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DEVELOPMENT OF A BIOMEDICAL DATABASE ON THE
MEDICAL ASPECTS OF CHEMICAL DEFENSE

Annual Report

Lawrence A. Landry, Ph.D.

December 1988

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SUMMARY

This report documents a one-year period of activities encompassing the further development and maintenance of the automated information system known as the Chemical Agent Retrieval System (CARS) for the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD).

During the period 19 November 1987 through 31 December 1988, Associate Consultants, Inc. (ACI), creator of the prototype system, expanded the database with relevant research articles taken from USAMRICD research reports and CRDEC holdings, medical and scientific libraries within the Washington area, and on-line searches of machine-readable databases containing citations from the worldwide literature. Within the 12-month period, ACI also succeeded in modifying the CARS Thesaurus by making key revisions. The CARS Thesaurus now includes a faceted structure using general biomedical index terms and tree structures. Significant automation with the Automated Citation Tracking System (CITES) and the CARS Update Tracking System (CUTS) significantly increased the efficiency and level of production while providing reduced costs to the government.



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FOREWORD

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I. INTRODUCTION

The summary of activities given in this report is in response to the USAMRICD contract objectives being carried out by ACI. During Contract Year (CY) 1987-88, the work completed in the on-going development of CARS under Contract Number DAMD17-86-C-6083, consisted of the following major accomplishments:

- Document acquisition and processing activities expanded the unclassified CARS (U-CARS) database to 10,754 records on-line; our projected gain of 1,900 records for this contract year.
- Completed pricing study and submitted final report to the Army on ACI's proposal to relocate the physical residence of the database from the VAX computer clusters at database from Battelle Columbus Laboratories in Columbus, Ohio, to the offices of ACI for permanent storage. ACI's recommendation to acquire and install VAX hardware, and meet necessary security requirements is pending the Army's response and approval for implementation. However, ACI's responsibility for the database maintenance functions continues.
- Installed an Automated Citation Tracking System (CITES file) to signal prior duplication when retrieving CARS documents.
- Installed the CARS Update Tracking System (CUTS) to automate database production procedures.
- Designed, tested, and finalized key scientific hierarchies for a new on-line thesaurus.
- Developed and printed three CARS Thesaurus documents: CARS Thesaurus Hierarchies, CARS Thesaurus Key Words Out of Context (KWOC) Listing, and CARS Thesaurus Alphabetical Index.
- Assisted USAMRICD researchers in assessing toxicology information on G-agents, V-agents, sulfur mustard, and lewisite. Database users such as the M-TRC Corporation were also provided services.

ACI responded fully to the task objectives described in the Contract Award and Proposal. Accordingly, we achieved the following goals:

- Expanded U-CARS database to include antidotes;
- Searched on-line databases, accessed special area libraries for relevant CARS literature, received draft reports from USAMRICD, and implemented search activities at the Defense Technical Information Center (DTIC);
- Researched and installed an automated citation tracking system for identifying CARS duplicates;

- Researched and installed an automated update tracking system to automate the CARS database production procedure.
- Installed 3 personal computers to increase cost-effectiveness in keying and editing prior to uploading data to the VAX mainframe computer;
- Updated CARS training manual for more effective searching and retrieving of chemical agent literature on the CARS database;
- Revised the CARS Abstract Style Guide;
- Developed, analyzed, and codified quality control and quality assurance procedures for securing CARS literature;
- Facilitated audit of U-CARS and C-CARS data concerning the nature of effects on animals and humans, and the nature of lethality, safe levels, and toxicity related to chronic exposures.
- Checked research literature within USAMRICD and CRDEC research holdings and added relevant documents to the database.

II. CONTRACT ACTIVITIES

Six major activities were successfully carried out during the 1987-1988 contract year:

- Database Expansion
- Data Collection
- Document Coding/Abstracting
- Thesaurus Design/Lexicography
- Keying and Editing
- Systems Development

Each task is described below with a general introduction followed by a description of activities.

A. Database Expansion

During CY 1988, the scope of the U-CARS database was broadened. CARS users now have access to data on pharmacological, pharmacokinetic, and other decremental performance mechanisms that are considered potentially relevant battlefield effects of nerve agent exposure. Literature on the treatment of threat agent exposure currently represents over 50% of the on-line CARS records. Inclusive in that data on performance mechanisms are the following treatment compounds: atropine compounds, HGG compounds, HI compounds, pralidoxime compounds, obidoxime, pyridostigmine, physostigmine, P2S, and TMB-4. In addition to these treatment compounds the U-CARS database literature on vesicants, mustard, and lewisite compounds was expanded in CY 1988

Our biomedical and information scientists supported effects by the MITRE Corporation to assess toxicity information on G-agents, V-agents, sulfur mustard, and lewisite, pursuant to MITRE's contract with USAMRICD. Scientists at MITRE audited both unclassified and classified CARS (C-CARS) data concerning the characterization of incapacitating lethality, safe levels (zero-effects), and toxicity related to percutaneous, ocular, respiratory, acute and chronic exposures. U-CARS and C-CARS searches were reviewed by MITRE for relevance, and designated source documents were photocopied. This included 250 C-CARS documents that were photocopied, approximately 7,300 pages. All photocopies were transmitted to MITRE headquarters for inclusion in briefings, reports, and deliverables required by USAMRICD.

B. Data Collection

The preparation of additional information to be incorporated into CARS involved systematic literature analysis, search, and screening procedures. Approximately 7,000 unclassified bibliographic citations were screened by CARS staff. For inclusion into C-CARS, 1,900 lewisite documents, 150 phosgene oxime documents, and 150 phosgene documents were

screened at CRDEC Technical Library by C-CARS staff.

Documents to be included in the database covered 3,100 U-CARS citations and 400 C-CARS documents that were determined potentially relevant, from which 1,900 unit records were processed and placed on-line, and 145 C-CARS were processed and placed in C-CARS holdings. The literature analysis work involved only the accepted documents from the literature search phase. Overall, literature analysis activities involved an on-line search for CARS literature of the following machine-readable databases:

- Eric
- Biosis 1981
- NTIS
- Social Scisearch
- Agricola 79
- Psycinfo
- Chem Ind Notes
- Federal Index
- Claims/U.S. Patent
- Claims/U.S. Patent A
- Scisearch 84
- Dissertation Abstracts
- Enviroline
- Pollution ABS
- Pharm News Index
- Nichem
- Magazine Index
- Pais International
- Cris/USEA
- SSIE Current Research
- GPO Monthly CAT
- Enviro Perio Bib
- Intl Pharm ABS
- Life Sciences Collection
- Conf Papers Index
- PTS A/DM&T
- Scisearch 81-81
- USPSD
- Scisearch 78-80
- CIS
- Agricola 70-78
- National Newspaper
- Claims/US PAT ABS
- Congressional Record
- Federal Register
- Chemical Exposure
- Psycalert
- Current Technology
- Health Planning
- Medline 1966-1974
- Medline 1975-1979
- Medline 1980
- Occupational Safety
- World Affairs Report

Scisearch 74-77
Agris
Newsearch
Nursing and Allied
Middle East: Abstract
Mideast File
Federal Research In Progress
De Haan Drug Data
Soviet Science
CA Search 67-71
CA Search 72-76
CA Search 80-81
CA Search 82
Chemical Business
World Patents Index
World Patents Index
Remarc 1900-1939
Remarc 1940-1959
Remarc 1960-1969
Remarc 1970+
LC Marc
Books in Print
Wiley Catalog Online
PTS MARS

Access to potentially relevant CARS literature was provided by the following libraries:

- National Library of Medicine
- National Institutes of Health Library
- U.S. Department of Agriculture Library
- Welch Medical Library of John Hopkins University
- U.S. Library of Congress
- USAMRICD and CRDEC research libraries

CARS staff also received, processed, and included draft annual reports from USAMRICD personnel.

C. Document Coding/Abstracting

Scientific and bibliographic data from 1,900 relevant CARS documents were abstracted, coded, indexed, and placed on-line during CY 1988. Seminars for abstractors were held periodically by ACI project management, to ensure continuing accuracy and comprehensiveness of data being entered into CARS.

CARS thesaurus experts conducted extensive quarterly training sessions to benefit abstractors, indexers, coders, and other editorial support personnel. Each session was designed to highlight ACI's analytical technique and format as a standard for defining specified thesaurus terms. The training sessions also stressed quality control/assurance (QC/QA) procedures needed to validate samples of CARS records that were indicative of the entire CARS database.

D. Thesaurus Design/Lexicography

ACI collaborates extensively with internationally recognized lexicographers to enhance analysis of the complex subject material in the CARS database. The experience of eight years of detailed indexing has yielded a rich vocabulary well-adapted to the contents of the database and needs of the users. The thesaurus has been developed for use by a faceted structure, a method in which vocabulary is analyzed and clustered into a set of terms, or facets, each bearing a primary characteristic. Maintenance of the faceted structure depends on: (1) analysis of raw vocabulary taken from existing vocabulary lists, user and indexer experience, and a sample of the contents of the database; (2) sub-arrangement of terms within the facets into appropriate hierarchies determined by the characteristics and the generic/specific relationships between the terms in the facets; and (3) the determination of the appropriate terms to represent the concepts displayed by the raw vocabulary as they are referred to in the literature by the users. A variety of hierarchies within the thesaurized facets of the database were analyzed and tested by ACI's science officer and technical editor.

Since facets are mutually exclusive, they are susceptible to revision and extension, without disturbing other facets. Another advantage in the faceted model is that vocabulary can be adjusted to the needs of the database -- in specificity (depth) and exhaustivity (scope) in core and fringe facets as needed. From classification schemes for shelf arrangement to thesauri for database organization and retrieval, faceted models efficiently generate a variety of controlled index languages. In addition, the faceted structure has been the chief resource for the revised CARS thesaurus.

Expansion of the CARS database consisted of a sequence of tasks which were refined throughout the project. Completion of the CARS thesaurus structure and database expansion significantly altered indexing guidelines. Alterations in CARS indexing vocabulary permitted standardization of CARS indexing vocabulary by using an interim thesaurus to facilitate automatic index term switching and modifications of CARS. The posting/switching program previously to permit revisions to existing thesaurus terms, through complete, was ultimately discarded in favor of a complete reindexing of the database and redesign of the thesaurus.

The CARS Thesaurus is divided into fourteen facets and the hierarchies within them:

- B Inorganic Chemicals
- C Organic Chemicals
- D Heterocyclic Compounds
- E Biochemicals by Structure
- G Biochemicals by Function
- H Antidotes and Agents
- J Chemicals by Chemical-Physical Activity
- L Chemistry and Physics
- N Enzyme Activity
- Q Biomedicine
- R Organisms
- T Environment
- V Equipment
- X Sociology

In the construction of the CARS database, documents were indexed by keywords, building a keyword list of approximately 10,000 terms. The keywords were fitted with broader term (BT), narrower term (NT), and related term (RT) references, USE and USE for (UF) and scope notes (SN). Many terms are stand-alone terms with no references or connections to any other terms. Each term was evaluated to ensure that the most appropriate term was used to represent a concept and the USE reference was established from its synonyms or quasi-synonyms. For CY 1988, the number of lead terms totalled 2,626.

The facets with corresponding hierarchies are controlled by a fully expressive alphabetic notation for the arrangement, display, and printing of several versions of the CARS Thesaurus in whole or in part. Thus ACI was able to fulfill its contract obligation by producing a technically accurate print thesaurus, the CARS Thesaurus Hierarchies, and two arrangements to facilitate index term retrieval: the CARS Thesaurus Keywords Out of Context (KWOC) listing and the CARS Thesaurus Alphabetical Index. Examples of these three print-on-paper thesauri are provided in Figures 1, 2, and 3 respectively.

	CARS THESAURUS HIERARCHIES
Hcsa	1,2-DITHIOGLYCEROL
Hcsa	BRITISH ANTILEWISITE
Hcta	DEFERRIOXAMINE SULFONATE
Hd	NERVE AGENT ANTIDOTES
Hdb	CHOLINOLYTICS
Hdba	BLEACHING COMPOUNDS
Hdbb	ANTIMUSCARINICS
Hdbbb	ATROPINE
Hdbbbb	ATROPINE BROMIDE
Hdbbbbj	ATROPINE METHANESULFONATE
Hdbbbbm	ATROPINE METHYLNITRATE
Hdbbbbn	ATROPINE NITRATE
Hdbbbbs	ATROPINE SULFATE
Hdbbd	BENACTYZINE
Hdbbi	HOMATROPINE
Hdbhca	CALCIUM OXYCHLORIDE
Hdf	ChE REACTIVATORS
Hdfb	OXIMES
Hdfbb	BDB COMPOUNDS
Hdfbc	DAM
Hdfbe	HGG COMPOUNDS
Hdfbeb	HGG-12
Hdfbec	HGG-42
Hdfbg	MINA
Hdfbh	OBIDOXIME
Hdfbk	TMB-4
Hdfbo	HI COMPOUNDS
Hdfbob	HI-1
Hdfbos	HI-6
Hdfbp	HS COMPOUNDS
Hdfbpb	HS-3
Hdfbpd	HS-6
Hdfbr	PAM
Hdfbrb	2-PAM
Hdfbrbc	2-PAM CHLORIDE
Hdfbrbf	P2S
Hdfbrbfb	BENZYL-P2S
Hdfbrbi	2-PAM IODIDE
Hdfbrbm	2-PAM LACTATE
Hdfbrc	3-PAM
Hdfbrci	3-PAM IODIDE
Hdfbrd	4-PAM
Hdfbrdi	4-PAM IODIDE
Hdfbrp	PRO-PAM
Hdfs	SAD COMPOUNDS
Hdfsb	SAD-128
Hebca	ACTIVATED CARBON

Figure 1

CARS THESAURUS KWOC LISTING

AEROSOL

AEROSOL Lsva

AFFERENT

AFFERENT NERVE ENDINGS Qbbnbheb

AFFERENT PATHWAYS Qbbmba

AFFINITY

AFFINITY COEFFICIENTS Lkec

AFFINITY CONSTANTS Lkeb

AFFINITY CHROMATOGRAPHY Lbha

BINDING AFFINITY Lke

AFLATOXINS

AFLATOXINS Dobb

AGAROSE

AGAROSE Ebob

AGENT

AGENT Q Cdkmkca

AGENT T Cdkmkf

AGENT BLUE Cucka

AGENT WHITE Hfjdoa

NERVE AGENT ANTIDOTES Hd

V AGENT SIMULANTS Hmhd

AGENT GREEN Hmjdc

CW AGENT SIMULANTS Hmh

G AGENT SIMULANTS Hmhb

AGENT PINK Hmjde

AGENT ORANGE Hmjdd

AGENT-BURSTER

AGENT-BURSTER RATIO Vebir

AGENTS

INFECTIOUS AGENTS Hmbb

DECONTAMINATING AGENTS Hh

CW AGENTS Hmf

CHOLINERGIC AGENTS Hhbda

BLOOD AGENTS Hmfd

CHOKING AND SNEEZING AGENTS Hmffb

ANTIDOTES AND AGENTS H

BIOLOGICAL WARFARE AGENTS Hfba

BW AGENTS Hmb

GANGLIONIC BLOCKING AGENTS Hhbfa

CHOLINERGIC BLOCKING AGENTS Hhbba

CHEMICAL WARFARE AGENTS Hffa

CYANOGENIC AGENTS Hmfd

TEAR AGENTS Hffca

BLISTER AGENTS Hffba

Figure 2

CARS THESAURUS ALPHABETICAL INDEX

ADENOSINE 5'-PHOSPHORIMIDAZOLIDE Engbbb
 ADENOSINE DEAMINASE Gcbcb
 ADENOSINE DIPHOSPHATE Engbea
 ADENOSINE MONOPHOSPHATE Engbba
 ADENOSINE TRIPHOSPHATASE Gcbdgca
 ADENOSINE TRIPHOSPHATE Engbga
 ADENYL CYCLASE Gced
 ADENYLATE CYCLASE Gceda
 ADH Eixa
 ADH Ghgma
 ADHESIONS Qfbb
 ADIPHENINE Cfgegbba
 ADIPHENINE Hrbbba
 ADIPOSE TISSUE Qbtbb
 ADMINISTRATION AND EXPOSURE Qmpb
 ADP Engbe
 ADRENAL CORTEX Qbpbb
 ADRENAL GLANDS Qbpb
 ADRENAL MEDULLA Qbpbd
 ADRENALECTOMY Qjsb
 ADRENALINE Chgoa
 ADRENALINE Gjga
 ADRENEGIC FIBERS Qbbnbnd
 ADRENERGIC ALPHA RECEPTOR BLOCKERS Hrbmba
 ADRENERGIC BETA RECEPTOR BLOCKERS Hrbmda
 ADRENERGIC BLOCKADE Qdnpb
 ADRENERGIC NEUROHUMOR DEPLETERS Hrbmc
 ADRENERGIC RECEPTORS Eksbsb
 ADRENERGIC RECEPTORS Qbbsnb
 ADRENOCORTICOTROPIC HORMONE Eika
 ADRENOCORTICOTROPIC HORMONE Ghgca
 ADSORBENTS Jba
 ADSORPTION Lr8a
 AEROSOL Lsva
 AFFERENT NERVE ENDINGS Qbbnbheba
 AFFERENT PATHWAYS Qbbmba
 AFFINITY CHROMATOGRAPHY Lbha
 AFFINITY COEFFICIENTS Lkec
 AFFINITY CONSTANTS Lkeb
 AFLATOXINS Dobb
 AFLATOXINS Hmbdfb
 AGAROSE Ebob
 AGENT BLUE Cucka
 AGENT BLUE Hmjdgga
 AGENT GREEN Hmjdc
 AGENT ORANGE Hmjdd
 AGENT PINK Hmjde
 AGENT Q Cdkmkca
 AGENT T Cdkmkf
 AGENT WHITE Hmjdoa

Figure 3

Maintenance of the CARS Thesaurus and the integrity of its application in indexing are ongoing tasks. To achieve this level of excellence, index terms for each new document are compared against valid CARS Thesaurus terms. If even one index term is not an exact match, the entire document is prevented from uploading to the CARS database. Invalid index terms are then reviewed by ACI's lexicographer or technical editor. Concurrently, a candidate term field has been designated as such to permit the abstractors, lexicographers, and technical editors to recommend new terms. These candidate terms are subjected to frequency analysis and final review/approval by a lexicographic committee established for this specific task. The committee determines whether the term is significant for inclusion in the CARS Thesaurus, or would be adequately retrieved by full-text searching.

E. Keying and Editing

In CY 1988, we installed three personal computers to increase keying and editing efficiency, and to reduce labor costs. These computers are equipped with state-of-the art word processing and database software to enhance off-line keying and editing functions for each record. As a result, we realized a significant monthly cost savings in connect-time and processing.

Installation of the personal computers made it possible for us to now place CARS manuals on diskettes, which promotes easier incorporation of modifications in user training materials. By December 1988, two manuals (described below) were revised:

- Searching and Retrieving the Chemical Agent Literature on the Chemical Agent Retrieval System (CARS Database)
-- Revised edition of the original CARS Training Manual. Modifications reflect changes in log-on procedures, range of data in the database, and increased examples for self-guided learning.
- Chemical Agent Retrieval System (CARS) Abstract Style Guide
-- Revised guidelines for instruction and use by abstractors and editors.

Also in CY 1988, CARS staff updated the "Standard Operating Procedures (SOP) Manual". The purpose of the manual is to familiarize incoming employees with CARS project goals. The SOP Manual was also designed as an instrument to document the flow of materials and information. Although considerable time was necessary for computer training and employee orientation, our goals were met and we successfully mounted 1,900 records over the contract year.

F. Systems Development

During CY 1988 we made several changes in the CARS database. In effects, we automated the document process for greater efficiency, which provided us the opportunity to reduce costs to the government.

At the start of the contract, four terminals were connected to the Digital Equipment Corporation's VAX mini-computers at Battelle Laboratories with the use of two direct data lines. Data entry, editing and quality control were performed in terminals; we were charged for the computer time used, and for data line costs.

We reduced Automated Data Processing (ADP) by using a total of 5 state-of-the art IBM-compatible computers to input and edit unit record and abstract information. Using Dbase III+ and WordPerfect software, a model of the CARS database was developed. Accordingly, ACI is no longer required to log onto Battelle's computers for extended time periods in order to input and edit data. In addition, the capability to maintain machine-readable data until editing and quality control functions have been performed has been extended. Once the editing function is complete, the data is then uploaded to the VAX. The result is ACI's ability to operate with one direct line to Battelle, rather than two previous lines.

By converting from terminals to personal computers, we gained an in-house processing and quality control advantage. In turn, this extended our capability to computer-generate microfiche headers as a standard operating procedure. Prior to automation, once documents were received, title forms were manually complete and forwarded to a designated microfiche vendor. We now output the microfiche headers electronically using the BASIS report module. Afterwards, the headers are transmitted to the vendor via modem, which minimizes labor time and proves to be more cost-effective.

During CY 1988, ACI installed a duplicate search strategy, the Automated Citation Tracking System (CITES). CITES is in operation as a computerized tracking system for identifying CARS duplicates. This text-searchable database is used to automatically avoid retrieving documents that have been previously screened and found unsuitable for inclusion in the CARS database. Presently over 11,000 citations are contained in the CITES File. In CY 1988, key entry of the CARS cardfile was computed, tested, and initiated. CARS staff continue to key input and edit the CITES database which was moved from Battelle's VAX to personal computers. ACI now keys and edits bibliographic citations in-house, on a once-per-week basis, the citations are transmitted to the VAX to be loaded into the CITES database. CITES testing is on going, and we expect to continue testing through final completion during CY 1989.

ACI also created and completed a duplicate checking file which is now incorporated into the Automated Bibliographic Citation Tracking System for operation.

By December 1988, the CARS Update Tracking System (CUTS) was integrated on the Novell Network. Multiple users can now access and manipulate the CARS (in-house) database. Implementation of CUTS will help to eliminate floppy diskettes and reduce paper generation thereby reducing costs to the government. In addition access to the system has been simplified by automatic routing. Each user, after identifying his/her ID number, accesses only the subprogram tailored to his/her needs. The specific work that has been allotted to this ACI staff member is posted on the screen. The CUTS automated process will allow for greater efficiency while maintaining the high level of integrity of the CARS database.

Furthermore, CUTS allows for generation of reports to show where and what documents are in progress. Logs for abstractors, translators, keyboarders, indexers, and editors can also be generated. Reports generating how many documents are ready for key input, indexing, and editing can be provided.

Automation of C-CARS to facilitate the screening of duplicate documents occurred during CY 1988. ACI automated the identifying numbers from the Medical Research Institute for Chemical Defense documents and the AD numbers from DTIC documents. In addition, ACI automated the C-CARS manual author index setup for ACI's internal accession numbers. Since no titles are involved (as some C-CARS titles are classified), a particular author can be identified and then the user can manually check out the relevant documents.

Finally, ACI created an automated accounting system to track and report the universe of CARS users. This system was designed to record user hours and any associated cost factors.

CONCLUSIONS AND RECOMMENDATIONS

Since its inception nine years ago, the CARS database has been expanded to support an increase in CARS users, and to enhance USAMRICD's research capability. A number of modifications occurred in the CARS thesaurus to yield a flexible vocabulary compatible to the needs of its users and to reinforce the contents of the database. Actual progress made by ACI in the ongoing development of CARS will facilitate an evaluation by the Army as called for in the Contract Award and Proposal.

Upcoming activities to improve the quality and effectiveness of the CARS database in achieving the stated goals of the USAMRICD include:

- Scientific support for research, testing and evaluation of medical material and treatments for chemical threat agents;
- Including literature generated by USAMRICD researchers;
- Developing antidotes and pretreatment compounds for chemical defense;
- A centralized biomedical information system to identify significant scientific data gaps;
- Providing a framework for a chemical defense information analysis center in which the effects of these chemical agents can be identified and analyzed in order to answer specific scientific research and development questions.
- Further system automation work on the classified CARS database, which is currently in manual form.

We recommend expansion of the CARS database to include both standard and newly-developed antidotes. This will support the efforts by USAMRICD to secure requisite Federal Drug Administration approvals for use of these antidotes. In addition, we recommend that USAMRICD undertake expansion of the database system to include a computerized machine-readable information analyses center which will allow for controlled, rapid searches of classified data, ongoing research data, quantitative data search capability, and efficient turn-around of state-of-the-art summary reporting.

Finally, we recommend that USAMRICD grant final approval to ACI to purchase and install VAX hardware at ACI for classified ADP in order to lower ADP costs. The VAX acquisition plan is pending response from the Army.

IV. REFERENCES

GLOSSARY

Abstract	In CARS, a detailed summary (up to 800 words) of the information content and data contained within a technical document
BASIS	The database management system (DBMS) used to manipulate the CARS database
C-CARS	The portion of the CARS database containing only classified documents
Clusters	A group of similar elements or terms gathered or occurring closely together
Codify	To arrange or systematize
Coding	The process of filling in work-sheets containing a map of the CARS unit record so data can be entered into CARS
Dbase III+	A database management system software application to be used on IBM compatible personal computers
Decremental	The amount lost by gradual diminution or waste
DEC	Digital Equipment Corporation
Downloading	The process of transmitting data from the last computer to the remote computer
Facets	An aspect; phase
Field	In computer memory, a collection of bytes suitable for storing a specific item of data
Hierarchies	A body of terms organized or classified according to rank or authority
Index Term	One or more words defining a subject area discussed in a document; member of the subject word list produced by BASIS or data within a CARS index term field
Lexicography	Process of writing or compiling a dictionary
Off-line	An operation performed to prepare data to be entered into a computer
On-line	An operation in which data entered from a terminal is immediately processed to alter the

	contents of a record stored on disk
Record	In computer memory, a collection of fields in fixed order, repeated one or more times, suitable for storage of specific data elements
Retrieval	Process of obtaining all bibliographic documents within a collection that contain certain data as specified by the search strategy
Search	Process of identifying bibliographic citations
Thesaurus	A controlled vocabulary showing logical interrelationships of all index terms
U-CARS	The portion of the CARS database containing only unclassified documents
Unit Record	The computer-coded set of all data elements pertaining to a given CARS document
Update	Addition of new records to the computerized database
Uploading	The process of transmitting data from a remote computer to a host computer
User	A researcher, administrator, or librarian interested in finding specific information in the CARS database
VAX 11/780	DEC computer housing CARS at Battelle Columbus Laboratories