meetings, conferencing and travel.

In order to support these developments and assure the appropriate degree of integration, the IMS organization will be mainly in the business of supplying tools, of maintaining the shared "corporate" data, and of supporting common communications linkages.

APPENDICES

- A. User Interviews
- B. Technological Opportunities

A. User Interviews: Attitudes and Needs

This section is a summary of several interviews done in December and January. (NOAA management now has a more definite composition and structure and some views expressed then may have moderated.) The entire year has been one of considerable change for the government generally and NOAA has been affected. The gyrations of the budget process without senior administrators in place generated confusion and consternation particularly in view of the fact that instructions were often passed by word of mouth and had very short deadlines. A sweeping realignment of administrative data processing activities with respect to consolidation in the Department is still under way. Several individuals noted the extensive changes in senior management positions and their contribution to a general decline in "corporate memory". On balance, most of those interviewed believe the administrative information processes of NOAA are not "broken". The system does respond, though sometimes at considerable expense, disruption, and special effort.

As a category of administrative service, the mail system was mentioned as the most circumvented. Circumventions include special courier, the "blue pouch", and an impressive array of strategies for "hand carrying". Somewhat in defense of the mail system, it has absorbed considerable reduction in staff and some delays attributed to the mail are a lack of expeditious handling by intermediate recipients. The mail system is the most studied of administrative systems and, in fact, is under review once again.

Mentioned second most often is a need to have financial information which reflects more clearly "cash on hand" than is the case in FIMA,

the NOAA finance system. While there are occasional delays in delivery or execution, the system is accepted as the starting point for all financial discussions. There is some relief provided by software used on the ADP Network Systems system which uses FIMA data provided on magnetic tape. This system should be enhanced, its documentation improved, and it should be made more widely available.

The conversion to full time equivalent (FTE) accounting for personnel costs is generating reporting requirements for personnel data which are similar in timeliness to those for financial data. As put by one, "we have to get our people numbers as good as our dollar numbers." The consolidation of personnel data processing and attendant changes in data processing equipment and procedures dictate that enhancements to current software be brought about with the most careful planning and thoughtfulness.

Nearly all of those interviewed mentioned the use of word processing as an immediate, pressing need. There are more than 400 pieces of equipment in use now and several requests are under consideration. Communications capabilities are needed so that the sharing of documents can take place in a timely manner. Most of the communications requirements are for transmitting documents within the same mainline component or office in the course of preparing and drafting documents. As a document becomes final the need to transmit it across component/office lines develops at the senior management levels in order to obtain clearance and concurrence.

A need was expressed for keeping track of a variety of documents in conjunction with every day business, such as travel, personnel and procurement. Tracking could fulfill a dual role: More timely updating of financial data as well as assisting simply in getting transactions made processed.

B. Technological Opportunities

The merging of electronics and communications technologies with office equipment products over the five years has produced fundamentally new ways to conduct routine office tasks. Local area networks are becoming available from several manufacturers and promise fast sharing of documents, ideas, and data. The use of networked office systems has the potential to reduce the volume of paper generated as dramatically as the photocopier increased it. Conceptually, the bulk of interoffice information such as messages, schedules, agenda, notices and instructions need never be recorded on paper.

Experience has shown that one must use these new technologies for 12 to 18 months before they become familiar enough to be applied to problems beyond those for which they were originally intended. NOAA must begin now to take advantage of these new technological opportunities in order to absorb the learning curve delay as quickly as possible. Management encouragement, support, and leadership are mandatory if we are to overcome the fear of change and resentment of technology.

Word processing is the most mature of the new office technologies. Word processing devices costing 400-700 dollars per month to lease all but eliminate repetitive typing of unchanging text. Revisions of documents are accomplished with ease. Some advanced equipment provides large (50000-80000 word) dictionaries to check for spelling errors and a few systems highlight cliches and provide other helpful services automatically .

Facsimile and related follow-on technologies have an important role to play in the future workplace because of the ability to send anything recorded on paper (e.g., drawings, handwriting, images, or graphics). These things are not handled well by character oriented systems. Also, facsimile can

provide an inexpensive method for entering into an electronic message system documents which do not originate within the system. NOAA presently utilizes relatively inexpensive office facsimile (telecopier) equipment to send/receive documents on an urgent basis. However, the quality of the received copies is marginal and adequate for only temporary office use. Communicating copying machines are becoming available which produce good quality but at a fairly high price. This price can be expected to drop into a more generally cost effective range in a few years.

Telephones are and will remain the fundamental mode of communication. Recent court settlements are expected to increase competition, and consequently produce new products and services in the telecommunications industry. A network used under contract by NOAA is oriented to text transmission and not generalized data packets such as would be appropriate for facsimile. This network does, however, demonstrate the usefulness and flexibility of a general purpose network and should be utilized more widely in planned prototype applications as we progress through the "learning curve".

Electronic mail/message systems provide the means to share ideas and drafts of documents or send many of the messages that are normally handled by telephone call. Booz-Allen and Hamilton have pointed out that one half of all telephone call attempts are unsuccessful (no answer, party not there, busy, etc.). Using an electronic message system, callers can send messages at their convenience and the called parties can retrieve it at their convenience. Callers may also send the same message to several destinations and have it filed for future reference. Some components of NOAA routinely use electronic messages to send reports, instructions and directives, and obtain commentary on proposals.

New telephone/voice messages systems are as easy to use as the now common telephone answering machines but are far more powerful. They involve the intermixing of voice with digital data. The systems are similar to current message store and forward except that the computer stores a digitized voice signal. Typically, a user will call the service, identify intent with phone push buttons, and record the message by speaking into the telephone. The digitized voice message can be sent through a network like any other data packet. The utility of this concept becomes very apparent and attractive upon demonstration.

NOAA has a significant capability for computer generated graphics in its program areas. We have available sophisticated, general purpose graphic software available and in use. The increasing complexity of administrative information and the increasing complexity of its analysis require more effective presentation. Future administrative terminals will provide graphics capabilities.