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AFRPL TR 65-157

RESULTS OF AFRPL TECHNICAL INFORMATION FACILITY SURVEY

A. A. Beltran & R. R. Scranton
Lockheed-California Company

TECHNICAL REPORT No. AFRPL TR 65-157

15 AUGUST 1965

AIR FORCE ROCKET PROPULSION LABORATORY
RESEARCH AND TECHNOLOGY DIVISION
AIR FORCE SYSTEMS COMMAND
EDWARDS, CALIFORNIA

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RESULTS OF AFRPL TECHNICAL INFORMATION FACILITY SURVEY

A. A. Beltran & R. R. Scranton

FOREWORD

This report was prepared by the Technical Information Center of the Lockheed-California Company, Burbank, California 91503 under USAF Contract AF 04(611)-10915. This work was initiated under Project No. P6801, "A Study of the Air Force Rocket Propulsion Laboratory Technical Information Services." The contractor's report number is LR 19040. The work was administered under the direction of the Air Force Rocket Propulsion Laboratory, Research and Technology Division, with Mr. D. E. Kistler/RPPR, project engineer.

The study, upon which this report is based, was conducted from 7 June to 13 August 1965. Project leader at Lockheed-California Company was Dr. H. Jacobs, Manager of the Technical Information Center. The study was conducted by Alfred A. Beltran and Robert R. Scranton with specialized assistance from Rocco Crachi the Chief Librarian and Max W. Mueller a Lockheed Development Planning Specialist. The manuscript of this report was released by the authors August 1965 for publication as an RTD Technical Report.

This technical report has been reviewed and is approved.

Dale E. Kistler
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ABSTRACT

This study is concerned with the technical information services required by personnel of the Air Force Rocket Propulsion Laboratory in support of their R & D activities. An on-site survey, consisting of personal interviews and investigation of the documentation and library situation, was conducted. Results indicate that increased documentation and library services are urgently needed. Specifically recommended are: (1) immediate construction of a centrally located classified vault, (2) rapid assimilation of 8000 scattered documents into a simple but effective automated retrieval system, (3) a more sophisticated system for currently received documents, (4) an active selection and acquisition program, (5) literature search services, (6) remodeling of AFRPL and Chemistry Lab. libraries, and (7) increase of library staff. Survey coverage, results and analysis are presented together with detailed recommendations.

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LIST OF ABBREVIATIONS

AFFTC	Air Force Flight Test Center, Edwards Air Force Base, California
AFOAR	Air Force Office of Aerospace Research
AFRPL	Air Force Rocket Propulsion Laboratory
AFSC	Air Force Systems Command
CPA	Chemical Propulsion Abstracts
CPIA	Chemical Propulsion Information Agency. Johns Hopkins University Applied Physics Laboratory. Silver Spring, Maryland
DDC	Defense Documentation Center
KWIC	Key Word In Context
KWOC	Key Word Out of Context
LPIA	Liquid Propellant Information Agency. Johns Hopkins University Applied Physics Laboratory. Merged with SPIA to form CPIA in December 1962
SDI	Selective Dissemination of Information
SPIA	Solid Propellant Information Agency. Johns Hopkins University Applied Physics Laboratory. Merged with LPIA to form CPIA in December 1962.

TAB	Technical Abstract Bulletin. Issued by DDC.
TSI	Telecomputer Services Inc.
WADEX	Word and Author Index

SECTION I

INTRODUCTION

The Air Force Rocket Propulsion Laboratory (AFRPL) of the Air Force Systems Command (AFSC) is a tenant of the Air Force Flight Test Center (AFFTC) at Edwards Air Force Base, California. Due to the nature of tests conducted by AFRPL and AFFTC, both sites are in isolated areas.

AFRPL is the rocket propulsion laboratory for the Air Force and conducts all applied research in this area. Consequently, in many areas of propulsion, AFRPL is ahead of the general state-of-the-art. However, to keep ahead, it is necessary for the AFRPL scientists and engineers to be constantly aware of propulsion, materials, and instrumentation advances under study or achieved elsewhere.

As a tenant of AFFTC, AFRPL's library and documentation services are provided by the host organization. These services appear inadequate, particularly in the area of documentation.

An on-site survey of technical information requirements, facilities, and services was made to ascertain whether the facilities and services met the requirements, and if not, to determine the specific areas of inadequacy, and what could be done to improve the situation.

Throughout the on-site survey and preparation of recommendations, it was necessary to consider AFRPL's unique situation.

1. AFRPL occupies a remote site near Rogers Dry Lake in the Mojave desert.

2. The AFFTC Technical Library, which furnishes library service to AFRPL personnel, occupies a similarly isolated site on the opposite side of Rogers Dry Lake.

3. AFRPL performs the applied research and development on rocket propulsion for the entire Air Force.

4. It is manned by a small but highly skilled group of scientists and engineers who must maintain a position in the forefront of propulsion technology.

These factors necessitate technical information support in excess of that required by a less remote and specialized group.

This report details the on-site survey coverage, analyzes results, and presents specific recommendations for library, documentation, and information services to meet requirements of AFRPL scientists and engineers.

SECTION II

SUMMARY

A study was made of the ways in which technical information services were needed to lend support to the R & D activities of AFRPL personnel. Results were then compared with actual services and facilities available and recommendations made for bringing the present situation up to the level required.

The study was conducted in two phases: (1) an on-site survey, and (2) analysis of findings developed in the survey. The on-site survey included: (1) interviews with AFRPL personnel, and (2) investigations of library and data processing facilities and services.

Informal, personal interviews were deemed most effective for determining actual fields-of-interest of AFRPL personnel, their technical information needs, methods currently pursued to obtain required information, and shortcomings of methods used.

Accordingly, interviews were arranged on the basis of AFRPL's organization chart and availability of personnel to be contacted. In this way, a fairly representative cross section was obtained while maintaining a flexible schedule. Data and responses were then correlated, analyzed, and evaluated.

The physical plant, collections, procedures, and services of the AFFTC Technical Library and its two branches at AFRPL were examined in detail. The completed study was then compared with the results of the personal interviews. This produced a fairly accurate assessment on which to base recommendations for expanded and improved technical information facilities and services.

To include the possibility of recommending an automated documentation system, the capabilities and facilities of AFRPL's Data Branch and Telecomputer Services Inc. (TSI) were investigated. TSI operates the data processing equipment at AFRPL under a service contract to the Air Force.

Results indicated that AFRPL personnel required increased technical information facilities and services in support of their research and development activities. Specifically recommended were: (1) complete redesign and rehabilitation of the AFRPL and Chemistry Lab. libraries, (2) strengthening of library staff and services, (3) construction of a centrally located classified vault and document processing area, and (4) establishment of documentation services based upon an automated retrieval system.

A title-based index was recommended for the documents on hand as a method of providing quick control over the presently scattered collection. It was proposed that currently acquired documents would include descriptive cataloging for more accurate selection.

Other recommendations included a reevaluation of the overall program after a year of operation and possible use of a controlled vocabulary system with keyword enhancement of bibliographic citations.

SECTION III

SURVEY COVERAGE

The on-site survey consisted of personal interviews to ascertain the technical information needs of AFRPL personnel, consultation with personnel to access present facilities and services, and detailed examination of present facilities to determine their adequacy and potential.

1. PERSONNEL COVERAGE

Every attempt was made to obtain a representative sampling in the personal interviews. In trying for as broad a spectrum as possible, individuals were interviewed even in units where information needs were unlikely. Unavailability of certain personnel during the two week on-site survey prevented complete realization of survey aims. However, such lapses were minimal. TABLE Ia shows personnel coverage.

In addition to the interviews, AFFTC, AFRPL, and TSI personnel were consulted about specific facts related to library procedures, construction details, and automated equipment. They provided information needed in developing workable procedural, remodeling, and automated retrieval recommendations.

2. INTERVIEW COVERAGE

Interviews were informal and from a half hour to an hour and a half in duration. Complexity of individual information problems determined length of interview. Though informal, every interview followed a definite pattern covering the topics shown in TABLE Ib.

3. FACILITY INVESTIGATION

Library and data processing facilities were studied to determine which technical information needs could be provided with present facilities, what additional facilities were indicated, and compatibility of retrieval system with data processing equipment.

a. Library Coverage

Facilities and services of the AFFTC Technical Library at Edwards AFB, AFRPL Library, and Chemistry Lab. Library were explored in detail. TABLE IIa indicates the areas covered.

TABLE I

PERSONAL INTERVIEW COVERAGE

a. Personnel Coverage

1.	AFRPL Scientists & Engineers Interviewed	
	a. Number Interviewed	24
	b. Average Length of Interview	1 hour
	c. Number of Organizations Represented	17
2.	Other Personnel Consulted	
	a. AFFTC	3
	b. AFRPL	8
	c. TSI	2
3.	Total Personnel Coverage	37

b. Interview Coverage

1. Function of Unit and Individual

2. Broad Subject Field of Unit

3. Specific Subject Areas of Individual

4. Information Problems in Carrying Out Functions

5. Technical Information Needs:
   a. Library Service:
      - Selection & Acquisition
      - Circulation
      - Reference
      - Literature Search
      - Interlibrary Loan

   b. Document Service:
      - Sources of Documents
      - Distribution & Storage
      - Retrieval & Use
      - Quantity on Hand & Monthly Growth

6. Suggestions & Comments

b. Data Processing Facilities

(1) Data Branch (RPFDP)

Besides overall capabilities of the AFRPL Data Branch, the possibility of utilizing the flexowriter tape produced in the AFFTC Technical Library cataloging process was considered. TABLE IIb indicates the areas investigated.

(2) Telecomputer Services Inc.

Available equipment and its capabilities were reviewed in general and specific application to possible retrieval systems for AFRPL's documents were examined in detail.

TABLE II

LIBRARY AND DATA PROCESSING FACILITIES INVESTIGATED

a. Library Coverage

Base Library - AFRPL Library - Chemistry Library

Areas Investigated

1. Physical Plan and Facilities
2. Staff & Functions
3. Collections
4. Procedures
5. Services

b. Data Processing Facilities

1. Data Branch (RPFDP)
   a. Programming of Flexowriter Tape
   b. KWOC Programming Possibilities
   c. Keypunching
   d. Thesaurus Compilation & Storage
2. Telecomputer Services Inc.
   a. Paper to Magnetic Tape Conversion
   b. Equipment for KWIC/KWOC Index

SECTION IV

SURVEY RESULTS

1. TECHNICAL INFORMATION NEEDS - STATISTICAL RESULTS

Technical information support required by AFRPL personnel in their R & D activities is shown in FIGURE 1 as a percentage of total interviewed. While the number of individuals involved produces only a generalized figure, a more accurate assessment of the situation is obtained by comparison with observed facts.

a. No Information Problem

Although 25 percent of those interviewed expressed no information problem, analysis of each situation indicates otherwise. Either their information problem is in an area outside the scope of the survey, the need is not immediately apparent, or requirements are being handled within the unit.

(1) Outside Survey Scope

Those concerned with maintaining collections of standards and specifications have several problems.

(a) Maintaining and up-dating collection

(b) Storage space for expanding collection

(c) Follow-up on standing orders since some revisions are never received

(d) Government Printing Office orders take too long under present system.

(2) Problem Not Apparent

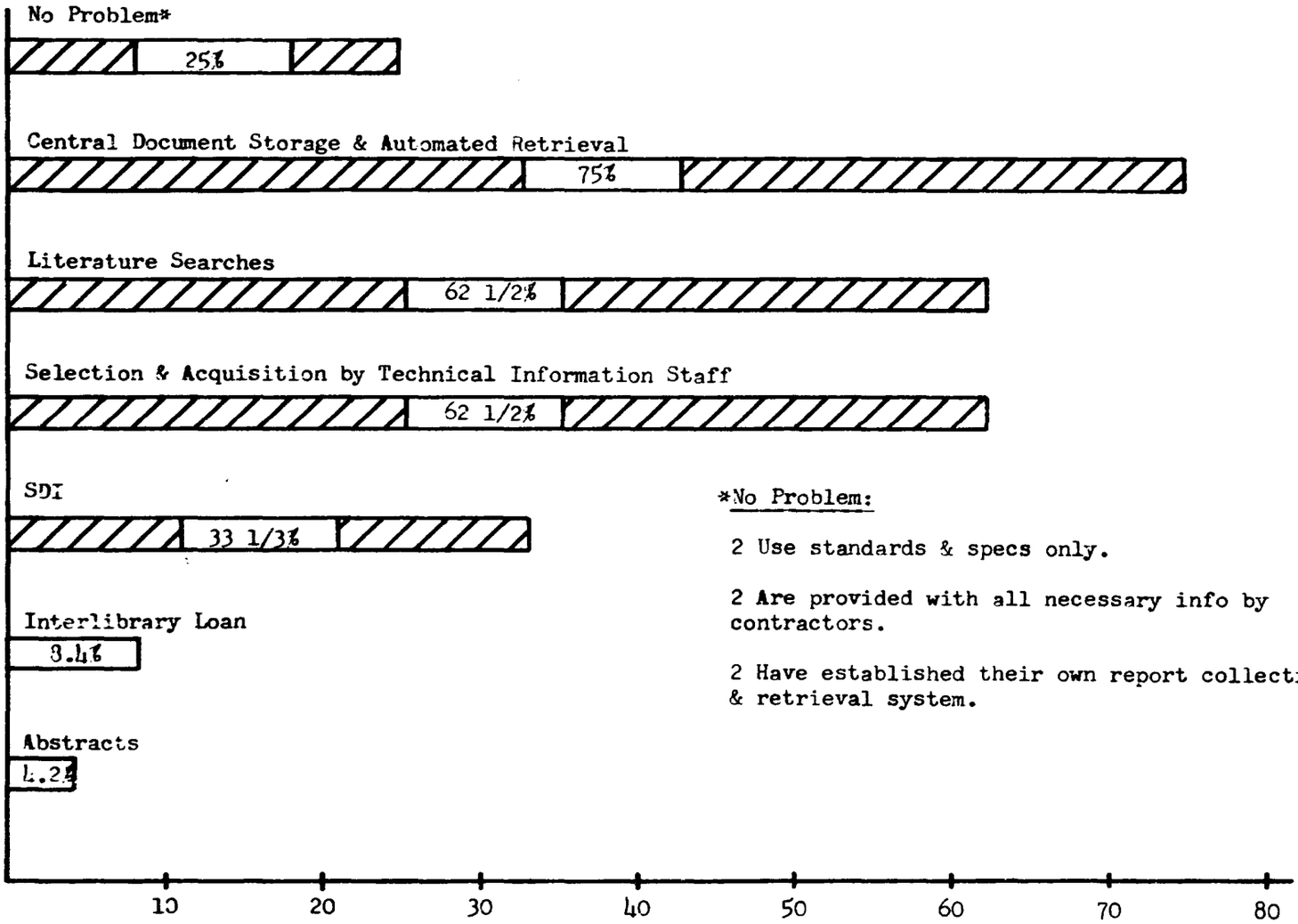
In some cases, all necessary technical information and literature searches were obtained from the contractors. Such information, though probably accurate

(a) May not represent all possibilities

(b) Offers no opportunity for comparison

(c) Literature search results may be selective.

(3) Requirements Handled Internally



*No Problem:

2 Use standards & specs only.

2 Are provided with all necessary info by contractors.

2 Have established their own report collection & retrieval system.

FIGURE 1

TECHNICAL INFORMATION NEEDS

DETERMINED BY INTERVIEWS

The documentation problem has, in some instances, been solved by establishing sizeable document collections and retrieval systems within small units. This poses several problems:

(a) Documents are available only to the unit concerned

(b) Time, effort and equipment are required to maintain these systems

(c) A number of small systems are not as economical or effective as one large one

b. Central Document Storage and Automated Retrieval

The vast majority (75%) expressed a pressing need for gathering all the scattered document collections into a centrally located, classified vault. This need was coupled with requirements for an effective automated retrieval system and frequent notification of new documents added to the collection (accession lists).

It is felt that those with no apparent problem and those whose requirements are being handled internally should be included in this requirement while those with no documentation need should not be counted at all. Therefore, 100% of the personnel depending upon documentation support require a centralized document collection and automated retrieval system.

c. Literature Searches

Complete literature searches were desired by those expressing this need. Specifically English and foreign language articles, theses, technical papers and proceedings; classified and unclassified documents in the AFRPL scattered collections; and documents listed in the NASA STAR and DDC TAB were desired as coverage on each search.

d. Selection and Acquisition by Documentation Staff

It was generally felt that when a document was required it should be on hand, completely processed, and ready for loan. Most scientists and engineers had no time to scan the various document announcement media, select the documents they might require in the future, and request them. They believed this function rested more appropriately with the documentation staff.

A pilot study was made to determine the number of documents that would be selected and acquired by the documentation staff. Random issues of the DDC TAB and both the classified and unclassified NASA STAR were scanned for items within AFRPL's fields of interest.

The number of pertinent items also appearing in Chemical Propulsion Abstracts were subtracted. Results of the study indicate that 2800 additional items would be acquired each year, arriving at an average rate of 11 per day.

e. Selective Dissemination of Information (SDI)

SDI is a system by which an individual is automatically notified that a document within his field of interest has been received. He then has the option of keeping the notification for future reference or requesting loan of the document.

The service is usually based upon an efficiently operating, sophisticated automated retrieval system. AFRPL will not have such a system in operation for several years, at which time the need for SDI can be reevaluated.

It is quite possible that the requests for SDI were prompted by the lack of accession lists. Lists based upon a permuted title index will probably negate the SDI requirements.

f. Abstracts

Misleading titles prompted the request for inclusion of abstracts in a retrieval system printout. Abstracting is a time-consuming process, even copying existing abstracts from CPIA adds 15 minutes per document to a retrieval system.

It is believed that keyword enhancement of titles and bibliographic citations will provide the benefits of abstracts without the additional cost.

g. Library Service

(1) Interlibrary Loan

Time in processing the request and in transit was thought to be too long, leaving only a few days for use of the borrowed item.

(2) Selection and Acquisition by Library Staff

This requirement for books is the same as that for documents covered in 1.d above.

(3) Library Handbook

AFRPL personnel considered the library as one of their research tools. To use this tool as effectively as possible they want to know what services are available and how to obtain these services.

They felt that a guide to the library or library handbook would enable them to obtain maximum benefit from the service offered.

2. TECHNICAL INFORMATION NEEDS - SPECIFIC COMMENTS

Specific comments made by AFRPL personnel during the interviews add specificity to the statistical summary. Representative statements are therefore reproduced below.

a. Central Document Storage and Automated Retrieval:

(1) AFRPL spends over $40 million annually for R & D and then is unable to retrieve the information for which it has paid.

(2) A nearby, central vault area is needed as a central storage point for the many documents now in individual files.

(3) A sophisticated automated retrieval system is necessary to overcome the manpower problem.

(4) In addition to easily accessible storage, a reliable retrieval system is required.

(5) Many of the reports in our eight security files should be released to a centrally located, nearby vault.

(6) We have between 3000 & 4000 uncataloged reports from which we cannot find required information.

(7) We have no report problem. We maintain five cabinets of reports filed under our own system.

b. Literature Searches:

(1) A literature back-up is required by us in defining the work a contractor must do.

(2) We need literature searches covering the AFRPL scattered collection; DDC and NASA documents, and published literature. However, we have no time to conduct a search.

(3) We are not familiar with literature search techniques and therefore would like to rely on a specialist for this service.

(4) Since it is up to the contractor to justify his stand, it is he who must search the literature in preparing the proposal and carrying out contract requirements.

c. Selection and Acquisition:

(1) Someone on the Library Staff should systematically select books and reports in AFRPL's areas of interest so that when an item is required it is already in the collection.

(2) The 30 to 90 days required to obtain a book is far too long. It should be available in the library when needed.

d. Selective Dissemination of Information (SDI):

(1) We have no contracts and therefore receive no reports. It is only by accident we learn of what's going on in our area of interest.

(2) Concerning CPIA distribution, while we receive directly the reports in our field, we require knowledge of the reports received in the other areas.

(3) We are unable to keep abreast of the subject areas in which we are doing important work.

(4) Current information is obtained through personal contact and at annual conferences.

e. Interlibrary Loan:

(1) Borrowing from other libraries (UCLA, USC, etc.) is inadequate because so much time is taken in transit that only two or three days remain in which to use the borrowed item.

f. Abstracts:

(1) Comprehensive abstracts are needed since titles are so often misleading.

3. LIBRARY SITUATION

a. Services

Most of the library services required by AFRPL personnel are already available. However:

(1) AFRPL personnel are not aware of the available services.

(2) They are not familiar with the procedure for obtaining these services and using them effectively.

(3) If the library were used effectively, the library staff and facilities would soon become overburdened. Since, as a general rule, 75% of a staff's effort is devoted to selection, acquisition, cataloging, shelving, and filing, with only 25% of the manhours left for service:

(a) A backlog would soon result, seriously effecting the collection and service.

(b) Eventually service would have to be curtailed radically to eliminate the backlog.

(4) Some services, such as interlibrary loan, could be expedited by minor changes in procedure.

b. Collection

The AFFTC Technical Library collection, available to AFRPL personnel through the AFRPL Library, is exceptional.

(1) The collection of indexes and abstracts is superior in scope to that found in most industrial libraries.

(2) The periodicals collection of 735 titles is twice that of missile libraries serving twice the number of users(2). In effect this makes the collection four times that of missile libraries serving an equal number of users.

(3) The book collection is also effectively four times that of missile libraries serving an equal number of users(1).

(4) Reference collection is well selected and extensive.

The remote location makes the library's excellent and sizeable collections necessary. Isolated as it is from such other libraries as those of UCLA, USC, and the industrial libraries of the Los Angeles area, it must be self-sufficient.

c. Staff

Composed of three professional librarians, two library assistants, a steno-clerk and one airman-administrative clerk, the library staff is about normal for the number of personnel served. Based upon size of the library's holdings (collections), however, number of staff members is less than half the number needed. A high level of efficiency in staff utilization enables library personnel to almost keep up with the workload.

d. Facilities

Salient facts are presented in TABLE III. Of special concern in the on-site survey were available space and types of equipment.

(1) Available Space

(a) AFFTC Technical Library - While of no direct concern to this study, space is critical and inadequate for the collection.

(b) AFRPL Library - Available space is adequate for present collection and functions. However, the area cannot be effectively used and has no provision for classified document storage.

TABLE III

LIBRARY FACILITIES AND STAFF

AFFTC TECHNICAL LIBRARY

Area - 2,680 sq. ft.

Collection - 1. Books - 16,579
2. Periodical Titles - 735
3. Reports - 57,058

Staff - 6 civilians, 1 airman (includes librarian in AFRPL Library)

AFRPL LIBRARY

Area - 1,576 sq. ft.

Collection* - (Approximate figures)
1. Books - 5,000
2. Periodical Titles - 330
3. Reports - 4,000
4. Tech Data - 2,000

Staff - 1 civilian professional supplied by Base Library

CHEMISTRY LAB. LIBRARY

Area - 386 sq. ft.

Collection* - (Approximate figures)
1. Books - 900
2. Periodical Titles - 30
3. Reports - 1,000 (includes some misc. material)

Staff - 1. Member of Lab. staff spends 1 hr. each day on routine problems.
2. Research Chemist handles book selection & binding.

Services - Limited, user must take care of own needs.

---

*NOTE: The AFRPL and Chemistry Lab. Library collection statistics are included in the AFFTC Technical Library totals.

(c) Chemistry Lab. Library - The available space is inadequate unless the library is allowed to expand into Room 108. It has the advantage of being close to the library users.

(2) Equipment

Overall library equipment is inadequate, mismatched, and non-standard.

4. DOCUMENTATION SITUATION

a. Source of Documents

(1) AFRPL Memorandum Reports generated in-house at the rate of approximately 50 per year.

(2) Technical Documentary Reports generated in-house at the rate of approximately 25 per year and by contractors at about 250 for an annual total of 275.

(3) Chemical Propulsion Information Agency (CPIA) automatic distribution brings in approximately 250 per month or an annual total of 3000.

(4) Individual document requests processed through the AFFTC Technical Library account for an estimated 1275 a year.

(5) Documents on hand number approximately 8000.

b. Present Situation

Current documents are distributed directly to the individuals concerned. No record is kept of the documents received nor of their location. Since the documents are not cataloged and are scattered in safes throughout AFRPL offices:

(1) Maintenance of files is expensive

(2) Accessibility is very limited

(3) Retrieval of information is relatively impossible

Information obtained in the personal interviews was proven accurate by conditions observed in the library survey.

SECTION V

LIBRARY SYSTEM RECOMMENDATIONS

It has been determined that AFRPL scientists and engineers clearly require a readily accessible source of pertinent scientific and technical information in the form of books, periodicals, and reports, as well as enhanced associated library services. This requirement can be met only if sufficient personnel, space, and equipment are available.

Recommendations for the library units are therefore directed toward establishing functional units capable of satisfying these requirements when supported by adequate staff.

The following action is advisable:

1. Increase utilization of existing floor space
2. Obtain additional space as required
3. Establish a centrally located classified storage area
4. Improve and expand study areas
5. Provide adequate equipment to accommodate collection expansion.

The detailed program which follows provides required library facilities and services at a minimum cost:

1. FACILITIES AND EQUIPMENT

a. AFFTC Technical Library

While the base library is not within the direct scope of this survey, a brief assessment has been made. Among its advantages are: (1) superior index and abstract collection, (2) a well selected and extensive reference collection, and (3) effective utilization of personnel and equipment.

Disadvantages include remoteness of location and lack of available floor space.

b. AFRPL Library

(1) Status of Existing Library

The present AFRPL Library as shown in FIGURE 2 has advantages

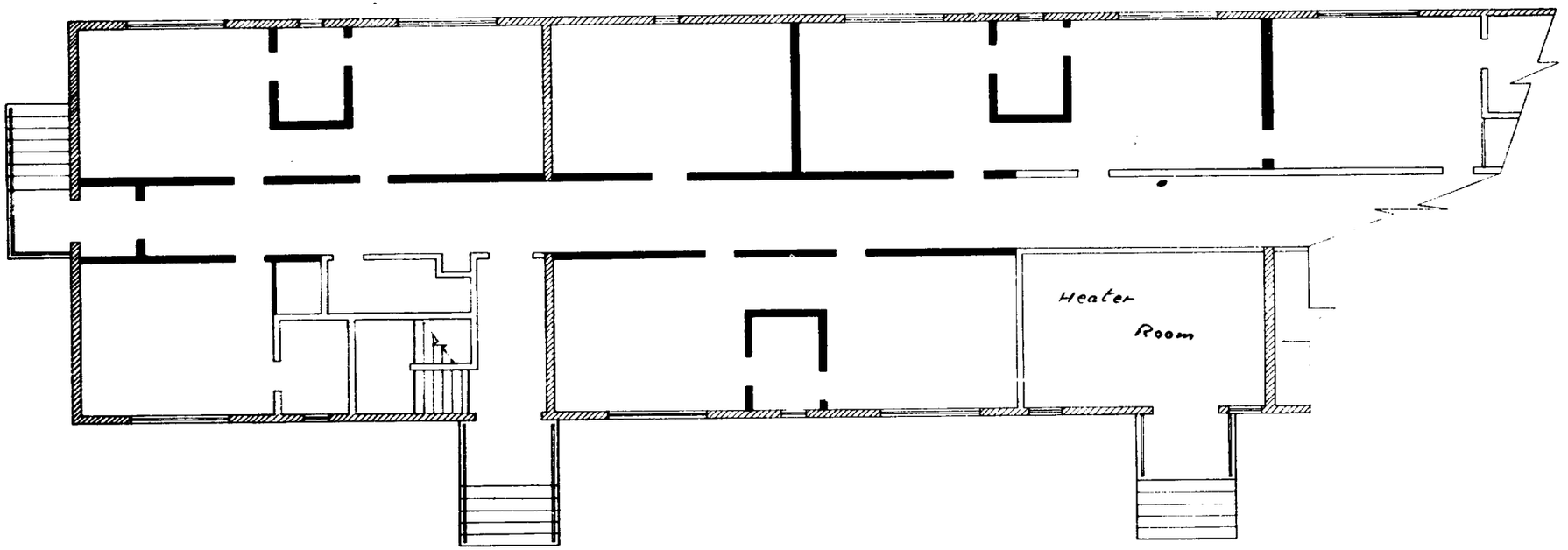


FIGURE 2. AFRPL LIBRARY - EXISTING FACILITIES

which are limited, but nevertheless important. The area of 1,576 sq. ft. is adequate to provide the required services and house the collection. The library also has at its disposal the services and facilties of the AFFTC Technical Library.

Disadvantages of the existing library are, however, critical. Complete utilization of the floor space is impossible because of the arrangement of partitions. This necessitates an equipment arrangement which decentralizes the collection and makes it impossible for the librarian to provide adequate service. Lack of a centrally located classified storage area decentralizes document handling and prevents effective retrieval and use of information.

A review of the collection indicates that it is inadequate to meet the needs of AFRPL personnel served. This is the result of insufficient selection and acquisition by the small library staff.

(2) Recommended Changes

(a) It is recommended that existing partitions, as indicated by a solid line in FIGURE 2, be removed. This will open up the area and increase the usable space to 2,455 sq. ft. Flexibility in arrangement of library equipment is provided and space for document storage, processing, material storage, and rest room facilities results.

In conjunction with removal of partitions, lighting units must be added as required for recommended levels of illumination in the various areas. (2) Plumbing fixtures will have to be removed and outlets capped. False ceilings are to be removed as required.

(b) To provide a classified vault area for the document collection a concrete block partition is needed as indicated in FIGURE 3. Steel plate covering for the ceiling is required to meet security regulations. Access to the vault will be through a standard vault door; windows will be barred to prevent unauthorized access.

(c) In addition to these structural changes, the following steps are recommended:

New asphalt tile installed to provide uniform floor covering

Complete repainting to cover scars left by remodeling and to create an atmosphere conducive to library use.

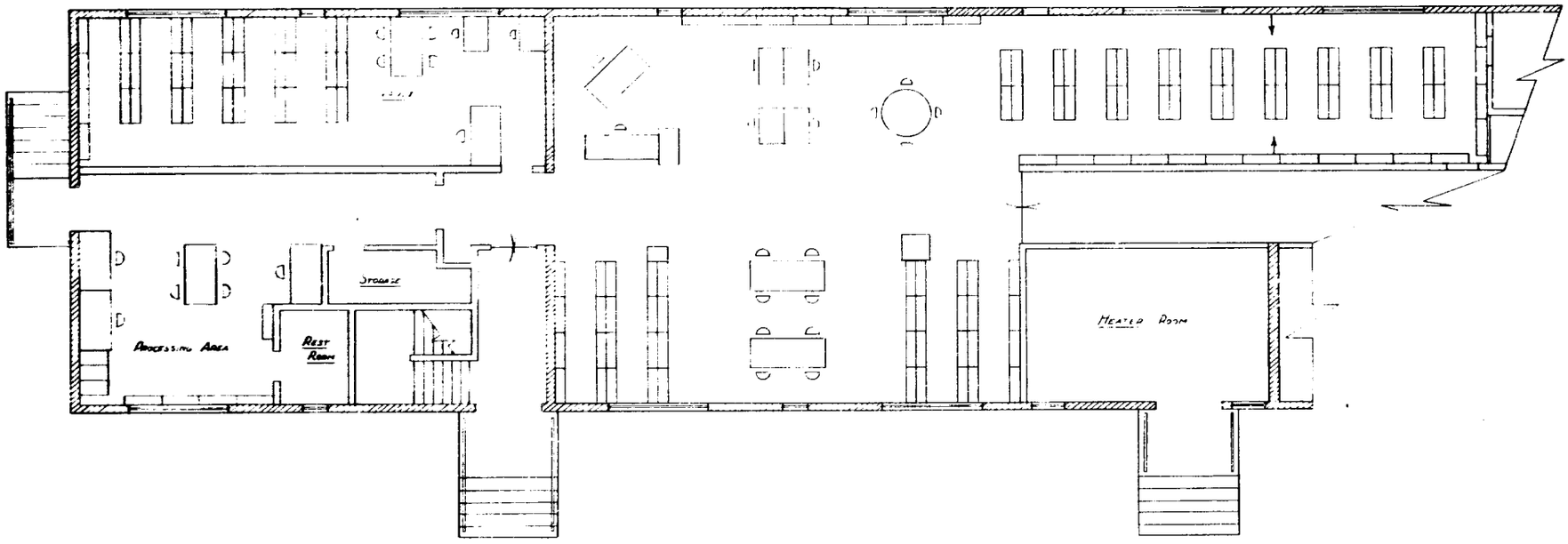


FIGURE 3. AFRPL LIBRARY - RECOMMENDED REMODELING

(3) Costs for Changes

Costs for the recommended alterations are given below. These are necessarily average figures and will fluctuate in relation to time work is performed, type of contract, and quality of materials.

(a) Removal of partitions and other necessary work to open up library service area, including removal of one bearing wall, installation of an "I" beam and necessary renovation $8,500

(b) Renovation and preparation of processing and storage area $2,500

(c) Construction of a storage vault and necessary renovation $7,000

This amounts to approximately $18,000 for renovation of the AFRPL Library.

(4) Equipment Utilization

(a) Plan #1

It is recommended that, if at all possible, new equipment be used in the library and vault area. Existing equipment will be suitable in the processing area. Certain items such as the circulation desk and card catalog will fit in well with new furniture and need not be replaced.

This equipment plan will unify library operations, decrease mutilation of books and periodicals, and improve overall appearance. The following equipment is recommended. In each case approximate costs are given.

Description	Approximate Cost
Double-faced metal book shelving with 5 adjustable shelves per face, canopies and end panels included. Quantity required is 34 units consisting of 12 initial and 22 additional	$3,028.00
Wall-type metal book shelving with 5 adjustable shelves per unit canopies and end panels included. Quantity required is 24 units consisting of 5 initial and 19 additional	$1,103.00

Description	Approximate Cost
Double-faced metal report shelving with 6 adjustable shelves and 5 dividers per shelf, end panels included. Quantity required is 15 units consisting of 5 initial and 10 additional	$2,525.00
Wall-type metal report shelving with 6 adjustable shelves and 5 dividers per shelf, end panels included. Quantity required is 5 units consisting of 1 initial and 3 additional	$ 400.00
Reading tables, wood 60" x 42" x 29" 3 ea @ $140.00	$ 420.00
Desk, metal, standard 2 ea @ $160.00	$ 320.00
Steno chairs 2 ea @ $45.00	$ 90.00
Wood chairs, armless with padded back 18 ea @ $45.00	$ 810.00
Executive chair 1 ea	$ 65.00
Upholstered arm chairs 4 ea @ $165.00	$ 660.00
Book truck, wood 1 ea	$ 135.00
Round 48" reading table 1 ea	$ 202.00
Individual wood study tables with plastic top 6 ea @ $126.00	$ 756.00
Library charge-out desk 1 ea	$ 393.00
15-Drawer catalog unit 1 ea	$ 250.00
Discharging truck for vault 1 ea	$ 280.00

Description	Approximate Cost
Microfilm Reader-Printer 1 ea	$ 800.00
Microfiche storage cabinet with 9 two-compartment drawers 4" x 6" 1 ea	$ 324.00
Stack stools 6 ea @ $25.00	$ 150.00

The approximate cost of this equipment plan is $12,711.

It is recommended that the following color guides be utilized:

all metal - light beige finish

all wood - light natural finish

all upholstering to be pastel colors

(b) Plan #2

This plan utilizes existing equipment in the library proper and processing area. The only additional equipment would be in the vault. Report-type shelving must be used in the vault as reports become unmanageable in any other type of shelving. Existing report shelving is currently used for books. Since some parts are no longer available, it is unsuitable for vault use.

Cost is reduced approximately $8,776 by this plan. However it also greatly reduces study facilities, eliminates the space saving microfiche reader-printer, and does not provide uniform equipment.

Required equipment is listed below:

Description	Approximate Cost
Double-faced metal report type shelving with 6 adjustable shelves and 5 dividers per shelf, end panels included. Quantity required is 15 units consisting of 5 initial and 10 additional	$2,525.00
Wall-type metal report type shelving with 6 adjustable shelves and 5 dividers per shelf, end panels included. Quantity required is 4 units consisting of 1 initial and 3 additional	$ 400.00

Description	Approximate Cost
Reading table, wood 60" x 42" x 29" 1 ea	$ 140.00
Individual study tables 2 ea @ $126.00	$ 252.00
Steno chair 1 ea	$ 45.00
Wood chairs, armless with padded back 6 ea @ $45.00	$ 270.00
Stack stools 6 ea @ $25.00	$ 150.00
Metal typist desk 1 ea	$ 160.00

Approximate cost of this equipment plan is $3,942.

Color recommendations are the same as Plan #1.

c. Chemistry Lab Library

(1) Status of Existing Facilities (FIGURE 4).

A centralized location and current collection are the key advantages.

Prime disadvantages are: Inadequate space; use of non-standard shelving; and shortage of any type of shelving.

(2) Recommended Changes

(a) Plan #1

This plan calls for the use of existing floor space and equipment supplemented with new shelving units. FIGURE 5 illustrates this plan.

The additional equipment required follows. In each case approximate costs are given.

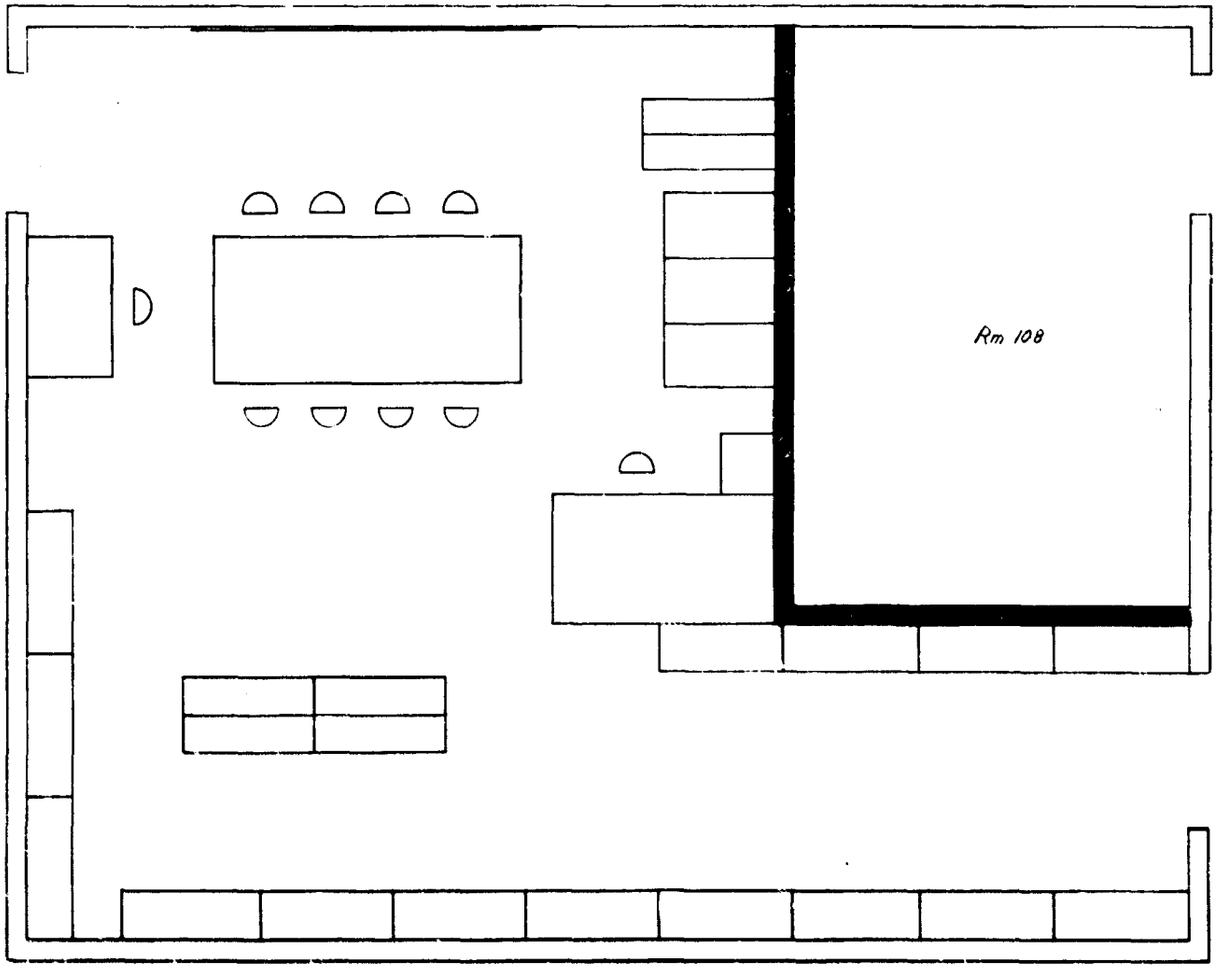


FIGURE 4. CHEMISTRY LABORATORY LIBRARY - EXISTING FACILITIES

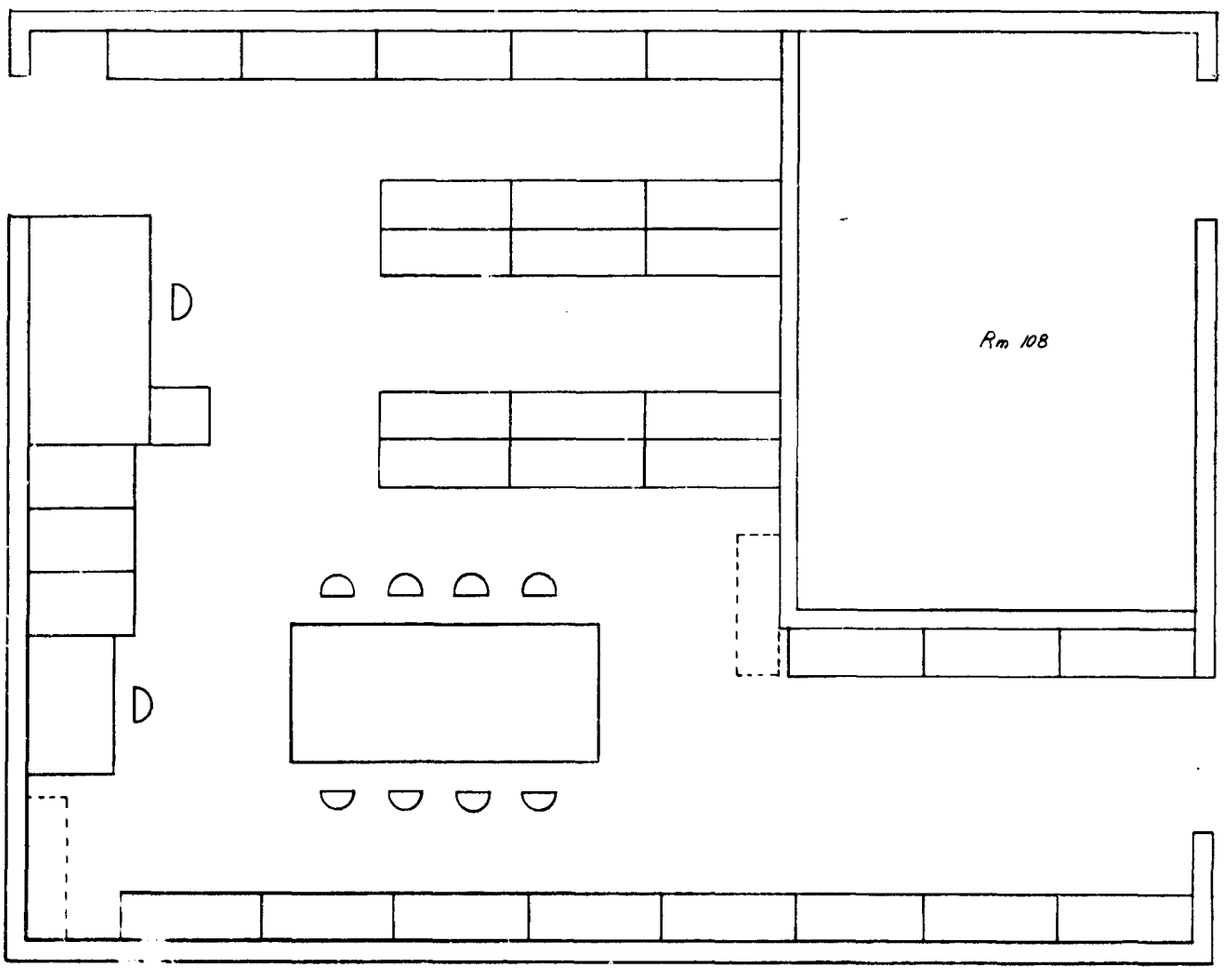


FIGURE 5. CHEMISTRY LABORATORY LIBRARY - REMODELING PLAN #1

Description	Approximate Cost
Double-faced metal book shelving with 5 adjustable shelves, canopies and end panels included. Quantity required is 3 units consisting of 1 initial and 2 additional	$ 286.00
Wall-type metal book shelving with 5 adjustable shelves, canopies and end panels included. Quantity required is 1 initial unit	$ 76.00

This plan costs approximately $362.00 and will provide for an estimated 2½ years expansion.

(b) Plan #2

Plan #2 calls for removal of partitions indicated by heavy lines in FIGURE 4. This increases the library area by 125 sq. ft. and provides expansion space for approximately seven years. Estimated cost of partition removal is $200.00.

For improved utilization of space and management of the book collection it is recommended that all shelving used be library-type. Equipment required is indicated below. In each case approximate costs are given:

Description	Approximate Cost
Double-faced metal book shelving with 5 adjustable shelves per face, canopies and end panels included. Quantity required is 14 units consisting of 3 initial and 11 additional	$ 595.00
Wall-type metal book shelving with 5 adjustable shelves per unit, canopies and end panels included. Quantity required is 16 units consisting of 3 initial and 13 additional	$ 682.00

Approximate cost of this preferred plan (FIGURE 6) is $1,877.00.

(c) Plan #3

Use existing equipment supplimented by new library-type shelving to conform to FIGURE 6. This plan provides the same capacity as Plan #2. However, shelving problems will still exist. Equipment required follows. In each case approximate costs are given.

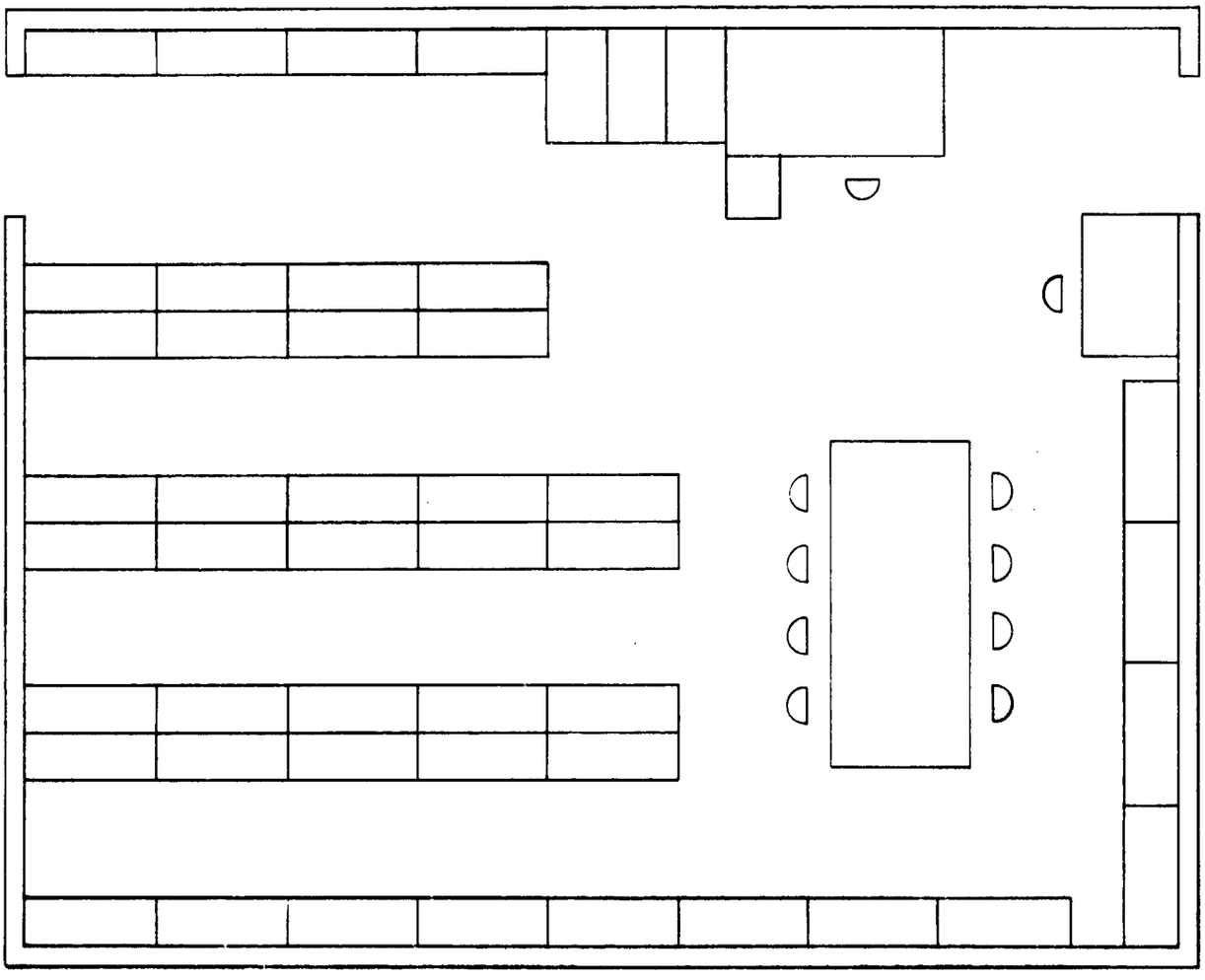


FIGURE 6. CHEMISTRY LABORATORY LIBRARY - REMODELING PLAN #2

Description	Approximate Cost
Double-faced metal book shelving with 5 adjustable shelves per face, canopies and end panels included. Quantity required is 11 units consisting of 3 initial and 8 additional	$ 794.00
Wall-type metal book shelving with 5 adjustable shelves per unit, canopies and end panels included. Quantity required is 1 initial unit	$ 75.00

Approximate cost of this plan, renovation included, is $1,069.00.

2. SERVICES

a. Selection and Acquisition of Materials

A collection should contain material completely processed and ready for loan before it is required. In other words, the librarian should have anticipated a large percentage of the needs of the users before they occur. In the past, this has not been possible in the AFRPL library because of the librarian's workload. Although the technical people will often anticipate their own needs, they cannot do this as a part of their regular work schedule. Therefore, responsibility must evolve upon the library where an active program of selection and acquisition within the AFRPL fields of interest should be undertaken.

The following advantages ensue: (1) books, technical papers, and proceedings are available when needed, (2) collection will contain more up-to-date material, (3) long delays in acquiring specific publications are avoided, and (4) accession lists offer greater selection. There are, of course, two penalties to be paid: (1) additional personnel are required, and (2) collection expands rapidly and requires more shelving.

b. Interlibrary Loan

Existing procedures do not meet requirements of AFRPL personnel. The borrowed item is so long in transit that little time remains for actual use. This is caused by remoteness of AFRPL from major lending institutions coupled with processing of requests and delivery of material through the AFFTC Technical Library.

Increased use of borrowed material might be obtained by:

(1) Processing of requests and receipt of material by the AFRPL Library.

(2) Encouraging immediate photo-duplication of required portions of the borrowed item.

(3) Provide AFRPL personnel with library cards and photo-duplication coupons for the most used, accessible libraries. This will enable them to visit these libraries and personnaly bring back the borrowed items and photocopies.

As the library collection increases through an active selection and acquisition program, need for interlibrary loans should diminish.

c. Publicizing Services

The library exists to serve the scientists and engineers in their research problems. To ensure proper use of the library, the librarian must make known on a continuing basis the services offered, new materials received, and how to use effectively both services and materials. It is recommended that an information bulletin be issued regularly to keep personnel informed of recent acquisitions, library services and procedures. Wide distribution of this bulletin is recommended.

d. Increased Staff

Clerical assistance is needed at both AFRPL and Chemistry Branch Libraries. The addition of clerical personnel is essential for implementation of the service recommendations. Employment of a minimum of one clerical person is recommended for the AFRPL Library. This clerk should also spend a portion of each week serving the Chemistry Laboratory Library.

3. SUMMARY OF RECOMMENDATIONS

The following recommendations are made:

Complete redesign and rehabilitation of the AFRPL Library.

Procurement of equipment according to either Plan #1 or #2. Plan #1 is preferable.

Redesign and rehabilitation of the AFRPL Chemistry Laboratory Library according to Plans #1, #2, or #3. Plan #2 is preferable.

Addition of a minimum of one clerk to the AFRPL Library staff to service both libraries.

Introduction of an active program of selection and acquisition of library material.

Initiation of minor changes in interlibrary loan procedure.

SECTION VI

DOCUMENTATION SYSTEM RECOMMENDATIONS

The responsibilities and functions of AFRPL scientists and engineers clearly demonstrate the need for an adequate document collection representing their areas of interest. Such a collection should be stored in a nearby security vault and the documents made accessible through an effective retrieval system.

Documents in the collection would consist of the reports now scattered throughout the various AFRPL offices, those currently received on automatic CPIA distribution, and those generated as a result of in-house and contractual research. For completeness it should also contain documents now obtained on individual requests through the AFFTC Technical Library and documents actively selected and acquired by a documentation staff.

Once a classified storage area is established and provided with the necessary staff, the documents on hand and those currently received can be entered into the retrieval system. To be effective, the retrieval system must satisfy the requirements of the user (AFRPL scientist or engineer) and the documentation staff.

The user requires:

1. Accuracy - Retrieval of all relevant material and avoidance of non-relevant items.

2. Completeness - Sufficient information concerning each item to enable accurate selection.

3. Speed - Immediate, on-the-spot printout.

4. Convenience - Results timed to fit into the user's schedule.

5. Browsing Capability - Provision for scanning through unrelated topics at random.

The documentalist requires:

1. Versatility - Freedom to enhance the system capability as demand increases.

2. Convenience - Simple and direct operation.

3. Compactness - Small and quiet.

4. Independence - The system should be assisted but not limited by the machine.

5. Economy - Minimum cost for value received.

These requirements are met by the recommended system.

1. FACILITIES AND EQUIPMENT

a. Classified Storage Vault

A classified storage vault and adjacent processing area occupying a protion of the present AFRPL Library area is recommended. Layout and costs were covered in SECTION V. This vault is capable of housing a collection of approximately 28,500 documents while comfortably seating 6 users and a member of the documentation staff. Document capacity can be increased to 48,700 by replacing the reading area with shelving.

The processing area provides for an additional three members of the documentation staff, automated processing equipment, and storage of supplies.

Only time and actual use can determine the most effective layout of the vault and processing area. Therefore, while the recommended layout is satisfactory for several years, it is designed to provide for many variations to the basic plan. This enables rearrangement of facilities to meet practically any requirement that may develop over the years.

b. Vault Furnishings

Open shelf filing is one of the most economical methods for document storage. Cost per filing inch is 25% to 50% less than for filing cabinets. Floor area required is approximately 40% less than for filing cabinets. Locating a desired item is 20% to 35% faster as is removing and replacing documents. (3)

However, with approximately 120 documents per shelf, removing and refiling documents is more difficult than in filing cabinets unless specialized report-type shelving is used. This equipment is specified in SECTION V as the recommended plan.

c. Documentation Equipment

Choice of equipment depends on documentation requirements. AFRPL has essentially two types of requirements. One concerns approximately 8000 documents on hand. The other is related to the documents received each day.

The documents on hand are intended to be absorbed gradually into the collection with a minimum of clerical effort and practically no professional supervision. Documents received daily on automatic distribution or by specific request must be processed and forwarded to designated personnel without delay.

These requirements suggest the following criteria for selection of the machine for producing input to the TSI equipment:

1. Documents do not leave the processing area

2. Information is obtained directly from the document

   a. Worksheets, 80 column or otherwise, are not necessary.

3. Text to machine language conversion takes place in processing area.

   a. Documentation staff requires no knowledge of conversion process.

4. Machine should be compact and quiet

5. Minimum operator training

6. Output should be directly usable as input to TSI equipment

   a. No punched tape to magnetic tape conversion

   b. No punched card to magnetic tape conversion

Equipment meeting these criteria is available in two different types:

1. With standard typewriter keyboard

2. With a version of the keypunch keyboard.

Both systems convert the typed or punched strokes into pulse patterns on magnetic tape. However, compatibility with the TSI equipment requires a 1/2 inch tape and some of the machines use a 1/4 inch tape. It is well to consider both types since keypunch training time may be offset by desirable features not available on the typewriter keyboard machines.

Purchase cost ranges between $7,000 and $9,500 depending on machine and model. Rental ranges between $115 and $145 per month plus maintenance. Rental is recommended over purchase because, with the rapid advances being made, the purchased machine will become obsolete before a reasonable return on the investment is realized. New techniques will scan typewriter produced lists and convert them to magnetic tape. It may be well to consider such a system.

2. INDEXING DOCUMENTS ON HAND

It is estimated that approximately 8000 documents are on hand. This figure takes into consideration: (1) a certain number of duplicate copies,

(2) retention by individuals of reports on active contracts, and
(3) weeding of unimportant documents.

Eight methods for indexing the documents on hand were considered on the basis of output and time required. These are shown in TABLE IV.

Results obtained by checking entries in the CPIA Abstracts and the DDC TAB were not worth the time required. Those using the KWOC (Key Word Out of Context) index, based on the KWIC (Key Word in Context) method of permuting significant words in a document's title, merited further consideration.

Such a title-oriented retrieval system is effective because titles are becoming shorter and more explicit by design. The AFPAR recognizes and provides for title oriented retrieval systems in its Author's Guide, which states:

> "There are good reasons for avoiding long titles... many of the published computer indexes derived solely from titles have limitations on the length of the title that can be printed in full (maximum 100 characters including spaces).
>
> "Practically all titles will at some time or other be mechanically processed. Expressions containing superscripts and subscripts complicate this process.
>
> "Indexing computers are programmed to disregard certain words (stop words) which are too common or broad for significance... In general... if you use titles with precise terminology they will be useful in all information and retrieval systems." (4)

MIL-STD-847, while not specifically mentioning title-based retrieval systems, contributes to the effectiveness of such systems by stating:

> "The title will be specific, describing the content of the report as explicity as possible within the limits of reasonable brevity. A classified report will normally be given an unclassified title." (5)

The trend regarding titles of technical papers is similar and therefore should cause no great problem were they ever considered for inclusion in the recommended system.

> "Experiences with the preparation of WADEX and other computer-processed title of technical papers show an increased responsibility of

TABLE IV

INDEXING DOCUMENTS ON HAND

	Method	Output	Time per Document	Totals Time
1.	Check in CPIA Abstracts	Entry in CPIA Abstracts check marked. No printout.	15 min.	1 year
2.	Check in DDC TAB	Entry in DDC TAB check marked. No printout.	25 min.	1 2/3 year
3.	Straight KWOC	Permuted title index. Automated printout of title only.	5 min.	4 months
4.	KWOC Keyed to CPIA Abstracts	Permuted title index to selected entries in CPIA Abstracts. Automated printout of title only.	20 min.	1 1/3 years
5.	KWOC Keyed to DDC TAB	Permuted title index to select entries in DDC TAB. Automated printout of title only.	30 min.	2 years
6.	KWOC + Descriptive Cataloging	Permuted title index to complete citation. Automated printout.	30 min.	2 years
7.	KWOC + Descriptive Cataloging and Keywords	Permuted title index to complete citation and keywords serving as modified abstract. Automated printout.	Not possible without thesaurus	
8.	KWOC + Descriptive Cataloging and Abstracting	Permuted title index to complete citation and abstract. Automated printout.	55 min.	3 1/2 years

*NOTE: Total is based on devoting full time of documentation staff to indexing documents on hand. In actual practice this work would only be done during time not required for indexing current documents.

authors and editors in selecting useful and informative titles for technical papers." (6)

Since KWOC is a title based index it must lead to something by which the user can select the documents he requires. A straight KWOC index leads directly to the documents concerned. The user must therefore make his selection from the actual documents. If some of the documents are out on loan, he must wait until they are recalled to complete his selection.

Ideally KWOC leads to full bibliographic citations and abstracts in the second part of the index. This information is usually sufficient for the index user to make an accurate selection. However, such an index would require 3 1/2 years for completion and is therefore not recommended for the documents on hand.

To assimilate these documents as rapidly as possible and make them available through a subject approach, the straight KWOC index is recommended. A sample of this index, based on 8 entries selected from volume 2 of the Chemical Propulsion Abstracts, is shown in FIGURE 7.

a. Straight KWOC Index

This is not the best method for the storage and retrieval of documents. However, it appears to be best suited to the particular situation at AFRPL and meets most of the requirements.

KWOC is an automated system yielding a legible, easy-to-scan printout as shown in FIGURE 7. Literature searches can be run on a broad topic by selecting a single key word. More specific searches are possible by using additional key words to limit the items selected by the machine.

The problem of synonyms can be overcome by manual or machine searching of the possible synonyms for any given key word.

(1) Advantages

(a) Speed - Documents can be entered into the systems at the rate of 5 minutes per document, the entire collection in 4 1/2 months by 1 clerk-typist working full time.

(b) Economical - A minimum of professional time is required.

(c) Versatile - The system's sophistication can be increased at a later date if desired.

(d) Independent - Magnetic tape input is produced directly from the document in the documentation processing area. Since the cumulative printout can be scanned rapidly, the system is

Key Word	Title		Retrieval No.
CHAMBER	HIGH CHAMBER PRESSURE ROCKETRY PROGRAM	02/18/63	63-2114
CONTROLLABLE	CONTROLLABLE SOLID PROPELLANT ROCKET MOTOR	09/15/63	63-2128
IGNITION	SOLID PROPELLANT IGNITION STUDIES	09/15/63	63-2165
INSULATOR	IMPROVED INSULATORS FOR ROCKET MOTORS	10/15/63	63-2200
LIQUID PROPELLANT	PACKAGED LIQUID PROPELLANTS	09/30/62	63-2144
MONOCOMPOUND	MONOCOMPOUND ROCKET ENGINE	08/63	63-2111
PACKAGED	PACKAGED LIQUID PROPELLANTS	09/30/62	63-2144
PRESSURE	HIGH CHAMBER PRESSURE ROCKETRY PROGRAM	02/18/63	63-2114
RL10	RL10 ROCKET ENGINE	08/63	63-2227
ROCKET ENGINE	MONOCOMPOUND ROCKET ENGINE	08/63	63-2111
	RL10 ROCKET ENGINE	08/63	63-2227
ROCKET MOTOR	CONTROLLABLE SOLID PROPELLANT ROCKET MOTOR	09/15/63	63-2128
	IMPROVED INSULATORS FOR ROCKET MOTORS	10/15/63	63-2200
ROCKETRY	HIGH CHAMBER PRESSURE ROCKETRY PROGRAM	02/18/63	63-2114
SOLID PROPELLANT	CONTROLLABLE SOLID PROPELLANT ROCKET MOTOR	09/15/63	63-2128
	SOLID PROPELLANT IGNITION STUDIES	09/15/63	63-2165
	SOLID PROPELLANT TRACING METHODS	03/63	63-1843
TRACING	SOLDI PROPELLANT TRACING METHODS	03/63	63-1843

FIGURE 7. SAMPLE OF KWOC INDEX

not dependent on machine time.

(e) Convenient - Printouts can be distributed to all personnel concerned. With semiannual cumulations, each has a complete record of the documents in the system.

(f) Browsing Capability - The cumulative printouts can be browsed in much the same manner as traditional library card catalogs.

(g) Search Capability - Broad literature searches can be made both manually and by machine. Very specific topics can be searched by machine.

(2) Disadvantages

(a) Accuracy - Retrieval of all relevant items and avoidance of non-relevant material is not certain because of uncontrolled vocabulary.

(b) Completeness - Information concerning each item is insufficient to enable accurate selection.

b. KWOC Keyed to Abstract Bulletins

The KWOC index keyed to full bibliographic entries and abstracts in Chemical Propulsion Abstracts (CPA) or DDC Technical Abstract Bulletin (TAB) proved to be impractical. Since neither abstract bulletin contained all the documents in the AFRPL collection, both would have to be used in this system.

(1) Advantages Over Straight KWOC

(a) Completeness - Information concerning each item is sufficient to enable an accurate selection.

(2) Disadvantages in Addition to Those of Straight KWOC

(a) Speed - Over 2 years would be required to process the entire collection.

(b) Inconvenience - Only the KWOC index would be printed out. The individual issues of the CPA and TAB would have to be consulted for complete information.

(c) Uneconomical - Professional time is required to locate the CPA or TAB entry.

3. INDEXING CURRENT DOCUMENTS

Under present procedure, AFRPL requests for specific documents are processed by the AFFTC Technical Library. Upon arrival, these documents are cataloged

into that library's collection. It is proposed that these requests be processed by the AFRPL documentation staff. By this procedure the documents will be entered into the automated retrieval system and become part of the AFRPL document collection.

Estimated annual acquisition totals 4600 documents and averages 18 per day. This includes the individual request now processed through the AFFTC Technical Library. A breakdown by source is shown in TABLE V.

There is no active selection and acquisition program at AFRPL. Such a program, to be implemented by the documentation staff, is recommended. Based upon a trial run, the program would add approximately 2800 documents to the collection annually for a total of 7400 or 30 per day.

Five different indexing methods were investigated on the assumption of 18 and 30 documents per day respectively. The manhours required for each method are shown in TABLE VI.

a. Use of Abstract Bulletins

Use of the CPIA Abstracts and DDC Technical Abstract Bulletin proved to be impractical. Documents generated internally, on contract, and CPIA distribution either do not appear in these media or appear months after receipt. Only documents selected through the DDC TAB would appear in time to be of use in a retrieval system.

b. Straight KWOC

While a straight KWOC index is an effective method to quickly gain control over a sizeable collection, it does not provide the retrieval points and bibliographic information required by a sound retrieval system.

Specifically it lacks retrieval by corporate author and contract number. Since it refers directly to the documents concerned, it does not provide the descriptive cataloging information needed to permit an accurate selection.

Therefore, in spite of its ability to store information on 30 documents in only 2 1/2 manhours, straight KWOC is not recommended for the current documents.

c. KWOC Combined with Descriptive Cataloging

The most effective system cannot be achieved immediately since it requires a thesaurus of keywords. Development of the thesaurus is a gradual process which takes about a year to a year and a half.

KWOC combined with descriptive cataloging is recommended for the current documents during the initial period. A sample printout of the system, including the various indexes and bibliographic citations, is shown in FIGURE 8.

TABLE V

QUANTITY OF CURRENT DOCUMENTS

Source of Documents		Quantity per Year
AFRPL Memorandum Reports		50
Technical Documentary Reports		275
Generated in-house	25	
Generated by contractors	250	
CPIA distribution at 250 per month		3000
Individual requests		1275 (est.)
TOTAL ANNUAL ACQUISITION		4600
Proposed active selection program at approx. 240/month		2800
MAXIMUM ANNUAL TOTAL		7400

	Quantity per Day
Current total at 4600 per year	18
Maximum total at 7400 per year	30

TABLE VI

INDEXING CURRENT DOCUMENTS

Method	Time per Document	Total Manhours at 18 per day	Total Manhours at 30 per day
1. Check in CPIA Abstracts or DDC TAB	NOT PRACTICAL		
2. Straight KWOC	5 min.	1 1/2	2 1/2
3. KWOC + descriptive cataloging	30 min.	9	15
4. KWOC + descriptive cataloging and keyword enhancement*	40 min.	12	20
5. KWOC + descriptive cataloging and abstracting	55 min.	16 1/2	27 1/2

*NOTE: Keyword enhancement is not possible until a thesaurus has been developed.

(1) Advantages

(a) Thesaurus - The system provides the input necessary for compilation of the keyword thesaurus.

(b) Indexes - Descriptive cataloging provides information for corporate author and contract number indexes.

(c) Economical in terms of value received but requires more professional effort than straight KWOC.

(d) Versatile - The system's sophistication can be increased by adding keywords or abstracts, decreased by dropping bibliographic citations and author and contract number indexes.

(e) Independent - Once cumulative printouts are obtained, they can be rapidly scanned without dependence on machine time. The bibliographic citations enable accurate selection without examining the actual document.

(f) Convenient - Personnel can select desired documents from the printouts right at their desks.

(g) Browsing capability - The KWOC index can be browsed by keyword while the bibliographic citations can be browsed at random.

(h) Search Capability - Similar to the KWOC index noted previously except that reference is both to the actual document and to the bibliographic citation. Author and contract number approaches are also possible.

(2) Disadvantages

(a) Accuracy - Vocabulary is still uncontrolled, thereby making accuracy uncertain.

(b) Speed - This has been decreased from 5 minutes per document under straight KWOC to 30 minutes.

d. KWOC, Descriptive Cataloging and Keywords

Once a keyword thesaurus has been compiled and edited, it becomes possible to index by a controlled vocabulary. This increases the accuracy of the system and permits retrieval of most relevant items while decreasing the number of non-relevant documents. By adding the keywords to the bibliographic citation the advantages of an abstract are obtained without the effort required for its production.

At this point it is advisable to re-evaluate the retrieval system on the basis of economy and effectiveness. An economical system requires a minimum expenditure for value received. With its increased accuracy and enhanced bibliographic citation, the use of a controlled vocabulary produces such a system.

(1) Advantages

Besides those of the previous system, use of a controlled vocabulary and keywords in the bibliographic citation produces additional advantages:

(a) Economy - Maximum effectiveness is obtained at an increased expenditure of only 10 minutes per document.

(b) Accuracy - The controlled vocabulary permits a high degree of retrieval accuracy.

(c) Completeness - Keyword enhanced citations provide sufficient information to permit precise selection.

(2) Disadvantages

(a) Speed - Indexing time is increased to 40 minutes per document. However, abstracting requires 55 minutes per document and the advantages of abstracts are achieved at an expenditure of only 40 minutes.

4. DOCUMENTATION SERVICES

The basic title-based indexing system enables AFRPL personnel and the documentation staff to retrieve documents in the collection by desired subject. Current documents can be retrieved by subject, corporate author, and contract number. Retrieval can be accomplished manually and by machine printout.

Retrieval constitutes the minimum service. Some additional documentation services are obtained as a byproduct of the automated system. Services not avaible as a byproduct are recommended because they fill the additional information needs expressed by AFRPL scientists and engineers.

a. Accession Lists

A knowledge of available and recently acquired documents is essential to AFRPL personnel. This need can be fulfilled by wide distribution of two different accession lists on alternate weeks. One lists the on-hand reports entered into the central system. The other announces documents recently received. Both are byproducts of the automated system.

(1) Documents on Hand

Since these documents are in a straight KWOC index, the printout will consist solely of a permuted title index as shown in FIGURE 8a. When the entire collection has been entered into the system, a cumulated printout can be distributed and all previous lists discarded.

The cumulated printout constitutes the catalog to the entire collection of documents on hand. This catalog can be searched manually or browsed. The magnetic tape from which it was produced provides for automated searches resulting in a printout of titles and numbers representing applicable documents.

(2) Current Documents

The Accession List of current documents includes AFRPL Memorandum Reports, in-house and contractor Technical Documentary Reports, reports received on CPIA distribution, and individually requested reports. Each list consists of four sections: (1) KWOC index, (2) corporate author index, (3) contract number index, and (4) the bibliographic citations. A sample of the list is shown in FIGURE 8.

Issued every two weeks (10 working days) the Accession List would index approximately 180 documents without selection and acquisition by the documentation staff. Backed by an active selection and acquisition program, each issue would contain references to about 300 documents.

b. Selection and Acquisition

A collection should contain the documents, completely processed and ready for loan, before they are required. This is accomplished through active selection and acquisition, within the fields of interest of AFRPL personnel, by the documentation staff.

(1) Advantages

(a) Documents are available when needed.

(b) The collection will contain more up-to-date literature.

(c) Long delays in acquiring specific documents are avoided.

(d) Rush requests are avoided together with attendant long distance calls and interruption of routine work.

(e) Automated searches are more meaningful because they are based upon a more complete collection.

Key Word	Title		Retrieval No.
CHAMBER	HIGH CHAMBER PRESSURE ROCKETRY PROGRAM	02/18/63	63-2114
CONTROLLABLE	CONTROLLABLE SOLID PROPELLANT ROCKET MOTOR	09/15/63	63-2128
IGNITION	SOLID PROPELLANT IGNITION STUDIES	09/15/63	63-2165
INSULATOR	IMPROVED INSULATORS FOR ROCKET MOTORS	10/15/63	63-2200
LIQUID PROPELLANT	PACKAGED LIQUID PROPELLANTS	09/30/62	63-2144
MONOCOMPOUND	MONOCOMPOUND ROCKET ENGINE	08/63	63-2111
PACKAGED	PACKAGED LIQUID PROPELLANTS	09/30/62	63-2144
PRESSURE	HIGH CHAMBER PRESSURE ROCKETRY PROGRAM	02/18/63	63-2114
RL10	RL10 ROCKET ENGINE	08/63	63-2227
ROCKET ENGINE	MONOCOMPOUND ROCKET ENGINE	08/63	63-2111
	RL10 ROCKET ENGINE	08/63	63-2227
ROCKET MOTOR	CONTROLLABLE SOLID PROPELLANT ROCKET MOTOR	09/15/63	63-2128
	IMPROVED INSULATORS FOR ROCKET MOTORS	10/15/63	63-2200
ROCKETRY	HIGH CHAMBER PRESSURE ROCKETRY PROGRAM	02/18/63	63-2114
SOLID PROPELLANT	CONTROLLABLE SOLID PROPELLANT ROCKET MOTOR	09/15/63	63-2128
	SOLID PROPELLANT IGNITION STUDIES	09/15/63	63-2165
	SOLID PROPELLANT TRACING METHODS	03/63	63-1843
TRACING	SOLID PROPELLANT TRACING METHODS	03/63	63-1843

FIGURE 8. KWOC COMBINED WITH DESCRIPTIVE CATALOGING
a. KWOC Index to Bibliographic Citations

Corporate Author	Retrieval No.
AEROJET-GENERAL CORP.	63-2114
AMCEL PROPULSION CO.	63-2128
ARTHUR D. LITTLE INC.	63-2165
ASTROSYSTEMS INTERNATIONAL INC.	63-2111
PRATT AND WHITNEY AIRCRAFT	63-2227
THIOKOL CHEMICAL CORP	63-1843 63-2144
UNITED STATES RUBBER CO.	63-2200

FIGURE 8. KWOC COMBINED WITH DESCRIPTIVE CATALOGING
b. Corporate Author Index

Contract No.	Retrieval No.
AF 04(611)-8191	63-2114
AF 04(611)-9065	63-2165
AF 04(611)-9067	63-2128
AF 49(638)-1197	63-1843
NAS 8-2690	63-2227
NORD 16788	63-2200
NOW 62-0755c	63-2111
NOW 62-0785c	63-2144

FIGURE 8. KWOC COMBINED WITH DESCRIPTIVE CATALOGING
c. Contract Index

Retrieval No.	Citation
63-1843	THIOKOL CHEMICAL CORP. SOLID PROPELLANT TRACING METHODS. REACTION MOTORS DIV., REPTS. QTSR-1 & QTSR-2, AF 49(638)-1197, 15 OCT 62 - MAR 63, 15P.
63-2111	ASTROSYSTEMS INTERNATIONAL INC. MONOCOMPOUND ROCKET ENGINE (U). REPT. TR 62014-Q6, NOW 62-0755C, JUN-AUG 63, 7P. CONFIDENTIAL REPORT
63-2114	AEROJET-GENERAL CORP. HIGH CHAMBER PRESSURE ROCKETRY PROGRAM (U). REPT. 8191-Q-3, AF 04(611)-8191, 18 FEB 63. CONFIDENTIAL REPORT
63-2128	AMCEL PROPULSION CO. CONTROLLABLE SOLID PROPELLANT ROCKET MOTOR (U). REPT. APR-21-2, AF 04(611)-9067, 16 JUN-15 SEP 63, 55P. CONFIDENTIAL REPORT
63-2144	THIOKOL CHEMICAL CORP. PACKAGED LIQUID PROPELLANTS (U). REACTION MOTORS DIV. REPT. RMD 5005-F, NOW 62-0785C, 2 JAN-30 SEP 62, 88P. CONFIDENTAIL REPORT
63-2165	ARTHUR D. LITTLE INC. SOLID PROPELLANT IGNITION STUDIES (U). REPT QPR-2, AF 04(611)-9065, 15 SEP 63. CONFIDENTIAL REPORT
63-2200	UNITED STATES RUBBER CO. IMPROVED INSULATORS FOR ROCKET MOTORS (U). REPT. QPR-21 AND FINAL HISTORICAL AND TECHNICAL SUMMARY, NORD 16788, MAY-AUG 63, 88P. CONFIDENTIAL REPORT
63-2227	PRATT AND WHITNEY AIRCRAFT RL10 ROCKET ENGINE (U). REPT. PWA RF 783, NAS 8-2690, AUG 63. CONFIDENTIAL REPORT

FIGURE 8. KWOC COMBINED WITH DESCRIPTIVE CATALOGING
d. Bibliographic Citations

(f) Accession lists offer greater selection since they would contain about 300 items per issue instead of only 180.

(2) Disadvantages

(a) Size of collection increases more rapidly, filling up expensive vault space sooner.

(b) Additional professional and clerical time is required for selection, acquisition, and processing of the increased volume of documents.

c. Literature Searches

Complete literature searches covering foreign and English language publications and the report literature are required by AFRPL scientists and engineers to:

(1) Solve specific problems

(2) Prevent duplication of effort

(3) Keep abreast of their field

(4) Make use of basic research results

(5) Define the work a contractor must do

AFRPL personnel are unable to perform their own literature searches because they (1) lack the time, and (2) are not familiar with search techniques.

The AFFTC Technical Library has the indexes and many of the periodicals necessary, but not the staff, to conduct fairly complete searches.

The documentation staff could meet part of the literature search requirements by: (1) pursuing an active selection and acquisition program, and (2) adopting the controlled vocabulary and keyword enhanced citation system. However, the search capability will be negligible until a sizeable document collection has been accumulated and processed.

Until an adequate literature search capability can be developed at AFRPL, it may be well to consider contracting for this service.

d. Documentation Bulletins

The documentation system is a research tool. To be used effectively, AFRPL personnel must know what services are available and the procedure for obtaining these services.

It is recommended that a bulletin be issued as progress warrants, informing AFRPL personnel of new services available, limitations of the service, and methods for obtaining maximum benefit from the service.

The Bulletin should receive the widest possible distribution.

e. Selective Dissemination of Information (SDI)

Consideration of this service can be postponed until the automated retrieval system is well established. SDI may prove superfluous in view of the distribution of the KWOC indexes.

5. DOCUMENTATION PERSONNEL

Depending upon the type of documentation system selected and the extent of services desired, either three of four of the following personnel will be required.

a. Science Research Specialist

(1) Functions

Develop AFRPL's documentation system. Evaluate system effectiveness in terms of user needs. Keep abreast of new developments in documentation techniques and equipment. Study possible applications of these advances to AFRPL's automated retrieval system. Publicize available services to obtain maximum use of documentation system. Instruct and supervise documentation personnel.

(a) Establish format for title based retrieval system and descriptive cataloging, select required equipment, recall documents to be entered into system, formulate procedures and determine flow of work.

(b) Develop list of suppressed words for permuted title index.

(c) Compile, edit and up-date keyword thesaurus.

(d) Re-evaluate documentation system in terms of output, user needs, and latest documentation developments.

(e) Recommend major changes in documentation system and equipment, implement minor changes to existing system.

(f) Determine exact services to be provided, formulate policy, and prepare bulletins to announce available services and procedure for obtaining service.

(g) Handle difficult descriptive cataloging and literature searches.

(h) Administer documentation center and supervise staff.

b. Technical Document Analyst

(1) Functions

Assist in development of documentation system and services, assign terms and prepare entries for machine storage, select and acquire documents, and provide literature search service.

(a) Select and assign descriptors to meaningless titles and prepare descriptive cataloging entries for current documents.

(b) Select documents from DDC TAB, NASA STAR, and other document announcement bulletins within the AFRPL fields of interest.

(c) Conduct literature searches, consult with requester to determine exact nature of problem, plan search strategy, select retrieval terms, and examine printout for relevancy.

(d) Provide for distribution of accession lists and bulletins.

(e) Direct and review work of clerk-typists.

c. Clerk-Typist (Documentation)

(1) Functions

Use typewriter or keypunch keyboard to store documentation information on magnetic tape.

(a) Assign control numbers in sequential order to documents and tape storage entries. Maintain log of control numbers.

(b) Select and store document title on magnetic tape for documents on hand.

(c) Store descriptive cataloging information on magnetic tape as directed by supervisor.

(d) Process documents for use according to established procedure.

d. Clerk-Typist (Circulation)

(1) Functions

Control access to vault, loan and recall documents, type and process document requests, file returned items.

(a) Permit authorized personnel only to enter vault.

(b) Distribute processed documents according to established plan.

(c) Locate and loan documents, recall overdue and requested items, file returned material.

(d) Order documents requested by individual and selected by supervisor.

(e) Downgrade classified documents according to security regulations and declassification notices.

(f) Type correspondence and requisitions.

6. OPERATION OF DOCUMENTATION SYSTEM

The procedure assumes full documentation services provided by a staff of four. Efficiency of the system is directly related to the capability of the documentation staff. No system can overcome human inadequacies. However, insufficient staff can decrease efficiency of the system in spite of individual capability.

Operation of the system is shown in FIGURE 9. Items on the flow chart are keyed to the paragraphs which follow.

a. Priority Documents

Documents received for distribution and ordered on individual requests must be entered into the system and forwarded to designated individuals on the day of receipt.

(1) Indexing and Distribution

(a) Technical Document Analyst prepares descriptive cataloging entries.

(b) Clerk-Typist assigns control number, stores descriptive cataloging information on magnetic tape, and sends document to vault.

(c) Clerk-Typist makes charge-out record and sends document to designated individual.

(d) Magnetic tape is sent to electronic data processing unit.

(e) When no longer required, document is returned to vault.

b. Routine Documents

(1) Selected by Documentation Staff

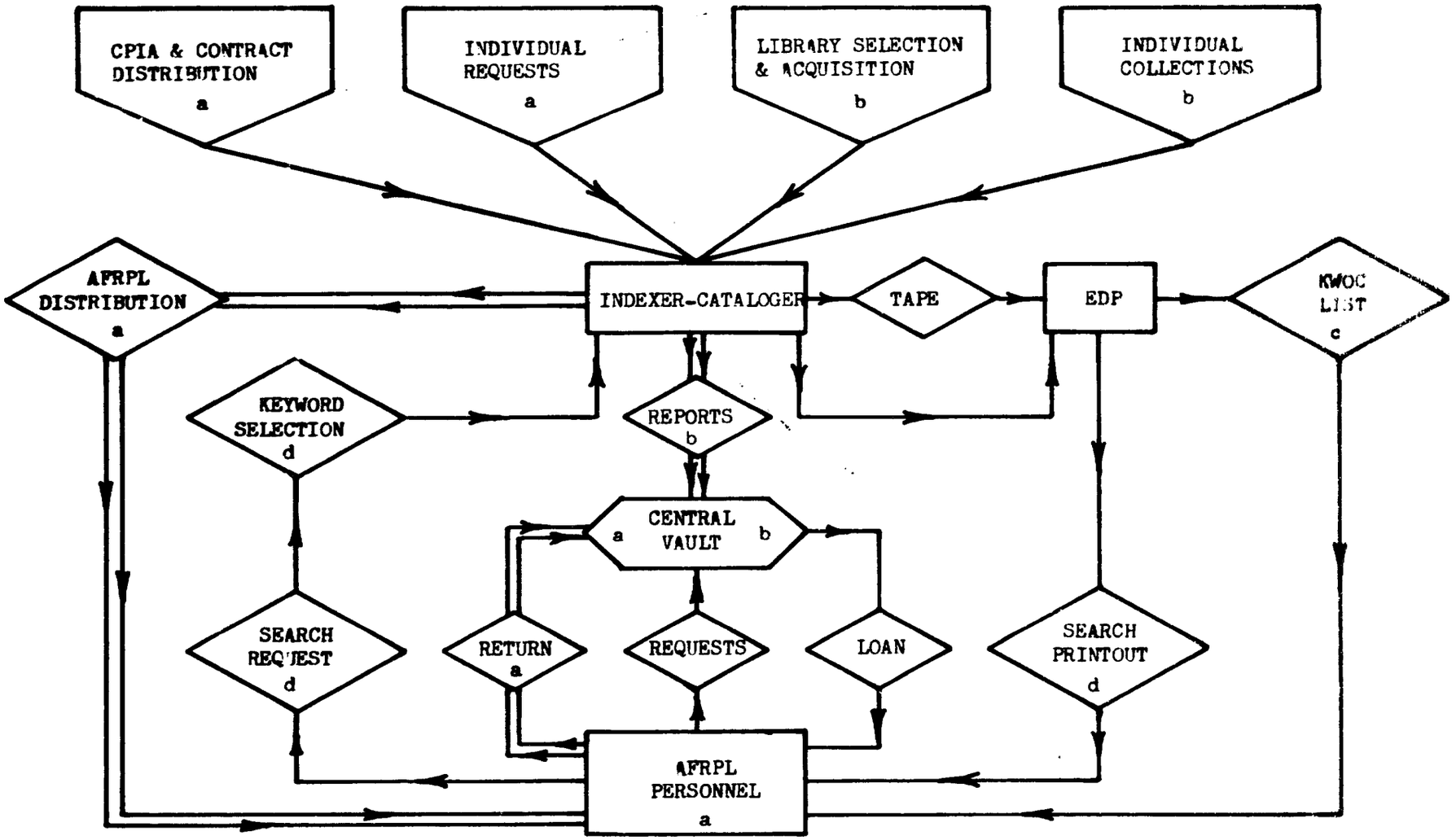


FIGURE 9 - FLOW CHART OF DOCUMENTATION SYSTEM

(a) Technical Document Analyst selects documents within AFRPL's fields of interest.

(b) Clerk-Typist processes requests and receives documents.

(c) Technical Data Analyst prepares descriptive cataloging entries.

(d) Documents stored on processing shelf until Clerk-Typist has time to assign control number and store information on magnetic tape.

(e) Document sent to vault for shelving, magnetic tape to electronic data processing unit.

(2) Documents on Hand

(a) Science Research Specialist recalls documents to be entered into system and schedules their processing after priority documents but before those selected by the documentation staff.

(b) Clerk-Typist assigns control number, stores title on magnetic tape, and sends document to vault.

(c) Magnetic tape is sent to electronic data processing unit.

c. Accession Lists

There are two accession lists produced by automated printout and issued on alternate weeks. One lists the documents on hand which have been processed into the system. The other lists documents recently received.

(1) Documents on Hand

(a) Magnetic tape with stored titles has been sent to the electronic data processing unit.

(b) List of suppressed words previously stored are matched against the words in each title.

(c) The computer program alphabetizes the remaining significant words and lists all titles containing these words beside the word concerned.

(d) The resultant printout, shown in FIGURE 8a, is distributed to AFRPL personnel every two weeks.

(2) Current Documents

(a) Magnetic tape with stored titles, authors, contract numbers, and full bibliographic citations has been sent to the electronic data processing unit.

(b) The keyword title index is prepared as above.

(c) The corporate author index is printed out in alphabetical order, the contract index in alpha-numerical order.

(d) Bibliographic citations are arranged and printed out in control number order.

(e) The complete printout, as shown in FIGURE 8, is distributed to AFRPL personnel every two weeks on alternate weeks with the index of documents on hand.

(3) Cumulated Indexes

(a) KWOC Index

The keyword title index to the current documents can be merged with the index to the documents on hand, cumulated at the end of a year and issued as a KWOC index to the complete collection.

(b) Current Documents Index

An annual record of the current documents can be issued complete with author, title and KWOC indexes, and full bibliographic citations by cumulating the current documents accession lists.

d. Literature Searches

Once a sizeable collection has been processed into the collection, an automated literature search becomes possible. However, printout for the original documents will consist solely of KWOC entries while those for the current documents will include full bibliographic information.

(1) Technical Document Analyst determines exact nature of the request and selects the keywords that represent the desired subject.

(2) The computer storage is queried for information on documents stored under the keywords and a printout results.

(3) Printout is examined for relevancy to the request by the Technical Document Analyst, forwarded to requester if applicable, but rephrased and sent back to electronic data processing if pertinent items were not retrievable.

7. SUMMARY

A title based automated retrieval system is recommended for the documents on hand. This method gains comparatively effective control over a large number of documents in a relatively short time. While the KWOC index is used as an example, other systems such as KWIC, WADEX (Word and Author Index), etc. are not discounted.

A more complete system is suggested for the documents arriving daily. Processing of these documents is slower but the quantity concerned is also much smaller. In this system far more information is developed. Besides a permuted title for keyword approach, corporate author and contract number retrieval is available. Descriptive cataloging permits more accurate selection than is possible with just the KWOC index. Again, variations of this method exist and can be explored.

Review of the overall system at the end of a year is advisable. The shortcomings of both systems will have become apparent as neither furnishes completely effective retrieval. However, each serves its purpose.

The system for current documents leads into an effective and lasting system by providing the basis for compilation of a keyword thesaurus and a corporate author authority list. Both are necessary for a controlled vocabulary system with accurate corporate author retrieval.

SECTION VII

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS

Results of the on-site survey demonstrated the need of AFRPL scientists and engineers for:

1. Increased library facilities and services.
2. Documentation facilities and services.

The survey also brought to light the fact that with an expenditure of over $40 million annually for research and development it was not possible to retrieve efficiently and use the information purchased with these funds.

2. RECOMMENDATIONS

To provide for the information support required by AFRPL personnel in their research and development activities and to make available the information already purchased, it is recommended that information facilities and services be established in the following sequence.

a. Remodel the AFRPL Library

(1) Construct a centrally located classified vault.

(2) Provide a document processing area.

(3) Rearrange the resultant library area for more efficient service and work flow.

(4) Provide necessary furniture and equipment.

b. Remodel the Chemistry Laboratory Library

(1) Provide additional space through removal of partitions enclosing Room 108.

(2) Erect additional shelving.

c. Increase AFRPL Library staff by at least one clerk-typist

(1) Utilize additional staff for part-time manning of Chemistry Lab. Library and increased service at the AFRPL Library.

d. Contract for documentation staff

e. Obtain necessary automated equipment

f. Establish documentation service

(1) Gradually recall documents scattered throughout AFRPL offices.

(2) Begin KWOC index for these documents.

(3) Process document requests through documentation staff.

(4) Deliver incoming documents to documentation staff for indexing and distribution.

(5) Begin KWOC index combined with descriptive cataloging of current documents.

(6) Issue accession lists and information bulletins.

(7) Start selection and acquisition of documents by documentation staff.

(8) Offer automated literature search service.

g. When documentation system has absorbed the documents on hand:

(1) Compile and edit keyword thesaurus.

(2) Reevaluate documentation system and consider:

(a) Indexing by controlled vocabulary.

(b) Addition of keywords to descriptive cataloging.

(c) Use of newly developed equipment and techniques.

(3) Reconsider SDI

(a) On basis of personal profile.

(b) On unit profile basis.

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   "Library Budgets in the Missile Business; the State of the Art." Sci-Tech news, v16, n2, Summer 62, p72.

2. Special Libraries Association. Professional Standards Committee
   "Objectives and Standards for Special Libraries." Special Libraries, v55, n10, Dec 64, p680.

3. Remington Rand
   "Open Shelf Filing vs. Filing Cabinets." n.d., p2-3. Reprint of table "Comparison of Factors in Open-Shelf and File Cabinet Filing System" from Dept. of the Navy AOlNST 5211.3 dated 21 Jul 54.

4. U. S. Air Force Office of Aerospace Research
   "Author's Guide for Technical Reporting." DDC, AD 605 443, Jul 64, p7.

5. U. S. Air Force
   "Preparation of Technical Reports." MIL-STD-847, 25 Feb 65, p2, paragraph 3.4.3.

6. Ripperger, E. A., Worster, H. and Juhasz, S.
   "WADEX (Word and Author Index)." Mechanical Engineering, v86, n3, Mar 64, p45-50. Also in Naval Engineers Journal, Oct 64, p685-90.

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American Library Association
"Descriptive List of Professional and Nonprofessional Duties in Libraries." Chicago, ALA, 1948, 75p., 45 refs.

A detailed list is presented of the many duties concerned with library procedures. The duties are grouped by major library functions. They are divided into professional and nonprofessional activities within each major function.

Bauer, C. K.
"Practical Application of Automation in a Scientific Information Center - A Case Study." Lockheed-Georgia Company paper presented at National Aeronautical Meeting, Wash., D.C., Apr 63, 38p. Also in Special Libraries, v55, n3, Mar 64, p137-42.

Presents the specific processes and programming of the Lockheed-Georgia Company's Scientific and Technical Information Department indexing and retrieval system. Economic considerations in converting a conventional

technical library into a dynamic information center are included.

Bloomfield, M.
"Role of the Technical Library in Support of an Information Center." Hughes Aircraft Co., Rept. TM-804, AD 609 825, Nov 64, 16p., 28 refs.

Information center and library are defined, their functions, activities, procedures and product are detailed and compared.

Carroll, K. D. and Summit, R. K.
"MATICO: Machine Applications to Technical Information Center Operations." Lockheed Missiles and Space Company, Rept. LMSC 5-13-62-1, Sept 62, 24 p., 10 refs.

Describes a modular development of a system for application of electronic equipment to various operations of a technical information center. The system, designed for the IBM 7090/1401 Computer Complex, includes KWIC index, catalog card production, SDI, automated search, and auto-abstracting.

Cohan, L. and Craven, K.
"Science Information Personnel." N. Y., Modern Language Association, 1961, 74p., 19 refs.

Describes the various functions of the Science Information Specialist, presents typical Science Information job descriptions, lists the job titles for science information personnel in government and industry, and discusses the educational requirements for such personnel.

Elias, A. W., ed.
"Technical Information Center Administration." Wash., D.C., Spartan Books, 1964, 171p.

Contents: Information Center Design; Personnel Selection and Education; Sources and Material Selection; Reprography; Seminar on Internal Publications; Abstracting Control; Indexing Control; Cost Accounting/Allocation; Seminar on Macrocoding Devices for Document Management; User Requirements and Public Relations; Equipment Selection; Computer Management in Information Centers; The Goals of Information Center Administration.

Farkas, G. Z.
"ASW/OS Information Center Analysis." Lockheed-California Company, Memorandum Report 7194, 1 Feb 62, 29p., 7 refs.

Analyzes the technical information needs of the Lockheed Antisubmarine Warfare/Ocean Systems organization and presents detailed recommendations for establishing a technical information center to provide the required facilities and services.

Hilligan, M. P., ed.
"Libraries for Research and Industry; Planning and Equipment." Special Libraries Association Monograph no.1. N.Y., SLA, 1955, 58p., 83 refs.

Contents: Why's, When's, and How's of Library Planning; Planning the New Library; Check List for Reviewing Layout Prints; You Can Expand Within Confined Areas; and Selected Readings on Library Planning. Flcor plans and photographs of many actual research libraries are used to illustrate the layouts and equipment discussed.

Holmes, E. H.
"The Information Center: Some Selected Examples." System Development Corp., Rept. SP-1702, AD 606 174, 4 Aug 64, 32p., 25 refs.

Discusses development of the information center, lists and describes its functions, lists and defines system criteria. Four case studies (Douglas, DDC, Title Insurance and Trust Co. & Smith, Kline and French Labs.) are presented and evaluated.

Hoshovsky, A. G., ed.
"Proceedings of the First USAF Scientific and Technical Information Conference." Office of Aerospace Research, Rept. OAR 15, AD 450 000, Oct 63, 157p.

Contents: Observations or the National STINFO Problems; The DoD Technical Information Programs; Dependence of Superior Weapons on STINFO; Coupling of Research and Exploratory Development; Researchers' Needs and Obligations for STINFO; Manufacturers' Needs and Obligations for STINFO; Managements' Needs and Obligations for STINFO; DoD User Survey; Utilization of STINFO During Project FORECAST; Canadian Approach to STINFO Transfer; Local Access to Aerospace Information; Publication as a Medium of STINFO Transfer; SIE Progress in Physical Sciences; Non-DoD Activities in the Transfer of STINFO; Experience with Information Centers; Requirements for Developing a Military STINFO Program; Transferring STINFO Between Originator and User; Current Capabilities of DDC; Acquisition of Foreign Technology and How it is Transferred to the Scientific and Engineering Community; Identify Command Needs for STINFO; Exchange of STINFO Between Originator and User; Functions and Training of STINFO Officers; Respective Roles of Information Centers, Technical Libraries, DDC and Theri Relation to STINFO; Relation Between Foreigh Technology and STINFO; STINFO Management and Communication.

Janning, E. A.
"Establishment of a Coordinate Indexing Retrieval System for the Air Force Materials Laboratory." Dayton University Research Institute, Rept. RTD TDR 63-4263, AD 428 423, Nov 63, 71p.

The 10,00 document collection of the USAF Materials Lab. Library is indexed by the coordinate system. This system provides for both manual and automated retrieval. The indexing of documents, procedure for editing the machine generated vocabulary, and the various machine operations are discussed in detail.

Janning, E. A.
"The Modification of an Information Retrieval System by Improving Vocabulary Control, Indexing Consistency and Search Capabilities. "

University of Dayton Research Institute, Rept. AFML-TR-65-20, AD 613 301, Mar 65, 81p., 7 refs.

The need for and establishment of vocabulary controls in a coordinate indexing retrieval system are described. The system was established to handle the document collection of the Air Force Materials Laboratory library facility.

Lewis, C. M., ed.
"Special Libraries: How to Plan and Equip Them." Special Libraries Association Monograph no.2. N.Y., SLA, 1963, 117p., 213 refs.

Basic information on the factors involved in structural and space requirements, equipment, initial planning, and flow of work is presented. Methods for making the best operational use of existing areas are discussed. A directory of library furniture and equipment suppliers is included.

Mueller, M. W.
"A Basis for Better Information Service at CALAC." Lockheed-California Company, Memorandum Report 7159, 20 Mar 59, 49p.

Discusses the economics of document acquisition, storage, retrieval, and dissemination in terms of potential value of a document vs. its age, net dollar value of a typical retrieval, and actual operating costs. System flow charts, information center organization, and job descriptions are included.

Mueller, M. W.
"An Evaluation of Information Retrieval Systems." Lockheed-California Company, Memorandum Report 7170, 30 Sept 59, 114 p., 34 refs.

Technical aspects of information retrieval are considered, fundamental principles outlined, and alternative methods and machines evaluated. Primary emphasis is on applications to technical library documentation processes. Specific equipment, systems and costs are included.

Mueller, M. W.
"Time, Cost and Value Factors in Information Retrieval." Lockheed-California Company paper presented at IBM Information Retrieval Conference, Poughkeepsie, Sept 59, 15p.

Examines the economic contributions of document collections to the organization that supports them. Presents dollar costs associated with a typical document and method of evaluating automated retrieval.

Randall, G. E.
"Special Library Standards, Statistics, and Performance Evaluation." Special Libraries, v56, n6, Jul-Aug 65, p379-86, 3 refs.

Special Libraries Association standards are measured against a "standard" electronics library on the basis of objectives and staff, special library

collections, services, facilities, and budget. The library's charter, library dealers, and the cataloging process are evaluated.

Roth, H. L., ed.
"Planning Library Buildings for Service." Chicago, American Library Association, 1964, 127p.

Individual papers discuss the elements of planning, selection, and evaluation of furniture and equipment, and the physical dimensions of equipment in relation to human size and reach. Floor plans are presented for college, university, public, and school libraries. They are discussed in terms of capacity, expansion, and costs.

Sievers, P. T. and Fasana, P. J.
"Automated Routines in Technical Services." Air Force Cambridge Research Labs., Rept AFCRL 64-70, AD 435 615, Feb 64, 16p.

The AFCRL Research Library automation of technical processes is discussed. Cost comparisons are included.

Strauss, L. J., Strieby, I. M. and Brown, A. L.
"Scientific and Technical Libraries: Their Organization and Administration." N.Y., Wiley, 1964, 398p.

Covers the duties and qualifications of the staff, library operating costs, physical layout and equipment, selection and acquisition, cataloging and classification, indexing of non-book materials, dissemination of current information, reference and literature search procedures, public relations, and basic reference publications.

Thompson, D. L., comp.
"Glossary of STINFO Terminology." Office of Aerospace Research, Rept. AFOSR 5266, AD 417 625, Oct 63, 154p., 18 refs.

A dictionary of library, information center, and information retrieval terms with each definition keyed to the 18 references.

U. S. Air Force
"Air Force Library Service." AFR 212-1, 22 Mar 65, 18p. Supersedes AFR 212-1 dated 19 Jan 62 and AFR 212-1 dated 2 Apr 58.

Establishes the AF Library System and explains the organization, administration and operation of Air Force libraries.

U. S. Air Force
"Requisitioning Technical Library Publications." AFR 212-3, 13 Jan 65, 18p. Supersedes AFR 212-3 dated 29 Aug 62.

Explains procedure by which Air Force libraries obtain technical library publications. Attachment 1 shows categories of technical library publications covered. Attachment 2 lists categories not covered. Applicable

forms are illustrated.

U. S. Air Force
"The Scientific and Technical Information (STINFO) Program." AFR 80-29, 18 May 64, 14p. including supplement. Supersedes AFR 80-29 dated 18 Sept 63 and AFR 80-33 dated 3 Feb 56.

Explains how the Air Force will carry out its responsibilities for the transfer of information under the STINFO Program established by DoD. Also covers how the STINFO Program is coordinated with the DoD Technical Information Program and the other four information programs comprising the Technical Information Program. Outlines procedures for use of DDC.

U. S. Air Force
"Technical Publications for Air Force Libraries." AFP 212-1-2, 25 Jun 64, 30p. Supersedes AFP 212-1-2 dated 22 Jan 62.

Provides guidance for Air Force librarians in selecting current technical publications. Informs Air Force personnel of the variety and extent of the Air Force technical library service available to them.

U. S. Air Force
"When to Buy What - A Buying Calendar for Annual Publications." AFP 212-1-4, 7 Jul 64, 21p.

Provides: (1) assistance in the selection of annual publications to meet specific library requirements, (2) a buying calendar for systematic ordering, before publication, of item selected, (3) a digest of bibliographic information about annuals.

U. S. Army Research Office
"Report of the Army Ad Hoc Group on Scientific and Technical Information." Volume 1, AD 291 900L, 3 Dec 62, 318p.

DESCRIPTORS: Information retrieval, Documentation, Data storage systems, Scientific reports, Literature, Costs, Handling.
Presents results of the study of requirements for establishment of an integrated Army scientific and technical information (STINFO) system and provide recommendations for its implementation, including appropriate research where applicable.

U. S. Army Research Office
"Report of the Army Ad Hoc Group on Scientific and Technical Information." Volume 2, AD 291 901L, 3 Dec 62, 338p.

DESCRIPTORS: Information retrieval, Documentation, Data storage systems, Scientific reports, Literature, Costs, Handling.
Continues results of the study of requirements for establishment of an integrated Army scientific and technical information (STINFO) system and provide recommendations for its implementation, including appropriate research where applicable.

U. S. Department of Defense
"Assignment of Functions for the Defense Scientific and Technical Information Program." DoD I 5129.43, 22 Jan 63, 8p.

A further amplification of DoD Directing 5100.36 including assignment of the Scientific and Technical Information Program functions to various DoD componets. Also defines the functions and their concepts.

U. S. Department of Defense
"Defense Documentation Center for Scientific and Technical Information (DDC)." DoD I 5100.38, 29 Mar 65, 10p.

Supplements DoD Directive 5100.36 and DoD Instruction 5129.43 by assigning policy direction of DDC to the Defense Supply Agency and delineating responsibilities of DoD components engaged in R&D.

U. S. Department of Defense
"Department of Defense Technical Information." DoD D 5100.36, 31 Dec 62, 7p.

Establishes basic policy for handling and dissemination of technical data and documents or their abstracts, publication of technical journals, and dissemination of other research and development information under the DoD Scientific and Technical Information Program.

U. S. Department of Defense
"Standards for Documentation of Technical Reports Under the DoD Scientific and Technical Information Program." DoD I 3200.8, 18 Feb 64, 6p.

Primary purpose of this instruction is to simplify and improve document control and cataloging procedures for technical reports derived from research and development activities of the Department of Defense.

U. S. Naval Ordnance Laboratory
"A Plan to Reduce Costs of Technical Library Operations in the Department of Defense." Rept. NOLTR 61-102, AD 262 935, 3 Aug 61, 12p.

The duplication of cataloging technical reports in the technical libraries of the DoD is examined. A plan is proposed to eliminate the duplication through establishing DoD-wide standards for descriptive, subject, and subject code cataloging and a standard code and dictionary for computer retrieval. Potential savings are indicated.

Weik, M. H. and Confer, V. J.
"Survey of Scientific and Technical Information Retrieval Schemes Within the Department of the Army." Army Ballistic Research Labs, Rept. BRL 1169, AD 283 772, Jul 62, 95p.

The 126 scientific and technical information storage and retrieval schemes in use within the research and development organizations of the Department of the Army are classified, described and analysed. Factors considered

include point of view of technical field of application, recording media, associated IR equipment, personnel requirements, system operation, present volume, rate of growth, inquiry frequency, remarks and references.

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)* Lockheed-California Company, Burbank, California	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b GROUP None

3. REPORT TITLE

RESULTS OF AFRPL TECHNICAL INFORMATION FACILITY SURVEY (U).

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

Final Report

5. AUTHOR(S) *(Last name, first name, initial)*

Beltran, Alfred A. and Scranton, Robert R.

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13. ABSTRACT

This study is concerned with the technical information services required by personnel of the Air Force Rocket Propulsion Laboratory in support of their R & D activities. An on-site survey consisting of personal interviews and investigation of the documentation and library situation was conducted. Results indicate increased documentation and library services are urgently needed. Specifically recommended are: (1) immediate construction of a centrally located classified vault, (2) rapid assimilation of 8000 scattered documents into a simple but effective automated retrieval system, (3) a more sophisticated system for currently received documents, (4) an active selection and acquisition program, (5) literature search services, (6) remodeling of AFRPL and Chemistry Lab. libraries, and (7) increase of library staff. Survey coverage, results and analysis are presented together with detailed recommendations.

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