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# Introduction to BIBELOT: A Bibliographic Filing and Retrieval System

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Prepared by M. I. Cochran

**Pacific Northwest Laboratory**  
Operated by  
Battelle Memorial Institute

Prepared for  
**U.S. Nuclear Regulatory  
Commission**

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Prepared by  
M. I. Cochran

Pacific Northwest Laboratory  
Richland, WA 99352

**Prepared for**  
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**U.S. Nuclear Regulatory Commission**  
**Washington, D.C. 20555**  
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## ABSTRACT

The BIBELOT System of COBOL and Datatrieve programs for bibliographic storage and retrieval is described. The storage scheme is also briefly described. The use of unique citation numbers and user defined keywords is illustrated by many retrieval examples. Finally, typical questions about the use of BIBELOT are answered.

## PREFACE

One of the tasks required in an NRC-funded project entitled "Application of Statistics in Siting and Managing Low-Level Radioactive Waste Disposal Sites" was to survey the appropriate statistical literature in order to define research needs. Several investigators at PNL specialize in different aspects of statistics relevant to the project (e.g., geostatistics, biostatistics, quantitative ecology, etc.) and maintain personal reference collections. In order to have these collections available to the project and to each individual concerned, the BIBELOT System was created.

We believe that similar situations may exist in most research installations where NRC funds research, as well as state regulatory agencies and at NRC headquarters. We hope this report stimulates interest so that other research, administrative and regulatory groups elect to pool their reference libraries.

## SUMMARY

BIBELOT is a system, using the Datatrieve language, developed to aid researchers in preparing a computer based bibliographic file of their research project references. The retrieval capabilities are based on the filing system whereby the references are stored numerically by unique citation numbers. These numbers are used both in the computer and on the references filed in filing cabinets. Computer retrievals based on searches for: (1) combination of keywords, (2) keywords plus author names, or (3) specific words in the references themselves. Results of searches are printed in alphabetical order by author and year of publication in a standard format which can be telecommunicated to a word processor. The complete reference is printed as well as the citation number. Should the reference need to be retrieved from the filing cabinet, the citation number facilitates rapid retrieval.

## ACKNOWLEDGEMENTS

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## 1.0 INTRODUCTION

With the onslaught of more and more reference material, researchers murmur time and again, "What did I do with that reference by what's his name?" Now this problem can be solved. Using the BIBELOT system, all those references stacked or scattered throughout filing cabinets in file folders can be filed numerically and retrieved quickly and efficiently.

BIBELOT is a Bibliographic Filing and Retrieval System which uses the Datatrieve language to store reference collections in DEC PDP or VAX computer files. Designed so that retrieval efficiency is not limited by the number of references, an essential ingredient of the system is the assignment of an arbitrary number to each reference. This number serves two purposes: it is used in the computer files, and it is stamped on the reprint filed in a filing cabinet. The retrieval capabilities not only include the ability to select references by the individual filing number, but also by authors' names and descriptor words (keywords). Using the ability to add keywords at entry or at a later time, researchers can add to their retrieval possibilities as the scope of their work changes. The key-wording facility allows up to 30 characters per keyword; there is no limit to the number of keywords per reference.

This document is divided into six chapters. Chapters 2 and 3 discuss storage and retrieval of references, with examples. Chapters 4 and 5 are in a question and answer format with Chapter 4 devoted to general user questions and Chapter 5 to more technical issues.

Readers who have had little or no experience with computerized bibliographic systems should start with Chapter 4 - General Questions. Those who wish to know specifically how BIBELOT operates should read both Chapters 2 and 3 dealing with storing and retrieval of references, then proceed to the other chapters.

The User's Guide for BIBELOT: Bibliographic Filing and Retrieval System contains detailed guidelines for setting up a bibliographic file. For further information contact:

M. I. (Marji) Cochran  
Environmental Sciences Department  
Pacific Northwest Laboratory  
P. O. Box 999  
Richland, Washington 99352  
(509) 376-6056

or

C. R. (Chuck) Watson  
Energy Systems Department  
Pacific Northwest Laboratory  
P. O. Box 999  
Richland, Washington 99352  
(509) 376-2227

## 2.0 STORING BIBLIOGRAPHIC DATA

To illustrate the operation of BIBELOT, we have selected one of our papers as an example:

Watson, C. R., M. I. Cochran, J. M. Thomas and L. L. Eberhardt. 1978. "COMP -- A BASIC Nonlinear Least-Squares Curve Fitting Package." In Proceedings of the Fall DECUS Symposium, pp. 515-519, San Diego, California. November 1977.

We entered the citation, just as it appears above, through an interactive menu-driven computer program. (For step-by-step guidance in running the data entry program see the chapter on data storage in User's Guide for BIBELOT: Bibliographic Filing and Retrieval System, page 1.)

The computer program stored this information onto a bibliographic file after assigning the reference a unique citation number--"000008." This number was stamped on the reprint and then the reprint was filed in a folder labeled "000008."

File labels are produced by a computer program, which writes the information directly off the bibliographic file. Once labeled, folders are filed numerically by the assigned citation number.

The data entry program is set up so abstracts or investigator comments can be included, either at the time the reference is entered or later. We chose not to add comments for this reference.

The menu-driven interactive program asked us to enter keywords for our reference. We entered each author as an "A" type keyword, several descriptor or subject words as "S" type keywords and publication type as a "T" keyword. We entered a total of seven keywords as follows:

A	WATSON CR
A	COCHRAN MI
A	THOMAS JM
A	EBERHARDT LL
S	COMP PROGRAM
S	LEAST SQUARES
T	SYMPOSIUM PROCEEDING

The data entry process took about five minutes. We had the reprint in hand while answering the program's questions, and we did not need to complete a keypunch form.

### 3.0 RETRIEVALS

References are retrieved from the bibliographic file either by searching for descriptor words or authors' names from a computer listing or by using an index listing of senior authors with corresponding citation numbers. Keyword search retrieval will be explained first, followed by an explanation of the indexing retrieval. These descriptor words and authors' names are called keywords and are categorized by key-types. Retrieval lists are generally printed alphabetically by key-types so that users can scan only sections of the list of interest.

For example, key-types and keywords for the reference

Watson, C. R., M. I. Cochran, J. M. Thomas and L. L. Eberhardt. 1978. "COMP--A BASIC Nonlinear Least-Squares Curve Fitting Package." In Proceedings of the Fall DECUS Symposium, pp. 515-519. San Diego, California.

could be:

<u>Key-Type</u>	<u>Keyword</u>
A	WATSON CR
A	EBERHARDT LL
A	THOMAS JM
A	COCHRAN MI
S	LEAST-SQUARES
S	COMP PROGRAM
T	SYMPOSIUM PROCEEDINGS

The key-types in the first column are:

<u>Key-Types</u>	<u>Explanations</u>
A	Author
S	Descriptor words
T	Type of publication, book, journal article, etc.

Other key-types within the keys could include:

C	Category - Projects, subjects, etc.
L	Physical location of reference
P	Publisher or Report No.
R	Radionuclide

The BIBELOT System user does not have to use or be restricted to all of these key-types. For example, a user might choose to use author keywords

only. We encourage users to begin with the key-types described, although additional key-types may be added by individual users.

Keywords are listed in three different types of reports. A Keyword Summary Report provides an alphabetized listing of all keywords within each key-type and includes every citation number in which each keyword is used (Figure 1). Program Key-Count produces this report. To find specific references, the user scans the listing for desired keywords and then locates the reference folder using the citation number.

The Keyword Summary Report works well for general or limited retrievals, but when a given keyword applies to several references, then the single or multiple keyword computer program Search is more efficient. The user first decides what key-type and keywords the retrieval will be made on, and then runs the program interactively (Figure 2) or in batch mode. The printout is in the format of a standard bibliographic listing that can be telecommunicated to a word processor.

A second list available is the Keys Report (Figure 3). This report provides an alphabetized listing of all keywords within each key-type followed by total number of times each keyword is used. This report does not list citation numbers.

The third option for locating references in the bibliography is to use the interactive computer program Keyword-Find (Figure 4). Keyword-Find asks for the key-type and keyword and then prints every citation number in which that keyword is used.

The types of retrievals that can be done are left up to the individual investigator's needs. Individualized search programs can be written by programmers for specific needs and purposes. Alternative search strategies can usually be developed in a matter of a few minutes.

Once a computer retrieval is complete, output can be telecommunicated to a word processor, eliminating the need for retyping references. If proof-reading has been done prior to the computer searches, then no further proof-reading is necessary.

The second option for retrievals is to use an index listing produced by the computer program Ndxs-List. This listing contains the citation number, senior author's name, year of publication, reference custodian, and date of entry. If the senior author and year of publication are known, then this listing will allow the user to retrieve the reference folder using the citation number.

A partial index listing:

<u>BIB ID</u>	<u>CIT NUM</u>	<u>SR AUTHOR</u>	<u>YEAR</u>	<u>SEQ</u>	<u>CUSTODIAN</u>	<u>ENTRY DATE</u>
SECT	000301	CATALDO D	76	01	MIC	830420
SECT	000305	COCHRAN MI	76	01	MIC	830201
SECT	000173	CUSHING CE	75	01	MIC	830201
SECT	000302	CUSHING CE	80	01	MIC	830510
SECT	000144	EBERHARDT LL	82	01	MIC	830201
SECT	000300	HURLEY JS	32	01	MIC	830420
SECT	000310	SCHULTZ V	76	01	MIC	830420
SECT	000303	THOMAS JM	79	01	MIC	830201
SECT	000304	WATSON CR	79	01	MIC	830201
SECT	000180	WATSON CR	65	01	MIC	830505
SECT	000116	WATSON CR	65	02	MIC	830506
SECT	000008	WATSON CR	78	01	MIC	830506

SEQ is the sequence order the user wants the references printed when the bibliography contains more than one reference published by a senior author in the same year.

KEYWORD SUMMARY REPORT

01-DEC-83  
Page 1.

KEYWORDS FOR TYPE = A

KEYWORD	CITATION NUMBER	TIMES USED
CATALDO DA	000301	1
COCHRAN MI	000008 000304 000305 000310	4
CUSHING CE	000310	1
EBERHARDT LI	000008 000301	2

01-DEC-83  
PAGE 5.

KEYWORDS FOR TYPE = S

KEYWORD	CITATION NUMBER	TIMES USED
BIBLIOGRAPHY	000304 000305 000310	3
COMP PROGRAM	000008	1
COMPUTER DATA	000311	1
COPPER	000302	1
DATATRIEVE	000304 000311	2
ECOLOGY	000305	1
LEAST-SQUARES	000008	1
MODELS	000303	1
RELATIVE GROWTH	000300	1
SIMULATION DATA	000303	1
ZINC	000302	1

FIGURE 1. Example Keyword Summary Report (Partial Listing)  
from Program Key-Count

DTR> :SEARCH1

Enter KEY-TYPE: A

Enter KEYWORD: CUSHING CE

Search resulted in 3 matches  
for Key-Type A and Keyword of CUSHING CE  
Today's Date is: 6-Dec-83

SECT  
000173

Cushing, C. E., J. M. Thomas and L. L. Eberhardt. 1975.  
Modeling Mineral Cycling by Periphyton in a Simulated  
Stream System. Verh. Internat. Verein. Limnol. 19:1593-  
1598.

SECT  
000302

Cushing, C. E. and J. M. Thomas. 1980. Cu and Zn Kinetics  
in Myriophyllum heterophyllum Michx. and Potamogeton  
richardsonii. (Ar. Benn.). Rydg. Ecology 61:1321-1326.

SECT  
000144

Eberhardt, L. L., W. H. Rickard, C. E. Cushing, D. G. Watson  
and W. C. Hanson. 1969. A Study of Fallout Cesium-137 in  
the Pacific Northwest. J. Wildl. Manage. 33(1):103-112.

DTR> EXIT

FIGURE 2. Report Based on an Interactive Search of a Single Keyword.  
(Underlined portions are typed by user; remaining is either  
system prompts or answers.)

KEY-TYPE = S REPORT 30-NOV-83 Page 1  
BIB-ID = SECT

AERIAL SURVEYING	29
ANIMAL KILLS	1
ANTARCTIC ECOSYSTEMS	1
AQUATIC SYSTEMS	1
BIBLIOGRAPHY	5
COMP PROGRAM	1
ENVIRON IMPACT ASSESSMENTS	3
FOOD CHAIN MODEL	1
LINE TRANSECTS	4
NUCLEAR POWER PLANT	5
POPULATIONS COMPARISONS	1
RANDOM NUMBER GENERATOR	2
SAMPLING TECHNIQUES	1
TRANSECT SAMPLING	1

Total Number of S Keys 56

FIGURE 3. Keys Report from Program List-One-Type-Keyword



```
DTR> :KEYWORD-FIND  
This procedure Finds a Keyword with Key-Type requested.  
DTR> ENTER KEYWORD TYPE? S  
DTR> ENTER KEYWORD? BIBLIOGRAPHY  
BIBLIOGRAPHY 000304  
BIBLIOGRAPHY 000305  
BIBLIOGRAPHY 000310  
DTR> EXIT
```

FIGURE 4. Keyword-Find Program Run Interactively

## 4.0 GENERAL QUESTIONS

This section covers specific questions that have been asked by bibliographic file users.

### 1. Question

Will the BIBELOT System run on my computer?

#### Answer

The BIBELOT System can be run on DEC Computers, either PDP-11's or a VAX. The computer must have COBOL and Datatrieve languages and the user must have access to a computer terminal. If all these conditions are met, then the BIBELOT System can be established on your computer. Step-by-step instructions are outlined in the user's guide.

### 2. Question

What kinds of research projects would benefit from a computerized bibliography?

#### Answer

Possibly the best way to answer this question is to list the various types of research projects which already have computerized bibliographies. There are: marine ecology projects, research on the bibliographic material available on low-level waste sites, air pollution, uptake of radionuclides by Japanese quail, and various cancer research projects. One researcher has established a bibliographic file which encompasses ALL reference material in his office; this includes his book collection.

### 3. Question

Does the person entering the information need the entire reference or is a photocopy of the title page sufficient?

#### Answer

Because all the information for entering the reference is not always on the title page, the person doing the data entry often runs into difficulty. One of the most prevalent problems is the absence of complete pagination and journal source. Also, the citation number should be affixed to the reference at the time it is entered onto the bibliographic file. Following entry onto the file, references should be placed in a labeled file folder that has the corresponding citation number affixed to it.

4. Question

How much time does the scientist need to be prepared to spend on keywording?

Answer

Really, no time needs to be spent over and above gathering the references to be entered. The keywording of the references can be done after the references are entered, although with instructions, the person doing the data entry can sometimes do the keywording. To make the file most efficient, the scientist needs to spend some time reviewing the keyword list or reading over a bibliographic listing with keywords printed after each reference.

5. Question

Is it possible to do a retrieval by searching the reference titles for specific words or word phrases?

Answer

Yes. The program Title-Word is available for searching the reference titles for words and word phrases. The results may contain some references which include the names of journals because there is presently no way to search just titles, the entire reference is searched, including the journal reference.

6. Question

How many keywords can I have per reference? How large a keyword can I have?

Answer

As many or as few as you like. The maximum number is whatever the owner of the reference needs to maximize the retrieval possibilities. I would say that the absolute minimum number of keywords per reference would be all the authors. The maximum size of the keyword (or keyword phrase) is 30 characters (alpha or alpha-numeric).

7. Problem

A scientist has several hundred references that have been compiled for six or seven different projects. He wants to maintain each project file and yet be able to retrieve references quickly.

Answer

Once again we can use the Key-type=C for category and keyword these according to project. For each reference, use the project ID or use a project description (up to 30 characters per keyword). Now the references can be listed alphabetically by project, or the entire file can be searched for keywords or authors.

8. Question

How can I edit keywords efficiently to be sure that the bibliography doesn't contain a plethora of synonyms, especially when more than one researcher is putting references in the same file?

Answer

If all the researchers are working on the same project, then a list of descriptor words can be agreed upon prior to entering the references, thus avoiding the problem. If not all the researchers are working on the same project, but are sharing a bibliographic file, then the problem becomes more complex. One researcher's synonym is another's descriptor word. Multiple keywords for a reference has not become a problem with one such file that I am familiar with. We recommend periodic use of the computer program Key-Count to monitor the use of synonyms in a particular bibliography.

9. Question

Can I retrieve a reference using two or more keywords simultaneously? Example: retrieve all references with key-type = S, and words = "mines" and "coal", or key-type = A and keyword = "Bonner SE" and key-type = S and word = "mines"?

Answer

Yes. System program Search-2-Keys allows multiple word retrievals either using the same key-type or using two different key-types. The program is interactive and self-guiding. See the section on running Search-2-Keys in the User's Guide for BIBELOT: Bibliographic Filing and Retrieval System.

10. Question

Whom do I call if I run into problems using my bibliography or in telecommunicating my references to a word processor?

Answer

The usual procedure would be to call upon that person who established the bibliographic file. If there are problems that cannot be resolved

using the User's Guide for BIBELOT: Bibliographic Filing and Retrieval System, then Chuck Watson (509-376-2227) or Marji Cochran (509-376-6056) would be the persons to contact.

11. Question

When full abstracts and/or comments are entered, how do I get just a bibliographic listing?

Answer

When the references are printed in a report format, only the section of the reference pertaining to the reference citation itself is printed.

The references can be printed with or without the abstract, or with or without the comments. How much is printed is up to the investigator.

12. Question

I want to know the number of books on my bibliographic file. How is this done?

Answer

We use the key-type = T for type of publication; books cited are keyworded BOOKS. Use the single word search program, retrieve all references keyworded BOOKS, and they are listed in author and year sequence. This is handy if you're unsure whether you have a certain book and cannot remember the author(s) or descriptor words.

13. Question

Can I use a data-entry form if several investigators are cooperating on gathering reference material?

Answer

This was done on one project (that ultimately brought together five investigators) where problems of inconsistency in categorizing references were to be avoided. The researchers decided early that the easiest way to differentiate the originator of a reference was to assign each investigator a different set of reference numbers.

A form was used to record information (Figure 5). Note that one of the instructions asks for a photocopy of the reference to be included. I highly recommend this, as it avoids many of the human transfer errors encountered in copying down author names or transposing publication years.

**BIOFOULING AT NUCLEAR POWER PLANTS**  
Literature and Evaluation

Ident. Letter: \_\_\_\_\_ Ident. Number: \_\_\_\_\_  
(Evaluator's Last Initial)

Publication Year: \_\_\_\_\_

Publication Type: (Check one)

- J ( ) Journal
- T ( ) Report
- O ( ) Book
- A ( ) Article in Book or Symposium
- I ( ) Bibliography
- S ( ) Speech
- P ( ) Personal Communication or Unpublished Data
- Y ( ) Thesis or Other not Listed

Location: (Check one)

- 2 ( ) LSL-II
- 3 ( ) Sigma III
- 4 ( ) 2400 Stevens
- 0 ( ) Other (Note in Evaluation)

Keywords:

<u>Type (A) Author</u>	<u>Type (S) Subject</u>
(List jr. Authors)	(check if apply)
_____	( ) <u>Corbicula sp.</u>
_____	( ) <u>Mytilus edulis</u>
_____	( ) <u>Crassostrea virginica</u>
_____	( ) <u>Biofouling</u>

List Additional Keywords:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Citation: (in Battelle style or attach copy)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Evaluation:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Abstract: (Author's abstract, when available)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

15

FIGURE 5. A Bibliographic Data-Entry Form Used with System Program BIBIN

Here are the forms for the literature survey.

- 1) Put your last initial in the space for ident letter.
- 2) Each person is assigned a distinct group of numbers for the ident number  
Ken: 1000-1999  
Duane: 2000-2999  
Mary Ann: 3000-3999  
You are responsible for keeping track of your numbers. If you need more let me know.
- 3) Use last two digits for publication year i.e., 81 for 1981.
- 4) Check publication type
- 5) Check appropriate Location box. Indicate in the evaluation if the reference is somewhere other than LSL-II, Sigma III or 2400 Stevens.
- 6) The author Keyword is for Junior authors only.
- 7) Please be consistent in spelling your Keywords.
- 8) You may attach a photocopy of the citation and abstract.

FIGURE 5. (Continued)

## 5.0 TECHNICAL QUESTIONS AND PROBLEMS

### 1. Question

What is the maximum number of entries that I can have on a file?

#### Answer

The citation numbering system was set up with a six-digit reference number (cit-num), the first two for file identification, the last four the individual citation numbers. Maximum number of individual files within a master file is therefore 99 files, with 9,999 references in each file. The maximum size of the keyword (or keyword phrase) is 30 alpha or numeric characters.

### 2. Question

How many references in my large bibliographic file are by one author?

#### Answer

Use the single word search program to obtain a list of all references with that author's last name and initials.

If you're unsure whether that author may have been keyworded with a single initial or all initials, use the multiple word search program and search both ways. You may also look up the author in the Keyword Summary Report for the large file.

### 3. Question

What if I want to add a reference and find that someone else has already entered it onto the file? Can I have my own file copy and add keywords?

#### Answer

Each reference can have more than one Index Record. Problem 1 in this section answers this first part of this question.

Each reference can have multiple descriptor keywords and each person can add keywords using the same key-types or add key-types that are not already used for that reference. (Communicating with the other persons citing this reference would avoid accidental erasing of keywords).



## PROBLEMS

### 1. Problem

Several scientists in an organization want to share a large bibliographic file, but at the same time they want to be able to differentiate as to reference ownership and where the references are filed. Can this be done?

### Answer

Yes. The bibliographic file contains three distinct parts: the references (CITS), the keywords (KEYS), and the index (NDXS). We use the index file to flag references as to which references originally belonged to each scientist, either in the BIB-ID or custodian field. (This flag can also be used to differentiate references pertaining to a specific project--BIB-ID.) These entries are in the index and are called records. The index record consists of seven fields, including a BIB-ID and custodian field. The BIB-ID field can be used to designate the owner of the reference or the project identification. The custodian field can contain the initials of the person in whose office the reference is physically filed.

As an example of how this might work, consider the following four index records which all flag the same reference:

<u>BIB</u> <u>ID</u>	<u>CIT</u> <u>NUM</u>	<u>SR</u> <u>AUTHOR</u>	<u>YEAR</u>	<u>SEQ</u>	<u>CUSTODIAN</u>	<u>ENTRY</u> <u>DATE</u>
SECT	000305	COCHRAN MI	76	01	GLP	830201
FAMS	000305	COCHRAN MI	76	01	MIC	830301
MIC	000305	COCHRAN MI	76	01	MIC	830201
JMT	000305	COCHRAN MI	76	01	JMT	830201

This particular reference appears once in the citation section even though it is indexed as four distinct index records. Each of these four records designates a specific file within the large file. If we were to print all references with BIB-ID = SECT, for instance, this reference would be included in that listing. The BIB-ID designates it as a reference belonging to a particular organization. Its citation number is 305, and in this case the custodian field (GLP) indicates that the reference is filed in the secretary's filing cabinet.

All references coded BIB-ID = SECT can be retrieved using a computer program which selects those references coded SECT which prints the references according to senior author and year. Using this method, computer costs are reduced because it costs less to retrieve an entire

project file than searches by keyword. Regardless of the number of index records per reference, each reference is printed once when printing the bibliographic file.

## 2. Problem

One of the investigators knows that before the project is finished, specific references will be cited in each of several reports. He/she doesn't want references cited in the first report to be cited in the second, or references cited in the second used in the third, and so on. How can this be done effectively?

### Answer

The most efficient way would be to establish a keyword category whereby references in the first report would be keyworded in key-type=C as "Report No. 1," the second report as "Report No. 2," etc. Now the user can do a multiple word search using a keyword search program and search for references with key-type=C, and keyword "Report No. 1," "Report No. 2," etc.

This listing would be printed alphabetically according to senior author and, therefore, could be used to produce a record of which references have been cited. Each time a new report was submitted, this listing could be revised, thus providing the user with an up-to-date record.

The user could also search the entire bibliography for citations of interest which do not have a keyword equal to "Report No. 1."

## 3. Problem

Several scientists in different locations wish to maintain their own reference files, but do not want to duplicate one another's efforts. How can they maintain their own files and yet share a computer bibliographic file?

### Answer

- 1) The scientists can differentiate their files within the large bibliographic file using the index records. This will enable them to look at one another's files and use the key-type = L for location to determine the holder of a reference.
- 2) Each scientist could have his/her own bibliographic file on separate accounts. The disadvantage to this approach is the inability to print the entire bibliographic file in a senior author, year sequence for a final report. In this case a programmer would be needed to merge the separate bibliographic files to create one large bibliographic file.

- 3) Maintain a large file until the project is completed, then transfer individual parts of the file onto separate bibliographic files. The costs of maintaining one large bibliographic file can be less than programmer costs for transferring files.

## 6.0 REFERENCES

Cochran, M. I., and C. R. Watson. 1984. User's Guide for BIBELOT: Bibliographic Filing and Retrieval System. NRC Interim Report, PNL-5203, Pacific Northwest Laboratory, Richland, Washington.

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