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LONEX (LABORATORY OFFICE NETWORK EXPERIMENT)  
COST/BENEFITS STUDY VOLUME 1(U) BOOZ ALLEN AND HAMILTON  
INC BEDFORD MA APR 84 RADC-TR-84-62-VOL-1

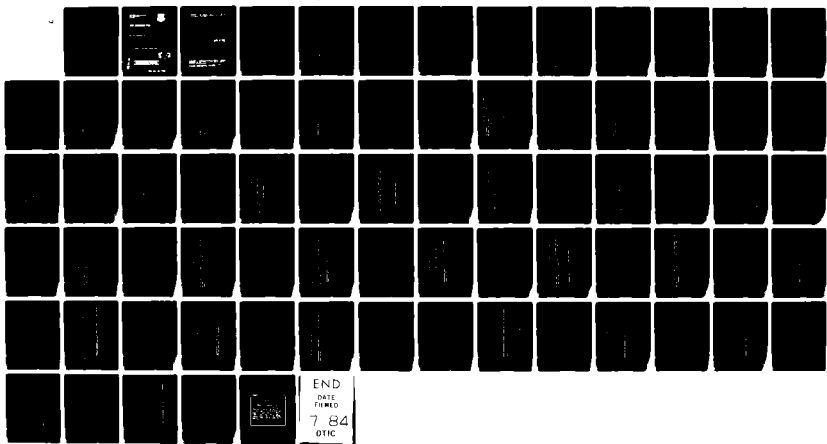
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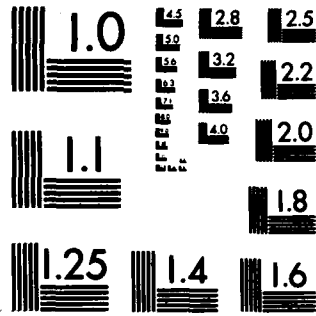
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19. ABSTRACT (Continue on reverse if necessary and identify by block number) This report documents the results of an analysis of costs and benefits which are expected to accrue to the Rome Air Development Center (RADC) through the acquisition and implementation of an organizational office automation system. The report has two major parts: (1) Volume I - the LONEX Cost/Benefits Study which describes the major findings and (2) Volume II - Appendix III, Cost Benefits Analysis - A comparative cost analysis is presented in accordance with AFSC regulations and guidelines. The ground rules and assumptions underlying the analysis are detailed and comparisons are made using constant, inflated and discounted dollars for three cases: (1) present (no automation), (2) lease and (3) purchase. Appendices I and II were not published as they contain RADC unique information and have doubtful value to other organizations.				
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## PREFACE

This report documents the results of an analysis of costs and benefits which are expected to accrue to the Rome Air Development Center (RADC) through the acquisition and implementation of an organizational office automation system. The report has two major parts: (1) the LONEX Cost/Benefits Study which describes the major findings and (2) the Appendices which contain the supporting data and results of the analysis.

This report begins with an introduction to the LONEX assessment effort and then presents the results, key factors to consider for implementation, and conclusions. Three appendices supplement this basic report by providing supporting data and analyses. They are:

\* . Appendix I--Recommended Enhancements to the LONEX Specification

Findings related to the enhancement of the office system specification requirements and to the organizational impact of the present system are described. Detailed recommendations for an operational system specification are provided for each LONEX system capability. General recommendations are made concerning the development of an acquisition and implementation strategy for the RADC operational office system.

\* . Appendix II--RADC Organizational Analysis

The survey, questionnaire and case study data on which the cost benefits analysis is based are presented. RADC work activities are profiled and a comparative analysis of selected manual and automated work process is detailed.

. Appendix III--Cost Benefits Analysis

A comparative cost benefits analysis is presented in accordance with AFSC regulations and guidelines. The ground rules and assumptions underlying the analysis are detailed and comparisons are made using constant, inflated and discounted dollars for three cases: (1) present (no automation), (2) lease and (3) purchase.

\*NOTE: Appendices I & II of this report were not published as they contain RADC unique information and have doubtful value to other organizations.

TABLE OF CONTENTS

- I. INTRODUCTION
- II. SUMMARY OF COST AND BENEFITS RESULTS
- III. KEY FACTORS FOR SYSTEM IMPLEMENTATION
- IV. CONCLUSIONS

## I. INTRODUCTION

### 1. THE LABORATORY OFFICE NETWORK EXPERIMENT (LONEX) WAS ESTABLISHED AT RADC TO DETERMINE THE IMPACT OF OFFICE AUTOMATION TECHNOLOGIES IN AN AIR FORCE SYSTEMS COMMAND LABORATORY ENVIRONMENT

In 1977, Air Force Systems Command/Directorate of Laboratories (AFSC/DL) requested the Rome Air Development Center (RADC) to be the organization that tests a "Paperless Laboratory" concept. As a test organization, RADC would assess and report the advantages of using office automation technologies in an AFSC laboratory environment. RADC then initiated the Laboratory Office Network Experiment (LONEX) and assigned the following charter to the LONEX Program Office.

- . Test the limits of off-the-shelf automated office technologies in this environment.
- . Gain experience in using office automation tools for the development of specialized applications tailored to meet unique organizational requirements.
- . Provide hands-on automation experience for professional and support personnel at all levels of the organization.
- . Assess the impact of the system on organizational work processes.
- . Provide a basis for estimating costs and benefits which could accrue in a fully automated office environment.
- . Provide an experimental environment in which the sociological aspects of emerging office technologies introduced into an AFSC environment could be studied.

The lessons learned from LONEX are being incorporated into the planning for office automation throughout the AFSC laboratory community and complement similar work for AFSC product organizations being accomplished under Project IMPACT (Improved Administrative Capability Test).

# I. INTRODUCTION

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## 2. RADC APPROACH

- The Information Resource Management Branch (RADCI/ACM) Managed The LONEX Program
- Bunker Ramo Was The System Integration Support Contractor
- Booz, Allen & Hamilton Conducted An Independent Assessment Of Cost And Benefit Results

I. INTRODUCTION

# I. INTRODUCTION

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## 1. BACKGROUND

- Automation Technologies Offer The Potential For Significant Productivity Gains In The Office Environment
- The Laboratory Office Network Experiment (LONEX) Program Was Established At RADC To Determine The Impact Of Office Automation Technologies On An Air Force System Command (AFSC) Laboratory
- Lessons Learned From The LONEX Demonstration Project Are Valuable For AFSC Office Automation Planning

I. INTRODUCTION

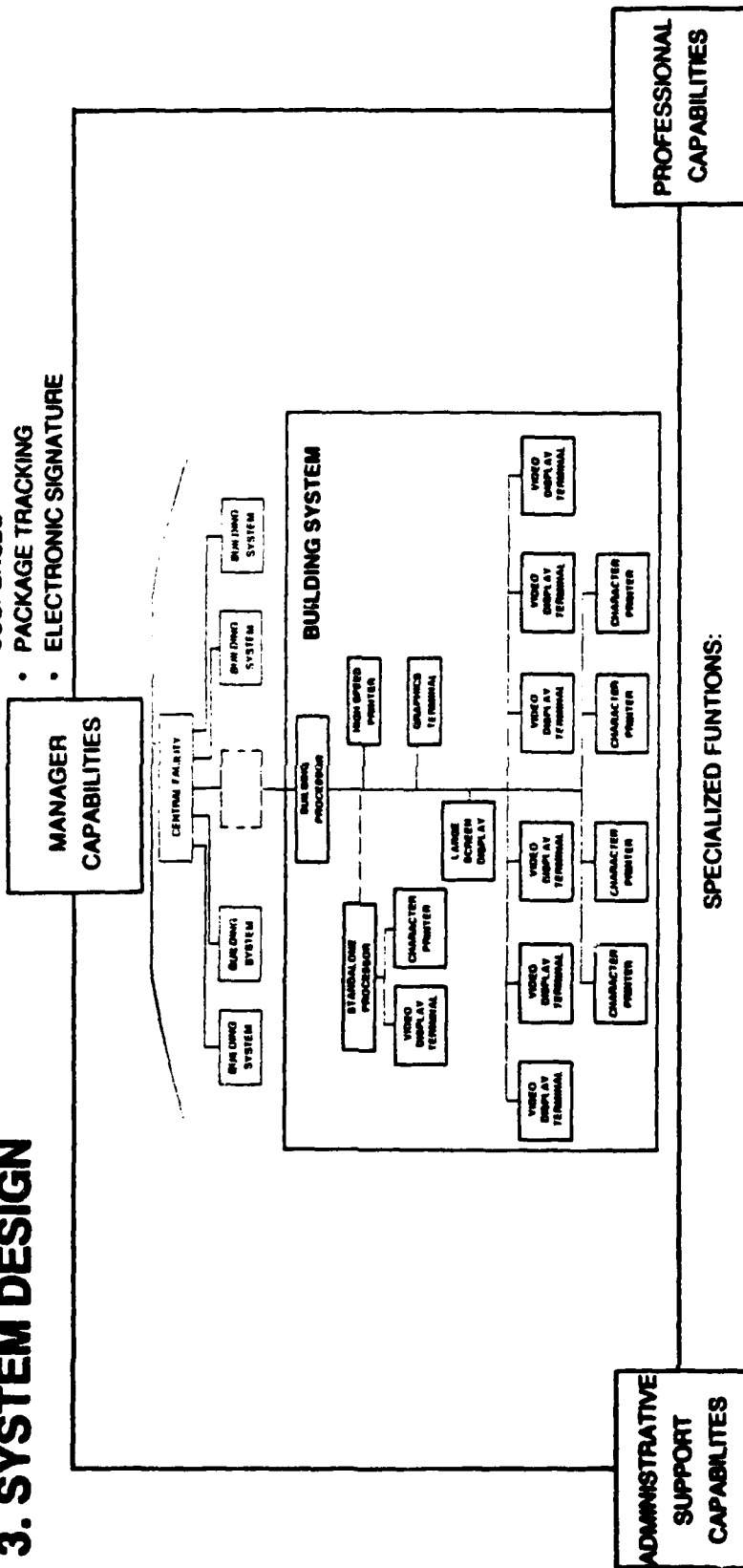
2. LONEX WAS CARRIED OUT BY A GOVERNMENT/INDUSTRY TEAM

- (1) LONEX Program Responsibility Was Assigned to the Information Resource Management Branch (RADC/ACM).
- (2) RADC Office Automation Requirements Were Defined Based Upon the Identified Needs of Laboratory Contract Managers and Staff.
- (3) Bunker Ramo Was Awarded a Competitive Contract in 1979 for the Lease of Sufficient Equipment, Software and Support Services to Conduct the Experiment.
- (4) Booz, Allen & Hamilton was retained by the LONEX Program Office as an Independent Evaluator to Assess the Impact of Automation in Selected Areas:
  - . Documentation on the use of the system in RADC work processes
  - . Measurement of quantifiable benefits
  - . Identification of non-quantified benefits
  - . Estimates of system costs
  - . Recommendations for the enhancement of selected system capabilities

# I. INTRODUCTION

## 3. SYSTEM DESIGN

- SUSPENSES
- PACKAGE TRACKING
- ELECTRONIC SIGNATURE



### SPECIALIZED FUNTIONS:

- GRAPHICS SUPPORT
- RADIC - SYSTEM INTERFACES
- EXTERNAL SYSTEM INTERFACES
- PROF. TEXT PROCESSING
- FORMS
- ELECTRONIC SIGNATURE
- CALCULATOR
- TEXT PROCESSING
- FORMS
- ELECTRONIC FILING
- ELECTRONIC MAIL

## I. INTRODUCTION

### 3. THE LONEX SYSTEM DESIGN PROVIDED ACCESS TO A VARIETY OF EQUIPMENTS AND AUTOMATED OFFICE CAPABILITIES

- (1) The LONEX System Design Included Hardware, Software, and Communications Capabilities.
  - . The system included 11 central processors, 5 standalone units, 205 video display terminals, 30 graphics terminals, 11 high speed printers, 100 letter quality printers and 4 large screen display units.
  - . Software capabilities included generic automated office capabilities, e.g., text processing, electronic mail, electronic filing and signature, forms, and graphics. In addition, the system provided specialized capabilities designed to support specific types of work activities related to the RADC acquisition process.
  - . Initial communications included local twisted pair networking, remote dial-up capability, and access to external systems.
- (2) The LONEX Demonstration System Has Been Installed, System Users Have Been Trained, and Automated Capabilities Are Being Used to Support RADC Work Activities.
- (3) The LONEX Demonstration Generated Both Quantitative and Qualitative Information on the Impact of System Capabilities on Both Individual and Organizational Productivity.

## **I. INTRODUCTION**

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### **4. SYSTEM IMPLEMENTATION**

- **User Organization Involvement Was Crucial To The Demonstration System Implementation**
- **All Levels Of The RADC Organization Had Access To The System**

## I. INTRODUCTION

### 4. USER ORGANIZATION INVOLVEMENT FACILITATED THE IMPLEMENTATION AND USE OF THE LONEX SYSTEM

- (1) User Organizations Took an Active Role in the Experiment.
  - . The system implementation concept assumed that much of the use of system capabilities would be determined by individual user needs, initiative and creativity.
  - . The distribution of LONEX hardware within organizations was controlled by the perception of need and the management philosophy of individual offices.
- (2) Access to the System Was Available to Managerial, Professional, and Secretarial Support Staff Throughout the Organization.

## I. INTRODUCTION

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### 5. SYSTEM IMPACT WAS ASSESSED IN TWO PHASES

- PHASE I - Baseline On Organizational Activities Established
- PHASE II - Recommendations Concerning Tool Enhancements Made
  - Organizational Analysis Conducted
  - Detailed Cost Benefit Analysis Performed

## I. INTRODUCTION

### 5. THE COST/BENEFITS ASSESSMENT OF LONEX INVOLVED TWO MAJOR PHASES AND INCLUDED FOUR BASIC TASKS

- (1) The First Phase Was Devoted to Capturing RADC Baseline Information (August 1979-May 1982).
  - . The RADC contracting process was selected as the focus of study.
  - . The cost of doing business in pre-LONEX (i.e., manual) condition was determined (Task 1).
- (2) The Second Phase Resulted in Analysis of Use of the Demonstration System (June 1982-February 1983).
  - . Recommendations concerning the applicability of selected tools to RADC processes were based on an analysis of the use of these tools (Task 2).
  - . An RADC organizational analysis was conducted to provide insight into how the system would be used most effectively (Task 3).
  - . A Detailed cost benefit analysis was prepared (Task 4).
    - Quantified benefits were documented.
    - Investment costs were estimated.
    - Operations and support costs were projected.
    - Cost-benefit comparisons were made.

# I. INTRODUCTION

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## 6. ASSESSMENT APPROACH

- Product Methodology Employed
- Representative RADC Products Targeted
- Potential Benefits Projected

## I. INTRODUCTION

### 6. THE PRODUCT APPROACH WAS USED IN THE ANALYSIS OF RADDC WORK

(1) This Methodology Focuses Upon the Analyses of Selected Tangible Paper "Products" Prepared By an Organization.

- . Specific products are selected which (1) are labor intensive, (2) are important for the accomplishment of the organization's mission, and (3) lend themselves to automation.
- . Time and work flow measures are used to quantify the difference in the level of effort required for manual and automated operations.
- . Qualitative comparisons of manual and automated processes are made.

(2) Quantitative and Qualitative Differences Between the Manual and Automated Processes Are Documented and Used to Project Annual Benefits for Management, Professional and Administrative Support Staff.

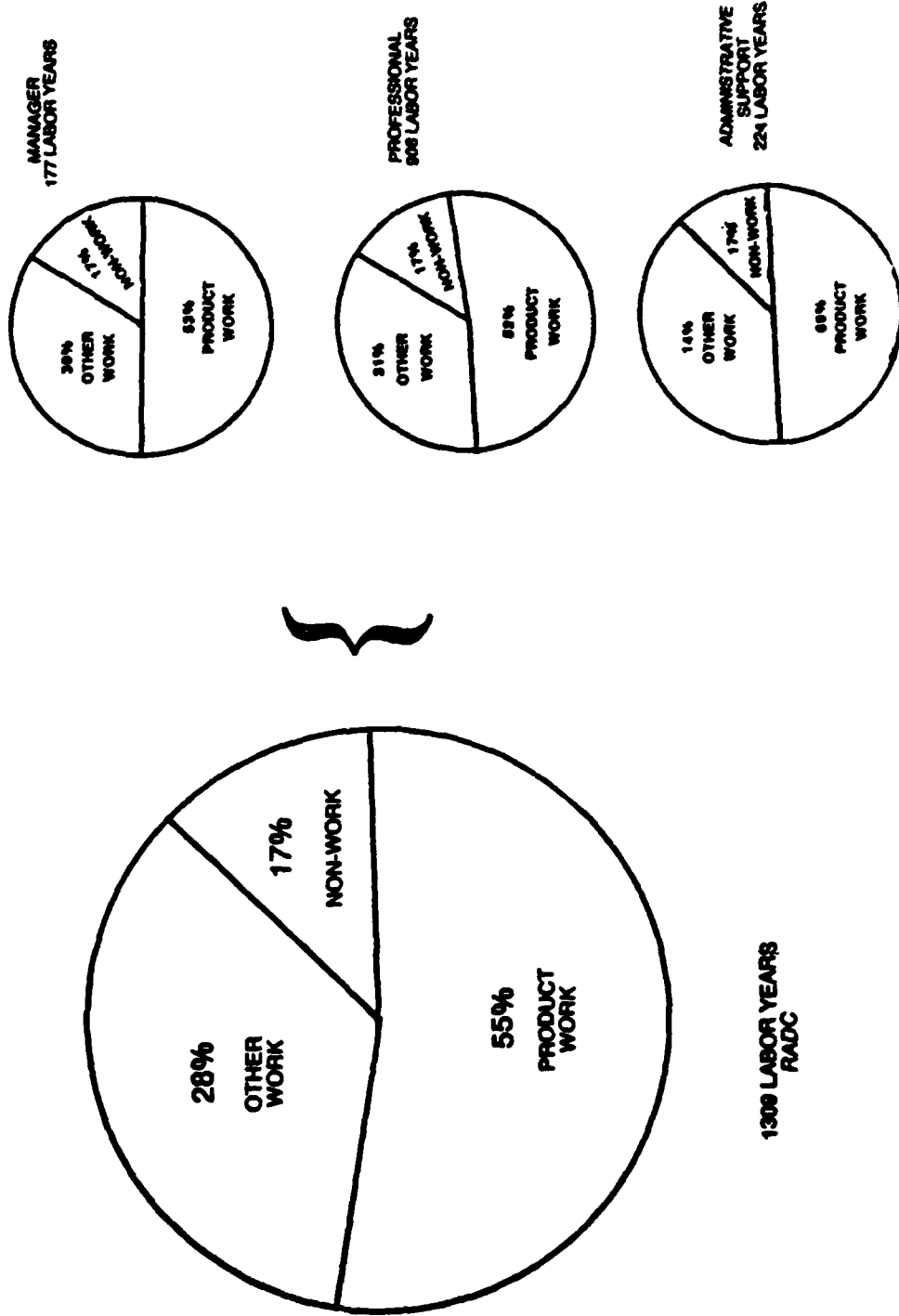
(3) The Remainder of this Report Summarizes the Results of Applying this Approach to the LONEX Analysis.

**II. SUMMARY OF COST AND BENEFIT RESULTS**

## II. SUMMARY OF COST AND BENEFIT RESULTS

### 1. THE OPPORTUNITY TO APPLY AUTOMATION TO PRODUCT PREPARATION IS SIGNIFICANT

#### DISTRIBUTION OF RADC LABOR RESOURCE



II. SUMMARY OF COST AND BENEFIT RESULTS

1. THE RADC ORGANIZATIONAL WORK PROFILE CHARACTERIZED THE POTENTIAL FOR IMPROVEMENTS THROUGH AUTOMATION

- (1) The RADC Internal Work Force Generates Approximately 1309 Labor Years of Effort.
- (2) The Overall Professional to Administrative Support Ratio at RADC Is Roughly 5:1. However, Due to Uneven Distribution of Secretarial Resources Among RADC Offices, Some Offices Have 15:1 or Higher Ratios.
- (3) A High Level of Managerial, Professional and Administrative Support Effort Is Devoted to the Preparation of Tangible Paper Products. Automated Office Capabilities Are Directly Applicable to Supporting These Paper-Oriented Work Processes.
  - Fifty-five percent of the RADC labor resource is expended in the creation of products.
  - Twenty-eight percent is devoted to work activities having less tangible aspects or are difficult to relate directly to specific products, e.g., conducting laboratory tests, attending meetings, travel, etc.
  - Seventeen percent of the labor resource is committed to non-work requirements (training, sick leave and vacation) and cannot be applied to work activities.

## II. SUMMARY OF COST AND BENEFIT RESULTS

### 2. AUTOMATION SIGNIFICANTLY REDUCED PREPARATION TIME FOR TYPICAL RADC BUSINESS PRODUCTS

SAMPLE PRODUCT	PREPARATION TIME (minutes)		PERCENT SAVINGS
	MANUAL	AUTOMATION	
CORRESPONDENCE			
A. FORMAL LETTER	107	70	35
B. INFORMATION REQUESTS (SUSPENSE)	268	157	41
PROPOSAL EVALUATION	11,215	10,916	3
TECHNICAL REPORT (INTERNAL)	63,803	41,732	35
BRIEFING	515	302	41
PROGRAM STATUS (RADC FORM 74)	7,306	3,807	48
WEEKLY ACTIVITY REPORT	290	177	60
TOTAL	83,504	57,161	32%

II. SUMMARY OF COST AND BENEFIT RESULTS

2. CASE STUDY RESULTS INDICATE THAT USE OF LONEX CAPABILITIES SIGNIFICANTLY REDUCES PRODUCT PREPARATION TIME FOR THE SAMPLE PRODUCTS

(1) Case Study Data Were Gathered On the Activities and Level of Effort Involved in the Development of Representative RADC Products Under Manual (Without LONEX) and Automated (With LONEX) Conditions.

- Six types of products sampled account for over 25 percent of the RADC labor expended on all product-related work activities.
- Six managers, 18 professionals and 16 secretaries participated in the product case studies.

(2) Average Preparation Time Savings Achieved Through Automation for the Products Studied Ranged From 3 to 60 Percent.

## II. SUMMARY OF COST AND BENEFIT RESULTS

### 3. THE IMPACT OF AUTOMATION ON PRODUCT WORK TIME VARIED FOR DIFFERENT TYPES OF PERSONNEL

SAMPLE PRODUCT	PERCENTAGE DECREASE IN PREPARATION TIME		
	MANAGERS	PROFESSIONALS	ADMINISTRATIVE SUPPORT
CORRESPONDENCE	-	3	57
A. FORMAL LETTERS	2	-	59
B. INFORMATION REQUESTS (SUSPENSES)	-	-	86
PROPOSAL EVALUATION	-	31	50
TECHNICAL REPORT	-	29	61
BRIEFINGS	-	45	94
PROGRAM STATUS (RADC FORM 74)	34	1	58
WEEKLY ACTIVITY REPORT			
SAMPLE AVERAGE	2%	27%	55%

II. SUMMARY OF COST AND BENEFIT RESULTS

3. EXPENDITURE OF TIME ON THE PRODUCTS STUDIED REVEALED DIFFERENT PATTERNS OF TIME SAVINGS FOR PROFESSIONAL AND ADMINISTRATIVE SUPPORT PERSONNEL

(1) On the Average, Compared to Manual Methods, Automation Resulted in a Reduction of Time Required to Create Selected Products.

- . Managers: 2 percent decrease
- . Professionals: 27 percent decrease
- . Administrative support staff: 55 percent decrease

(2) The High Level of Savings for Professional and Administrative Personnel and the Low Level of Savings for Managers Can Be Attributed to Two Factors.

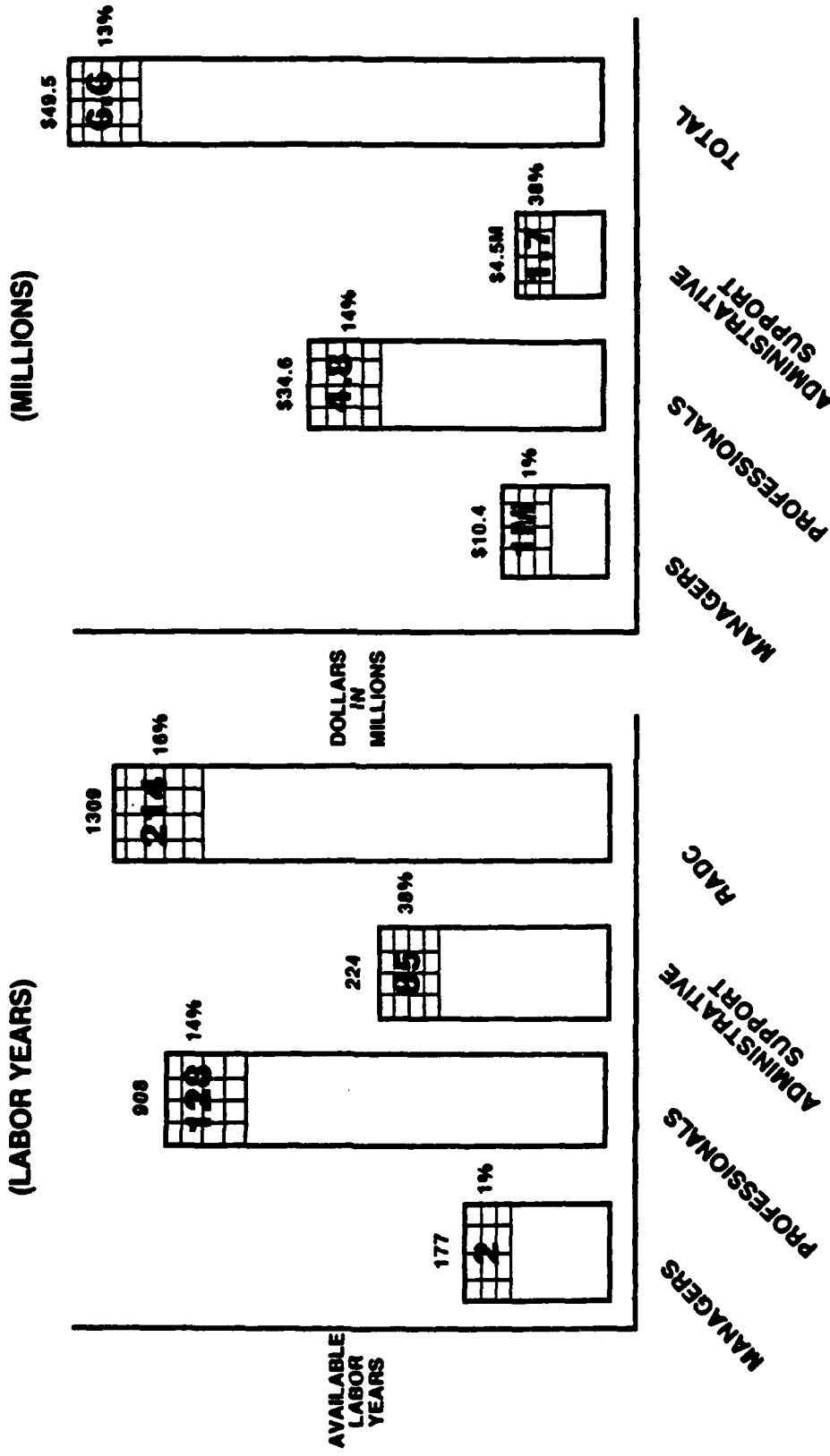
. Emphasis was placed upon supporting the laboratory contract manager and their support staff during the development of the functional requirements for the LONEX automated office capabilities.

Most of the automated product work processes studied had limited application to managers' activities; however the actual savings potential for managers is expected to be higher than the sample results indicated.

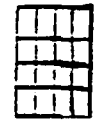
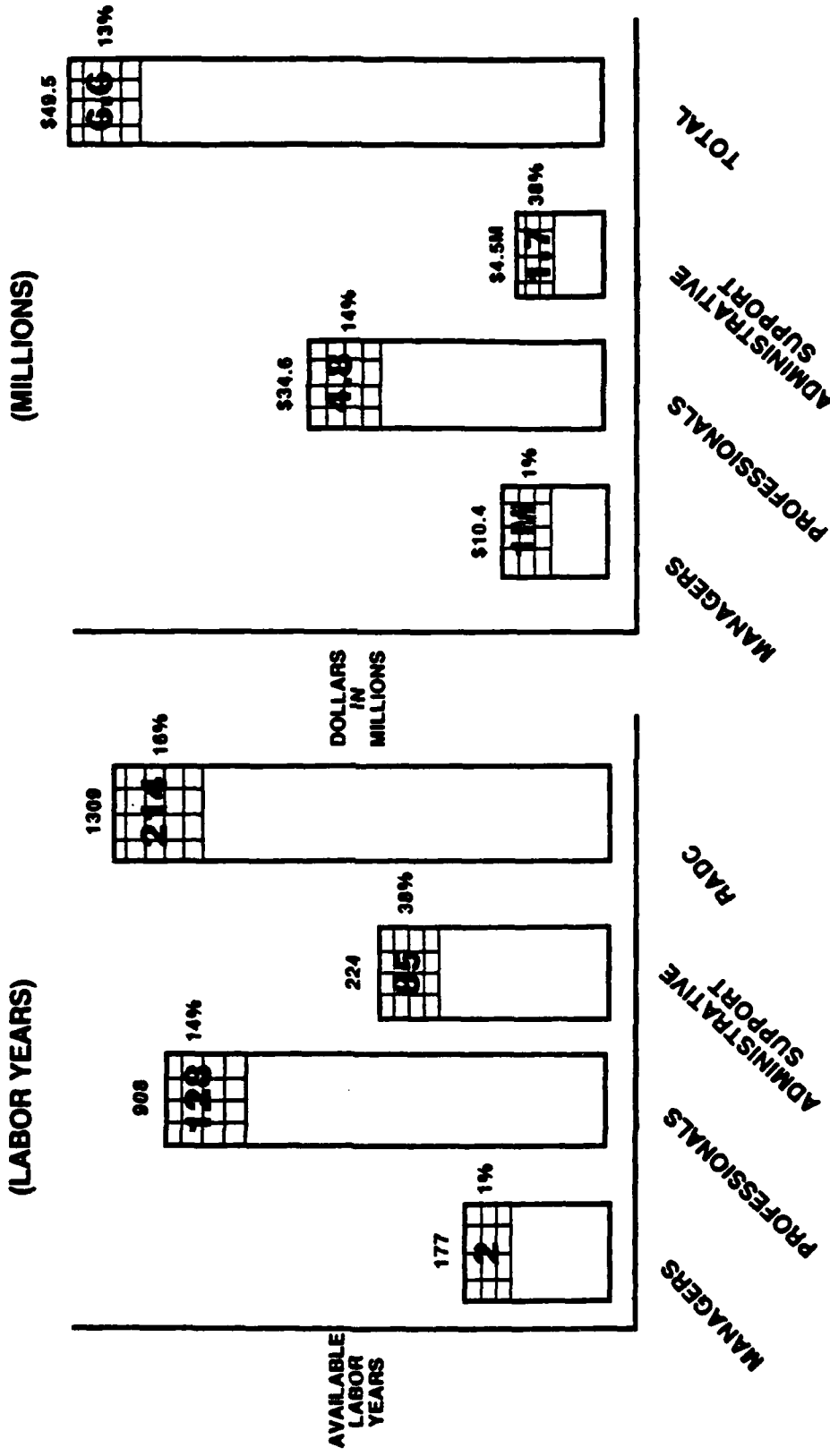
- Products sampled included a low portion of managerial work.
- Automation offers managers additional savings from increased efficiency in non-product activities.

# II. SUMMARY OF COSTS AND BENEFITS RESULTS FOR A FULLY OPERATIONAL SYSTEM

## 4. POTENTIAL ANNUAL TIMED SAVED (LABOR YEARS)



## POTENTIAL ANNUAL VALUE OF SAVINGS (MILLIONS)



POTENTIAL SAVINGS

II. SUMMARY OF COST BENEFITS RESULTS

4. IF THE FULL OPERATIONAL BENEFITS REFLECT THE SAMPLE RESULTS, SUBSTANTIAL ANNUAL SAVINGS CAN BE ACHIEVED

(1) Projecting the Sample Patterns of Quantifiable Benefits to the Entire Organization When Supported by Automation Indicates That 214 Labor Years Could Be Made Available Each Year for Other Work Activities.

• The labor years able to be saved through automation were determined by applying the product time savings factors established for managers, professionals, and administrative support staff (2 percent, 27 percent, and 55 percent respectively) to total RADC product time.

• This projection resulted in an estimate of annual savings of 2 labor years for managers, 128 for professionals and 85 for administrative support staff.

(2) The Annual Value of the RADC Quantified Labor Savings for a Fully Operational System Potential is \$6.6M.

• The value of benefits is based upon labor years saved through automation and an average burdened labor year cost for managers, professionals and support staff.

• The major portion of the dollar value of labor year savings is for professionals (73%), followed by administrative support personnel (25%) and managers (2%).

## **II. SUMMARY OF COST AND BENEFITS RESULTS**

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### **5. ORGANIZATIONAL BENEFIT PROJECTIONS ARE BASED UPON CRUCIAL ASSUMPTIONS**

- Product Sample Studied Is Representative Of RADC Work Activities
- Operational Conditions Will Facilitate System Use
  - Adequate Access To Equipment
  - Reliable Capabilities
  - Appropriate Procedures And Guidelines
  - Adequate Training
  - Widespread System Use By Knowledgeable Users
- Transition Period Is Used To Create The Operational Conditions Required To Achieve The Projected Benefits

## II. SUMMARY OF COST AND BENEFITS RESULTS

### 5. BENEFITS PROJECTIONS ARE BASED UPON CRITICAL ASSUMPTIONS

- (1) The Most Critical Assumption Is That the Sample Used for Determining Quantifiable Benefits (Time Savings) Is Representative of RADC Work Activities.
  - . Efforts were made to control for any potential bias by selecting typical RADC products which differed in their relative labor intensity, emphasized different system capabilities, and required varying degrees of communication among users.
  - . The sample size was constrained by limiting data collection to those products being prepared with automation during the scheduled formal test period within a single RADC mission division.
  
- (2) Benefits Projections Assume the Operational System Will Be Functioning Within a Supportive and Synergistic Environment.
  - . Terminals and printers and other peripherals will be positioned to provide unrestricted access to the system.
  - . System reliability will be high.
  - . Procedures will be documented and implemented to maximize the efficiency and effectiveness of users in applying system capabilities to their work.
  - . A comprehensive training concept and training resources will be available to provide users with basic and advanced skills and with knowledge about effective system application procedures.
  - . RADC personnel will have gained the sophistication and knowledge needed to accept and to integrate system capabilities into daily work routines as a result of their experience with the demonstration system.
  
- (3) The Transition Period Will Provide Sufficient Time in Which the Requirements Can Be Completely Explored.

## **II. SUMMARY OF COST AND BENEFIT RESULTS**

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### **6. POSITIVE QUALITATIVE IMPROVEMENTS RESULT AND IMPACT THE ORGANIZATION IN TWO GENERAL AREAS**

- **Improved Quality Of Output**
  - Product Information Content
  - Availability Of Information
  - Turnaround Time
  - Product Appearance
- **Improved Quality Of Worklife**
  - General Work Activities
  - Opportunity To Improve Personal Skills
  - Physical Surroundings And Workspaces

## II. SUMMARY OF COST AND BENEFIT RESULTS

### 6. QUALITATIVE BENEFITS FROM AUTOMATION CAN BE OF EQUAL OR GREATER VALUE THAN QUANTIFIABLE LABOR SAVINGS

The qualitative impact of automation can significantly enhance the work of RADDC mission organizations and can improve the service that staff organizations provide. Interview and questionnaire responses from LONEX users suggested several areas in which qualitative benefits should be realized with a fully implemented, operational system.

(1) The Use of Automation Leads to Improvements in the Quality and Timeliness of Products Produced. (Fifty-three Percent Reported that the Quality of the Contents Had Improved.)

- . The capability to easily add materials encourages the creation of more complete documents.
- . Office automation offers access to information in established scientific and management data bases as well as stored applications programs.
- . Reduction of turnaround time alleviates problems resulting from the slow exchange of information.
- . The ease of making changes permits more attention to document format and the correction of minor, but troublesome, typographical errors. Seventy percent of LONEX users surveyed indicated that automated office capabilities had led to improvements in the appearance of documents.

## II. SUMMARY OF COST AND BENEFIT RESULTS

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### POSTIVE QUALITATIVE IMPROVEMENTS RESULT AND IMPACT THE ORGANIZATION IN TWO GENERAL AREAS

- Improved Quality Of Output
  - Product Content and Appearance
  - Availability Of Information
  - Turnaround Time
  - Product Appearance
- **Improved Quality Of Worklife**
  - General Work Activities
  - Opportunity To Improve Personal Skills
  - Physical Surroundings And Workspaces

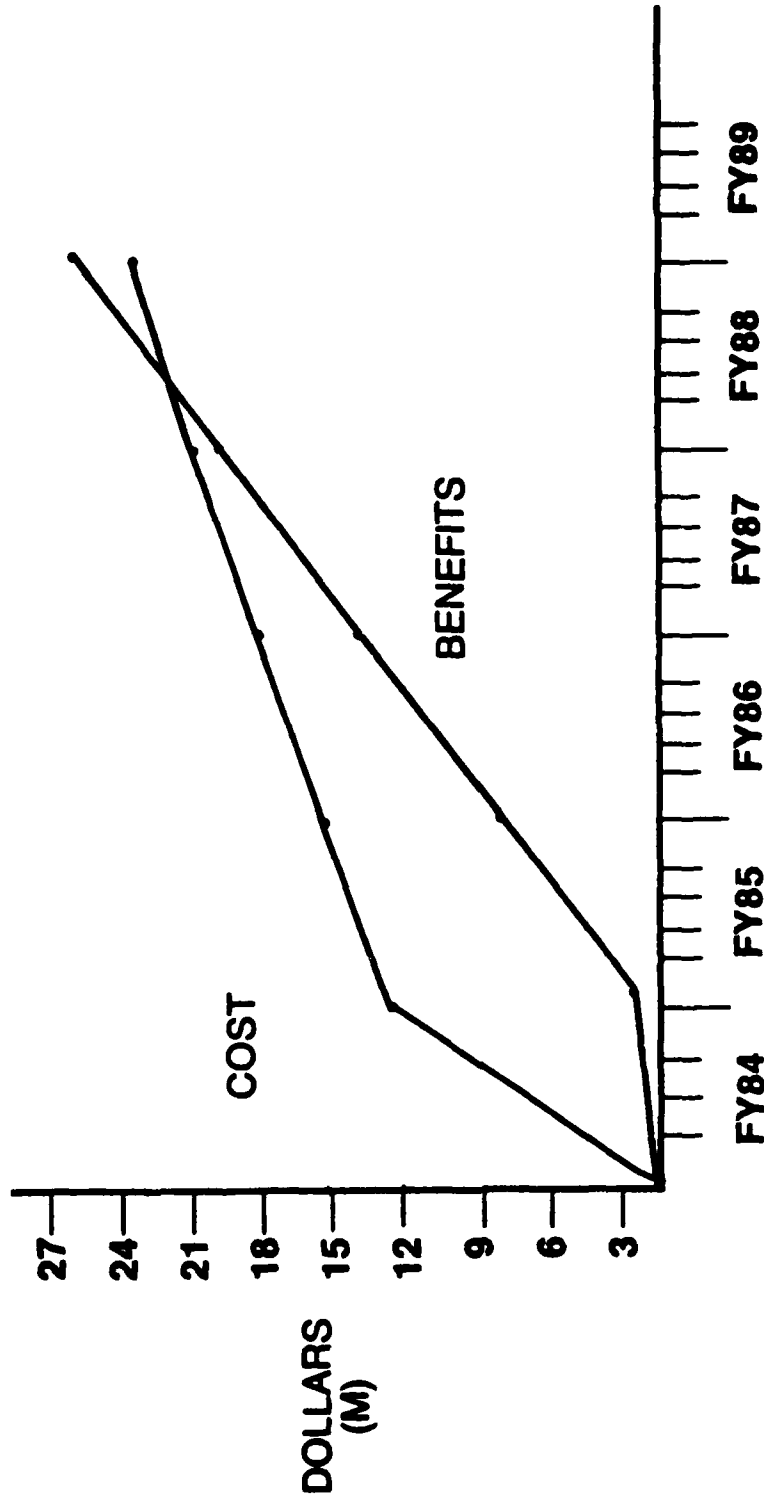
## II. SUMMARY OF COST AND BENEFIT RESULTS

### (2) Automation Is Also Expected to Have a Positive Impact On the Ways In Which Work Is Perceived and Performed.

- Increased levels of individual control and increased flexibility in organizing and performing work improves the general nature of work activities for managers, professionals and administrative support staff.
- Automation provides the catalyst for exploring new ways of handling work requirements and can reduce job pressures resulting from limited access to administrative support.
  - Over half of the system users reported that the demonstration system was suitable for their work activities.
  - Seventy percent of demonstration system users indicate that their immediate working group was more efficient as a result of automation and that they were interested in using an enhanced operational system.
- Shifts in work activities can result from automation and provide opportunities to improve personal skills. As the distribution of work activities among different types of personnel changes and as some work activities are naturally absorbed by automation, new types of work activities should emerge.
- Improvements in the condition of the physical workplace accompanies the introduction of automated office equipment. New types of workspaces and environmental conditions are required. Specialized furniture, modular workspace design and new lighting and noise level requirements result in a general upgrading of office space.

## II. SUMMARY OF COST AND BENEFIT RESULTS

### 7. CUMULATIVE COST/BENEFIT PROJECTIONS



II. SUMMARY OF COST AND BENEFIT RESULTS

7. SYSTEM BENEFITS AT RADC ARE EXPECTED TO OUTWEIGH SYSTEM COSTS DURING THE PROJECTED FIVE YEAR LIFE CYCLE

(1) A Single Point Estimate of System Costs Was Calculated Based Upon An Extrapolation of a LONEX-Like System Configuration to All RADC.

- The cost projection is based upon documented LONEX hardware cost history.
- The cost of a full scale implementation of an operational system at RADC, including investment and operations support costs, was estimated at \$23.3M over a five year period.

(2) A Single Point Estimate of Benefits Was Calculated Based Upon LONEX Product Sample Results.

- A two year phase-in period occurs during the first two years and is included within the five year life cycle.
- The estimated potential annual value of benefits for a fully operational system was \$6.6M.
- The total value of benefits over a five year period (including phase-in) was estimated to be \$26.4M.

(3) The Comparison of Estimated Cumulative Costs and Benefits Indicates that the Payback Could Occur in Slightly Over Four Years and Result in a \$3.1 Net Cost Avoidance.

- Initial investment costs outweigh early benefits.
- Benefits outweigh costs in a mature system.

## **II. SUMMARY OF COST AND BENEFITS RESULTS**

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### **8. THE COST AND BENEFIT ESTIMATES BASED ON THE EXPERIMENT ARE BELIEVED TO BE CONSERVATIVE**

- System Configuration and Detailed Design Changes May Reduce Costs
- Full Operational System Use Can Be More Effective Than The Experimental Use

II. SUMMARY OF COST AND BENEFIT RESULTS

8. THE COST ESTIMATE IS MOST SENSITIVE TO SYSTEM CONFIGURATION AND HARDWARE COSTS

(1) The Architecture for the RADC Operational System May Change.

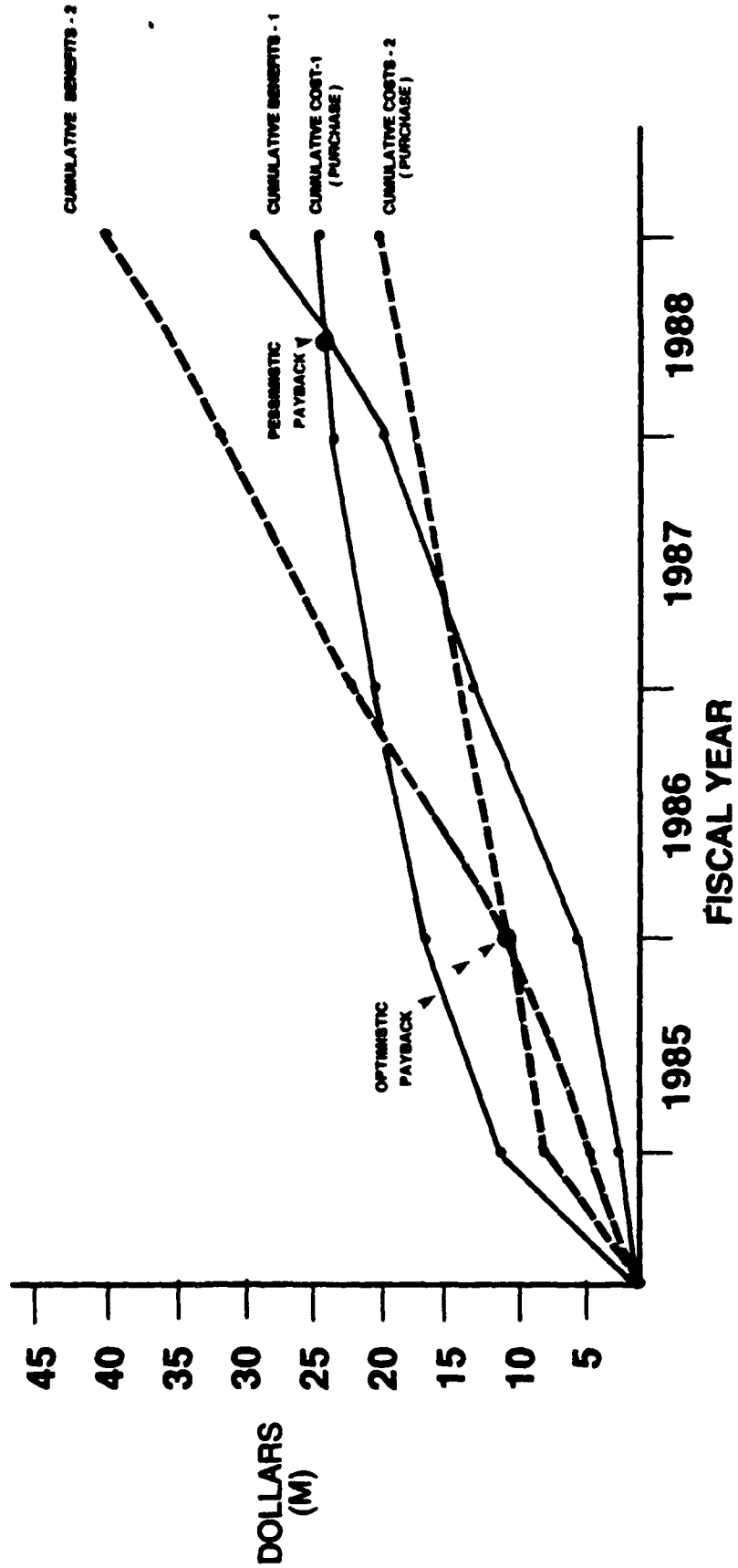
- . Prospective bidders may propose more cost-effective architectures.
- . An original equipment manufacturer might offer hardware with lower handling costs than an integrating contractor.
- . Many unit hardware costs have decreased since LONEX began.
- . Acquisition of a large operational system lends itself to better quantity discounts.

(2) The Use of the Operational System Should Be More Effective than the Demonstration System.

- . The operational system capabilities will reflect specification refinements made possible by advances in technology and the improved definition of RADC requirements.
- . Additional benefits are likely in some non-product areas and from system by-products.
- . Automated office system capabilities can also be used in conjunction with RADC management information and decision support activities.
- . RADC management and users are more knowledgeable about the use and misuse of automation.

## II. SUMMARY OF COST AND BENEFIT RESULTS

### 9. A COST BENEFITS ENVELOPE EMBRACES A RANGE OF ESTIMATES.



## II. SUMMARY OF COST BENEFITS RESULTS

### 9. AN ENVELOPE OF COST-BENEFIT RESULTS WAS CREATED BY USING ESTIMATE RANGES

First, the initial estimates of system benefits and system costs for a five year system were made on the basis of the LONEX experience. Then in a post-analysis, judgments were made about selected aspects of the system configuration and intended system use. Cost and benefit ranges were established based upon this analysis and were combined with the initial estimates to create an envelope of cost/benefit possibilities.

#### (1) Costs and Benefits Ranges Were Used to Describe the Cost Benefits Envelope.

- . A cost estimate range was established by comparing estimated costs of alternate system configurations to the "best estimate" of system cost. The office automation system cost range established for RADC is from \$18.5M to \$23.3M over a five year period.
- . A benefits estimate range was established by comparing judgements about the potential benefits of the operational system to the automation potential projected in other Air Force Organizations. Office automation at RADC is expected to yield between \$26.4 and \$41.6M worth of benefits over a five year period.

#### (2) Comparison of the Cost and Benefit Ranges Results in the Formation of the Cost/Benefits Envelope.

- . Under the least cost/maximum benefit condition (optimistic case) system payback could occur in two and a half years.
- . The payback for the maximum cost/minimum benefits condition (pessimistic case) is estimated to be four and one-quarter years.

III. KEY FACTORS FOR IMPLEMENTATION

### **III. KEY FACTORS FOR IMPLEMENTATION**

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#### **1. CERTAIN ORGANIZATIONAL CONDITIONS ARE KEY TO ACHIEVEMENT OF BENEFITS**

- **Appropriateness Of System Architecture And Design**
- **Balance Between Control And Use Of System Capabilities**
- **Adequate Training Concepts And Procedures**
- **Planning And Monitoring Implementation Activities**
- **Management Commitment**

### III. KEY FACTORS FOR IMPLEMENTATION

#### 1. THE SUCCESSFUL IMPLEMENTATION OF AN AUTOMATED OFFICE SYSTEM IS DEPENDENT UPON SEVERAL ORGANIZATIONAL FACTORS

- (1) The System Architecture and the Detailed Design are One Part of the Equation.
- (2) For Full Benefits to be Realized, A Balance of Centralized Control and Decentralized Use Should Be Struck.
- (3) Evolutionary Improvements Will Require Both Initial and Continual Training.
- (4) The Achievement of System Benefits Depends Upon Organizational Ability to Plan and Address Several Key Implementation Factors.
  - . Design and placement of system capabilities
  - . Establishment of approaches to facilitate the integration of system operations
  - . Development of training concepts able to support system evolution
  - . Conduct of implementation planning
  - . Implementation of effective monitoring of operations.
- (5) Success Assumes Full Top Level Management Support.

### **III. KEY FACTORS FOR IMPLEMENTATION**

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#### **2. THE DESIGN AND PLACEMENT OF CAPABILITIES SIGNIFICANTLY INFLUENCE SYSTEM APPLICATIONS AND THE PRODUCTIVITY GAINS**

- Well-documented Requirements Should Determine System Design
- Intended Applications Influence Placement Of Capabilities
- Integration Yields Organizational Synergism.

### III. KEY FACTORS FOR IMPLEMENTATION

#### 2. SYSTEM DESIGN AND DISTRIBUTION OF CAPABILITIES ARE CRITICAL FACTORS GOVERNING SYSTEM APPLICATIONS AND EVENTUAL CAPTURE OF SYSTEM BENEFITS

- (1) The Architecture and Design Should Be Based on Documented Organizational Requirements.
- (2) The Physical Placement of Equipment Within an Office Can Be as Important as the Equipment Ratio.
  - . Shared terminals can limit system use if their locations are inconvenient or require adjustments to the pattern of user work activities.
  - . Dedicated terminals can limit other's access to the system.
  - . An optimal sharing/dedicating ratio should be determined.
- (3) System Capabilities Should Be Positioned to Meet Specified Application Requirements.
  - . The changeover from manual to automated processes can be hastened by focussing upon selected applications.
  - . Determining the appropriate placement of equipment to support a variety of applications is generally beyond the capabilities of individual users and requires special types of support, expertise and coordination throughout the organization.
- (4) The Successful Integration and Application of System Capabilities Can Have a Synergistic Effect Upon the Organization.
  - . New uses will be found for familiar information.
  - . New types of information will become available.
  - . The motivation to acquire new skills and to try new applications is improved when the benefit is apparent to the user.

### III. KEY FACTORS FOR IMPLEMENTATION

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#### 3. INTEGRATION OF SYSTEM OPERATIONS REQUIRES A BALANCE OF CENTRALIZED CONTROL AND DECENTRALIZED USE

- **Centralized Control Is Necessary For A Well-Coordinated Implementation.**
- **Decentralized Use Encourages Innovation.**

### III. KEY FACTORS FOR IMPLEMENTATION

#### 3. PROCEDURES FOR SYSTEM USE SHOULD STRIKE A BALANCE BETWEEN SYSTEM CONTROL AND SYSTEM USE

For organizational changes to occur as rapidly and as efficiently as possible, it is important to plan for and control the change process.

- (1) Policy and Procedures for System Operations Should Be Centrally Controlled and Guided to Minimize Organizational Disruption and Permit a Well-Coordinated Approach to System Use.
  - . An internal working committee of an oversight group can prepare the organization to use system capabilities effectively.
    - Development of implementation guidelines
    - Identification and prioritization of system applications
    - Refinement of procedures leading to an optimal mix of manual and automated activities
    - Development of recommendations concerning equipment locations.
  - . Testing prior to full-scale implementation can help identify problems requiring corrective action.
    - The use of a small, working office test group can provide the "hands-on" experience necessary to ensure system capabilities and procedures are adequate.
    - The "fit" among the application, the automated capability, and existing procedures can be assessed and explored under manageable, real world conditions.

### **III. KEY FACTORS FOR IMPLEMENTATION**

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#### **INTEGRATION OF SYSTEM OPERATIONS REQUIRES A BALANCE OF CENTRALIZED CONTROL AND DECENTRALIZED USE**

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### III. KEY FACTORS FOR IMPLEMENTATION

(Continued)

(2) Establishment of a Set of Recognized Procedures Can Enable Software Changes To Be Made Without Damaging the Integrity of the System Design.

- . The modification of system capabilities should be predictable and accomplished according to standard procedures.
- . Users should be prepared for upcoming changes to fully understand how modifications will effect their work and the way the system operates.

(3) System Information and Data Bases Can Be Structured to be Centrally Managed and to Have Controlled File Storage.

- To facilitate consolidation of information for data and information processing requirements, identification keys used for the automated office system files should be consistent among users.
- Demonstration system data files should be consolidated to provide a transitional file structure able to be transferred to the operational system.
  - Demonstration system files can be consolidated into a smaller number of more structured data files.
  - Preservation of the demonstration system data files permits the creation of an initial operational system data base without an intensive keyboarding effort or allowing a three to five year period for natural accrual through system use.

### III. KEY FACTORS FOR IMPLEMENTATION

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#### INTEGRATION OF SYSTEM OPERATIONS REQUIRES A BALANCE OF CENTRALIZED CONTROL AND DECENTRALIZED USE

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### III. KEY FACTORS FOR IMPLEMENTATION

#### (4) The Use of System Capabilities Within Offices Should Encourage Development of Innovative Applications.

- . The maximum benefit of a system will not be achieved by simply overlaying electronic methods on existing work procedures; new ways of organizing and processing work should be explored.
- . The "best fit" of automated and manual operations can require the redesign of office procedures and a new division of responsibilities; or the development of software "bridges" to fill gaps interfering with a smooth flow of work; or the creation of application guidelines for different types of offices or personnel.
- . The lack of a coordinated approach can restrict system use to relatively simple, independent tasks requiring limited user interaction. Appropriate coordinated support for the development of new user applications should be provided.

### **III. KEY FACTORS FOR IMPLEMENTATION**

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#### **4. THE TRAINING REQUIRED FOR THE SUCCESSFUL IMPLEMENTATION AND USE OF OFFICE AUTOMATION SYSTEMS GOES BEYOND INITIAL SKILL TRAINING.**

- Applications Orientation Will Enhance Training Effectiveness.
- Organizational Support Is Critical.
- Evolutionary Training Concept Emphasizes Comprehensive Support.

### III. KEY FACTORS FOR IMPLEMENTATION

#### 4. DEDICATION TO BOTH INITIAL AND CONTINUING TRAINING IS ESSENTIAL FOR EFFECTIVE USE OF SYSTEM CAPABILITIES

- (1) Training Efforts Should Emphasize the Application of System Capabilities to Work Requirements.
  - . Classroom presentations, initial hands-on training and users' manuals and reference documentation can provide an initial understanding of basic system capabilities.
  - . Structured follow-up training efforts can enhance users' effectiveness in applying system capabilities to daily work activities.
- (2) The Organization Should Provide the Support Necessary to Ensure That Users Can Benefit From Training.
  - . The pressures of work make it difficult to set aside training time.
  - . The time required to accomplish work when first learning how to apply automated capabilities may be greater than the time required when using traditional methods. This may require temporary adjustments to office work routines.
  - . Personnel are more likely to fully exploit the features and capabilities of the system if they can easily access information and assistance they require.
- (3) The Training Concept Should Be Sufficiently Broad to Permit Comprehensive User Support as System Operations Evolve.
  - . Initial training is required for most personnel in basic system skills and recommended procedures.
  - . Specialized training is required for personnel having advanced applications requirements.
  - . Training in the use of customized RADC application software will be required as new software is developed and system applications mature.

### **III. KEY FACTORS FOR IMPLEMENTATION**

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#### **5. A PLAN THAT STRUCTURES THE IMPLEMENTATION APPROACH IS CRITICAL**

- **Implementation Issues Need To Be Resolved.**
- **Smooth Transition From The Demonstration To The Operational System Requires Planning.**
- **Organizational Commitment To Continual Assessment Of System Operations Can Be Valuable.**

### III. KEY FACTORS FOR IMPLEMENTATION

#### 5. A LONG-RANGE IMPLEMENTATION PLAN SHOULD GUIDE ORGANIZATIONAL PROGRESS

The development of an operational system design requires the balancing of work requirements, management information needs and existing and planned RADC automation resources. Equally important, however, is the requirement to provide a structured approach to implementation.

##### (1) The Implementation Planning Approach Should Accommodate the Resolution of System Issues.

- . Establishment of long range objectives permits the development of a phased implementation plan which brings high pay-off applications on line early.
- . An analysis of the priority of organizational applications can ensure consonance with long term organizational objectives for office automation.
- . An organizational approach can help ensure that system applications can be effectively implemented across the organization rather than in isolated pockets.
- . The focal point for the planning and coordination of activities can be prepared for project control activities.

### **III. KEY FACTORS FOR IMPLEMENTATION**

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#### **A PLAN THAT STRUCTURES THE IMPLEMENTATION APPROACH IS CRITICAL**

- Implementation Issues Need To Be Resolved.
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### III. KEY FACTORS FOR IMPLEMENTATION

#### (2) A Conversion Strategy Is Essential For Continued User Support During Transition to the Operational System.

- . Transition planning can help minimize disruption to organizational work processes as operations are transferred from the demonstration system.
- . Demonstrated progress is essential to maintaining continued user support and participation.
- . Continued use of the demonstration system should be supported.
- . Systematic efforts should be made to capitalize on existing experience.
- . Initiatives to gain additional experience through the use of the demonstration system should be made to permit operational system implementation issues to be more fully addressed.
- . Approaches to the development of application procedures can be tested.
- . Phase-out of duplicative manual processes should begin as soon as practicable.

### III. KEY FACTORS FOR IMPLEMENTATION

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#### A PLAN THAT STRUCTURES THE IMPLEMENTATION APPROACH IS CRITICAL

- Implementation Issues Need To Be Resolved.
- Smooth Transition From The Demonstration To The Operational System Requires Planning.
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### III. KEY FACTORS FOR IMPLEMENTATION

#### (3) Continual Measurement Can Provide Valuable Feedback to Management.

- . The evolution of the operational system can be monitored and documented on a routine basis to obtain the data required to control and manage the organizational change process.
  - Specific measures which are appropriate to established organizational goals should be identified.
  - Mechanisms should be established to routinely collect required data without relying upon special study efforts.
  - Regular assessments of the direction and rate of progress should be made by management.
- . Automated systems can be improved, their operations optimized, and the achievement of benefits maximized with appropriate management feedback.
  - Adequacy of system components for identified functional requirements can be assessed.
  - Patterns of system use can be monitored for indicators of system saturation requiring expansion of capabilities.
  - Customized, RADC-unique application software requirements can be identified to more effectively integrate, control, and manage the organization.

### **III. KEY FACTORS FOR IMPLEMENTATION**

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#### **6. MANAGEMENT COMMITMENT TO EFFECTIVE AUTOMATION MUST BE REAL**

- The Organization Will Follow The Leaders
- Learning Time Must Be Set Aside
- Hard Dollar Investments Are Required

## III. KEY FACTORS FOR IMPLEMENTATION

6. (1) Organizational Personnel Will Quickly Assess Top Level Commitment to the Project
  - . Managerial use of capabilities will encourage use throughout the organization.
  - . Management fluency in the language of automation and a practical experience base is imperative to resolution of issues.
- (2) Some Mission Time Will Need to Be Made Available for Learning
  - . At first the "new way" will take longer.
  - . The need to set wide specific time to learn is organizational-wide.
- (3) Future Benefits Depend on Today's Investment
  - . Specific budgets should be established early.
  - . Automation provides an opportunity to capitalize from productivity investment funding.

IV. CONCLUSIONS

## IV. CONCLUSIONS

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- **Office Automation At RADC Is Expected To Be Cost Beneficial**
- **Additional Non-Quantified Benefits Are Projected**
- **LONEX Provided An Effective Learning Base**
- **Further Short And Long Term Planning Is Required**
- **Success Is Directly Dependent Upon Management Commitment**

#### IV. CONCLUSIONS

### 1. AN OPERATIONAL OFFICE AUTOMATION SYSTEM CAN BE IMPLEMENTED AT RADC ON A COST BENEFICIAL BASIS

- (1) The Purchase of an Operational System For RADC Can Provide An Economically Rational Return on Investment.
  - . A purchased system utilized under maximum cost/minimum benefits conditions is predicted to yield a five year cost avoidance of \$3.1M in FY83 dollars (\$4.7M in inflated dollars).
  - . No quantified cost avoidance is projected for a leased system under maximum cost/minimum benefit conditions; alternative designs, however, might prove more cost-effective.
- (2) Benefit Potential Increases With Synergism and With Use of System Capabilities Beyond Traditional Office Automation.
  - . The effective integration of automated office system capabilities with information processing and data bases could increase the potential benefits.
    - Administrative support personnel could be relieved of some data entry tasks.
    - Professionals could more easily validate data when consistency with organization MIS data bases is critical.
    - Managers could have access to more timely data for decision making.
  - . The operational office automation system will provide a wide range of automated tools and the capability to store and recall data.
  - . The addition of customized system applications can effectively address labor intensive tasks in functional work areas such as contract preparation, source selection, post contract award activities, budget modeling and progress reporting.
- (3) The Potential for Implementing a Cost Beneficial System is Consistent With Findings In Selected Other Air Force Organizations.

## IV. CONCLUSIONS

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- Office Automation At RADDC Is Expected To Be Cost Beneficial
- **Additional Non-Quantified Benefits Are Projected**
- LONEX Provided An Effective Learning Base
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IV. CONCLUSIONS

2. THE OPERATIONAL SYSTEM IS EXPECTED TO YIELD VALUES BEYOND STRICTLY QUANTIFIABLE BENEFITS

- (1) The Majority of Demonstration System Users Were Affected in Positive Ways By the Use of Automation.
  - . The quality of output improved with the increased ability to more quickly retrieve and exchange information.
  - . The quality of output also improved with the ability to easily make additions and modifications to documents.
  - . The quality of work life improved for managers and professionals with the increased level of control and freedom which automation provided to them in the scheduling and distribution of their workloads.
  - . Administrative support staff experienced a reduction in work pressures and increased satisfaction with the quality of the work they produced.
  
- (2) The Value of Qualitative Benefits Can Exceed the Value of Labor Savings For Some Types of Organizational Activity.
  - . Establishing a broad based system of automated capabilities now positions the organization to capitalize on further developments later.
  - . Better and faster information capture and processing has a positive but non-quantifiable impact on organizational decision making.

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## IV. CONCLUSIONS

- Office Automation At RADC Is Expected To Be Cost Beneficial
- Additional Non-Quantified Benefits Are Projected
- **LONEX Provided An Effective Learning Base**
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#### IV. CONCLUSIONS

### 3. LESSONS LEARNED FROM THE LONEX DEMONSTRATION CAN LEAD TO FUTURE IMPROVEMENTS

- (1) The Design and Implementation of the Operational System Can Be Improved Through the Refinement of Requirements Specified For the Operational System and By Attention to Key Organizational Conditions.
  - . Automated text and data processing capabilities can be combined more effectively.
  - . Critical performance areas can be defined more clearly.
  - . The implementation of the operational system can be improved through better system placement, procedures and training.
- (2) The Future State of Office Automation Technologies Can Be Molded By The Ability to Detail Work and Communication Requirements Within an Office Environment.
  - . Office processes are comprised of many complex, often misunderstood, micro-systems of activity which have evolved to support traditional work requirements of a non-automated world.
  - . The adequacy of future office automation systems is dependent upon an increased understanding of the critical requirements of these processes and the ability to create and integrate appropriate technologies to enhance and optimize work processes in new ways.
- (3) Additional Lessons Can Be Learned From the LONEX Demonstration System During the Transition Period.
  - . Refined and expanded system applications can increase understanding of RADC functional requirements and can lead to improved selection criteria for the operational system and a more precise definition of software tailoring requirements.
  - . Capabilities distribution and placement issues can be explored more fully.
- (4) The Experiment Sets the Stage For An Evolutionary Approach Which Allows Users to Build Effective Systems Over a Period of Time.

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## IV. CONCLUSIONS

- Office Automation At RADC Is Expected To Be Cost Beneficial
- Additional Non-Quantified Benefits Are Projected
- LONEX Provided An Effective Learning Base
- **Further Short And Long Term Planning Is Required**
- Success Is Directly Dependent Upon Management Commitment

#### IV. CONCLUSIONS

#### 4. THE SUCCESSFUL IMPLEMENTATION OF AN OPERATIONAL SYSTEM AT RADC ENTAILS BOTH SHORT AND LONG TERM PLANNING

- (1) The Organization's Ability to Assimilate Change Will Be an Important Planning Factor.
  - The rate of technological advance is faster than the rate of organizational change.
  - The major constraint in the development of an automated office capability can be the organization's reluctance to change.
  - Organizations can support the change process by creating conditions that will facilitate the acceptance and use of the operational office system.
  - A significant period of time is required to plan and fully effect the changes required to capture the full benefits potential of automation.
  - The momentum achieved by the use of the demonstration system should be maintained.
- (2) Implementation Planning Will Be Required to Ensure That the Organization is Well Positioned for the Capture of Potential Benefits.
  - Preliminary implementation planning based on LONEX experience can be refined during the transition period as new lessons are learned and constraints become evident.
  - Planning should map out a reasonable course of action which emphasizes system operations and training concepts and also details concepts for system management and maintenance.
  - The long range development plan should prioritize long term, high payoff applications.

## IV. CONCLUSIONS

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- Office Automation At RADC Is Expected To Be Cost Beneficial
- Additional Non-Quantified Benefits Are Projected
- LONEX Provided An Effective Learning Base
- Further Short And Long Term Planning Is Required
- **Success Is Directly Dependent Upon Management Commitment**

5. Management Commitments to Automation Must Be Real:

(1) To New, Improved Ways of Doing Business

(2) To Learning

(3) To Investment

# MISSION

## Center for Developmental Studies

The Center for Developmental Studies is a research center that focuses on the study of human development. The center is committed to the advancement of knowledge in the field of developmental psychology and to the application of this knowledge to the improvement of human health and well-being. The center's research is conducted in a variety of settings, including the laboratory, the clinic, and the field. The center's research is interdisciplinary, involving the collaboration of psychologists, biologists, and other scientists. The center's research is also applied, with a focus on the development of interventions to improve the lives of children and adolescents. The center's research is supported by a variety of funding sources, including the National Institutes of Health, the National Science Foundation, and the Department of Education. The center's research is disseminated through a variety of channels, including peer-reviewed journals, books, and public outreach programs. The center's research is also used to inform policy and practice in the field of child development.

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