STANFORD RESEARCH INSTITUTE
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February 15, 1977

CLIENT PRIVATE

Proposal for Research
SRI No. ISC 77-20

TEXT PROCESSING SYSTEM

Mr George Stehle
Second Vice President
The Chase Manhattan Bank,N.A.
1 New York Plaza
New York, NY 10015

Dear Mr. Stehle:

Stanford Research Institute (SRI) hereby submits the enclosed proposal, SRI No. ISC 77-20, in response to your letter of January 14 and its enclosed RFP for the Text Processing (TXTP) project.

As you suggested in your letter, SRI is bidding primarily on software and its support, rather than on hardware and its maintenance. However, all the hardware required for satisfactory use of the proposed system is fully specified in our proposal and is readily available for purchase or lease, including installation and maintenance, from standard sources.

I am confident you will find that our proposal is fully responsive to the technical requirements of your RFP. The proposed system meets or exceeds all your basic requirements, and in fact contains many features that make it widely useful beyond the immediate context of your text processing needs.

In preparing this proposal, we were challenged to reduce the scope of our current system, rather than, say, to stretch the limits of a system with less-comprehensive capabilities. Therefore please note that our proposed system can readily be upgraded and expanded, with

rapidly-increasing cost effectiveness, from the configuration proposed here.

We shall look forward to presenting a demonstration in New York on March 7 (if that date is agreeable with your people) of the currently operating "NLS" system, upon which our proposed system for Chase Manhatten Bank will be based.

Although SRI has taken exception to some of the contractual details of your RFP, I'm sure such issues can be resolved to our mutual satisfaction after the technical decision has been made.

If you have any further questions about this proposal, please do not hesitate to call me.

Incidentally, this proposal was prepared by a small team in an elapsed period of 19 days, from initial decision to bid to final typing, entirely with the use of our current text processing system.

Sincerely yours,

Bertram Raphael

Bertram Raphael, Director
Augmentation Research Center

BR:bpm

Approved:

Earle D. Jones

Earle D. Jones, Executive Director
Information Science and Engineering Division

STANFORD RESEARCH INSTITUTE
Menlo Park, California 94025 · U.S.A.

15 February 1977 38930

CLIENT PRIVATE

Proposal for Research
SRI No. ISC 77-20

A TEXT PROCESSING SYSTEM FOR CHASE MANHATTAN BANK

Volume I: Technical, Management and Corporate Information Proposal

Prepared for:

THE CHASE MANHATTAN BANK, N.A.
Contracts Administration
Data Processing Area
1 New York Plaza, 21st Floor
New York, New York 10004

Prepared by:

Augmentation Research Center

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ATTACHMENTS

1. A Uniform, Consistent, and Extensible Human-Computer Interface (SRI ARC Journal Number 38943)

2. Irby, C.H. "The Command Meta Language System." AFIPS Conference Proceedings, National Computer Conference, Vol. 45, 1976.

3. Output Processor Users' Guide (SRI ARC Journal Number 32812)

4. NLS Users' Training Guide (SRI ARC Journal Number 29012)

5. Bair, James H., "Strategies for the Human Use of a Computer Based System." NATO Advanced Studies Institute on MCI, Sept. 1976 (SRI ARC Journal Number 38634)

6. Reprint from WORD PROCESSING WORLD Magazine, Jan/Feb., 1977.

VOLUME I: TECHNICAL, MANAGEMENT, AND CORPORATE INFORMATION PROPOSAL

1 TECHNICAL RESPONSE

1.1 Overview of the System

1.1.1 Introduction

1.1.1.1 The Augmentation Research Center (ARC) of Stanford Research Institute (SRI) is pleased to submit this proposal in response to Text Processing Request for Proposal (TXTP), dated January 12, 1977. For fifteen years ARC has been developing a computer-based textual and graphical information processing system. This development has resulted in a superior text processing system for use in document production and control. This system, the Online System for Document Production (NLS-DP), has been in use as part of SRI's service operation by over 300 users for over three years.

1.1.1.2 NLS-DP currently incorporates state-of-the-art text processing and document production facilities which run on time-sharing computer systems. NLS-DP is a coherent, integrated, open-ended set of documentation tools. It is designed to provide a nontechnical user with a straightforward interface with a large and powerful group of editing, displaying, printing, formatting, controlling, and backup facilities. Using one system and one consistent command language, the NLS-DP user today has complete control of document production and management.

1.1.1.3 This proposal describes in detail how NLS-DP will meet the requirements and needs stated in the RFP and New Project Request. NLS-DP not only meets the requirements, it provides extensive additional features, many of which are included without additional cost. It also provides one of the most advanced approaches to computer-based text processing available today. According to WORD PROCESSING WORLD (January 1977), the system is "one of the more mature and most successful" approaches to text processing and office automation (see Attachment VI).

1.1.1.4 One of the keys to this success is the provision of a video display terminal, which displays the document to be edited and all the status and feedback information necessary for errorless control. The display changes immediately when any alteration in the text is commanded. The commands are English words such as Delete and Insert. Text to be changed is selected

by "pointing" to the text by moving a cursor on the screen. The user operates the cursor by pressing keys on the keyboard, or by moving a "mouse," a hand-held cursor control unique to the NLS-DP system.

1.1.1.5 In addition to the appearance of editing changes on the screen, the displayed text is immediately rearranged to accomodate the changes. The desired structure of the text, the headings, paragraphs, tables and the like, is always maintained. In addition, the user may see any page in the system at any time by either pointing to its location or entering its address. Viewing pages is facilitated by displaying specified portions of pages so that many can be viewed simultaneously. This is an outline view, provided instantly at a users request.

1.1.1.6 At the heart of NLS-DP is a unique hierarchical file structure. Most computer systems provide the user with a line-oriented editor which operates on sequential files. Lines are formal units of a document, not logically based on content, which do not reflect the document's organization into headings, paragraphs, subheadings, and so on. The hierarchical structure represents these relationships and is manitained by the system. The structure can be changed easily at any time, and facilitates formatting and searching on the basis of the document's logical structure.

1.1.1.7 The "statement," which is a logical block of text, is the basic unit of the hierarchical file structure. It may be a chapter heading, a diagram, a paragraph, or a row in a table. The NLS-DP statement bears a one-to-one correspondence to the logical structure of the document. In addition, statements in a NLS-DP file are not ordered sequentially but hierarchically; thus, a document's structure in the system corresponds to its logical structure.

Hierarchical structure facilitates draft development by providing the analogue of an outline. Basic NLS-DP structure editing commands serve to rearrange and reorder the outline more rapidly and flexibly than is possible with paper copy or with online systems that address text line by line. This facility is particularly useful during the initial stages of creating a document. Similar commands can transfer or copy files or parts of files according to their outline position or content. The indentations of these paragraphs reflect the outline structure of this proposal, which was prepared using NLS-DP.

Text addressing capabilities are provided that enable the user to easily address any text within the system. This simple, flexible addressing scheme permits the user to enter addresses for any

desired text at any time and have that text immediately displayed and/or edited. It also permits the user to enter the same addresses as text in the document which can be pointed to for immediate display or editing.

The addressing is not limited to the current page, document, or user's collection of documents. The text addresses may be absolute through the use of permanent statement numbers and index terms, or relative through the use of hierarchical numbers, relative location in the hierarchy, or text strings.

> All documents may be addressed in this way. In addition, they may also be protected to permit access by only certain users. Permission may also be granted for certain operations, such as reading or writing. These protections may be easily specified.

The capabilities described above represent some of the more fundamental tools that have resulted from many years of development. This proposal will describe many more capabilities that comprise the Documentation System and are being used in operational situations today. However, our philosophy is that systems can never remain static, even after extensive development efforts have produced the most advanced system for practical use. ARC will continue to take advantage of the rapidly advancing technology. Our organization includes a development group which receives funding from government agencies for research and development. Thus, there is a great advantage for our system users, who receive the result of this continuing funding through enhancements to the product they use. Currently, the Air Force Document Production and Control System Design Study is nearing second stage completion, providing new inventive designs for text processing (see the Corporate Information section). Other efforts sponsored by NSF, the Army, and the Navy will also have direct benefit to our clients.

1.1.2 Text Processing

1.1.2.1 ARC is proposing a text processing and document production system. It is oriented toward secretaries and typists who receive textual information from authors, enter it into the system, provide authors with review copy(s), and through editing and formatting facilities produce a high quality document with a minimum of effort. A system such as NLS-DP offers many advantages for this kind of production; e.g., key strokes and proofreading are greatly reduced, filing and access control are outmoded, and various units of text can be reused or modified for other documents. Chase Manhattan Bank (CMB) is very aware of the potential advantages. When these facilities are designed after extensive

research into the best possible approach, the advantages go much beyond those of more conservative, conventional systems.

1.1.2.2 NLS-DP includes the facilities for creating, modifying, distributing, and controlling documentation. The capabilities discussed above have particular advantages for facile detailed editing and easy reorganization of documents. A variety of output printing forms are available, including line drawings. NLS-DP has been applied for over ten years to produce reports, users' guides, proposals, and other technical documents, including some that are very large.

Typically, authors produce handwritten drafts or dictate their material for transcription and editing by clerical staff at online terminals or at offline keyboards (recording onto a magnetic medium that is later read into the computer). This latter mode is quite efficient, using the Deferred Execution facility (DEX), which can operate with several kinds of terminals and digital cassette recorders. The tapes can be loaded into NLS-DP during off-hours.

NLS-DP structure editing commands serve to rearrange and reorder the outline more rapidly and flexibly than is possible with paper copy or with other online systems that do not "know" about structure. NLS-DP is the only text processing system that knows about structure. This facility is particularly useful during the initial stages of creating a document. Similar commands can transfer or copy files or parts of files according to their outline position or content.

Automatic editing facilities are available to support extensive routine editing tasks. For example, there are facilities to generate a table of contents or an index, correct the number of spaces between sentences, or automatically format a file, processes greatly facilitated by the hierarchical structure.

Output facilities allow printing text in several ways, e.g., in a simple draft form, or in a format with headers, footers, controlled top and side margins, etc. Output may be to printers, displays, tapes, etc., and optionally via photocomposition (Computer Output to Microfilm,COM) to offset plates with a variety of fonts and type sizes and may include line drawings. Coded instructions (directives), visible online but not printed, control format through the NLS-DP Output Processor. Such directives may be inserted automatically by calling upon special format generators designed for particular document standards, but may also be inserted by users.

Document control can be greatly facilitated by the optional numbering and indexing services described under the "Journal subsystem. The Journal subsystem serves as a medium for distributing, freezing, cataloging, identifying documents, and recording their standing with respect to updates. This option offers new freedom to the publications process. Procedures that have in the past been forced by the medium, for example limited distribution of drafts, become matters of option. (See Document Retrieval Module Section 1.5.7)

1.1.3 System Concept

1.1.3.1 The system proposed here is designed to operate within the CMB Data Processing Area (DPA) environment as specified in the NLS-DP New Project Request. The system supports all aspects of document entry, editing, retrieval, printing, storage, archiving, restoral, security, and deletion, as described in this proposal.

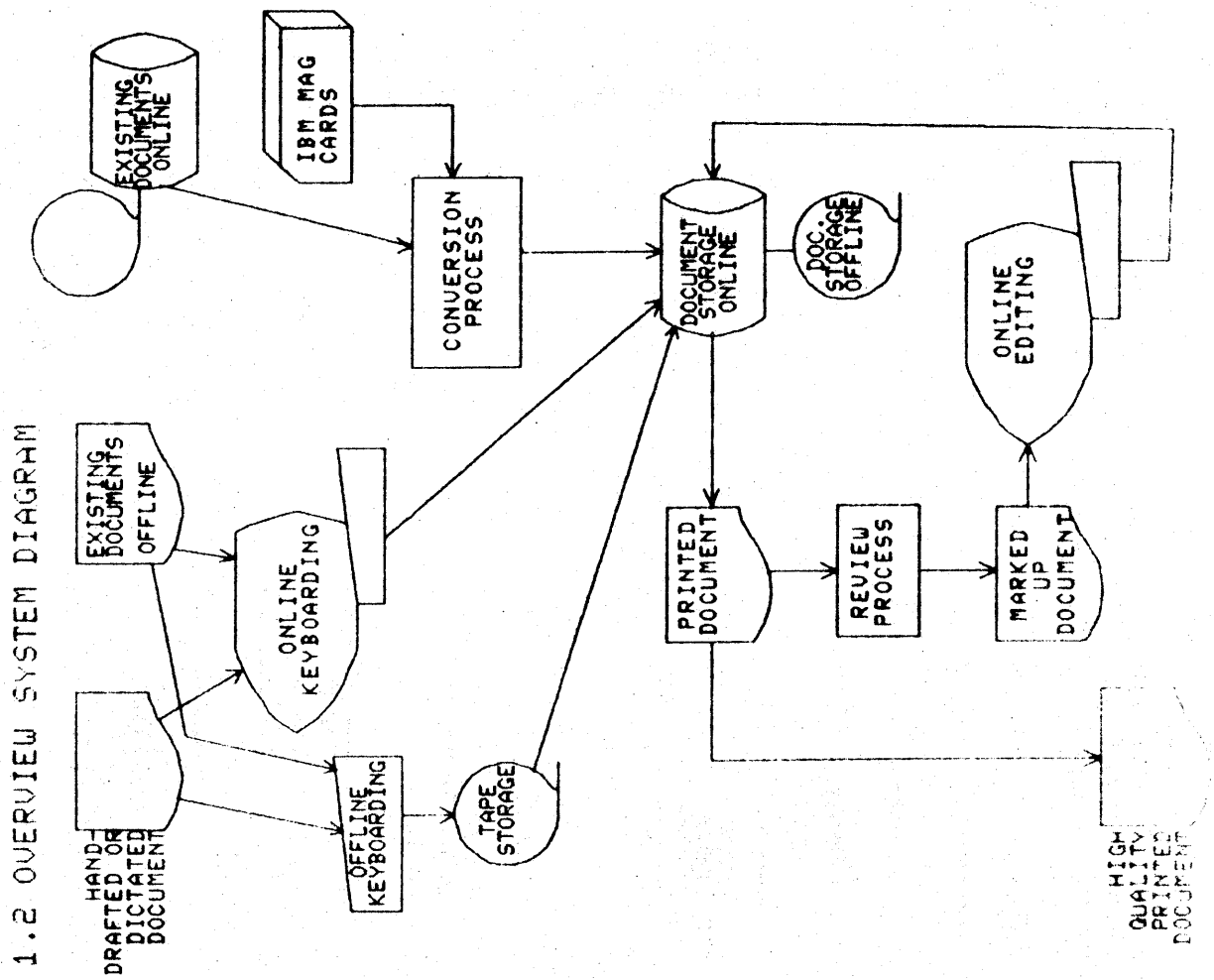
1.1.3.2 The system will operate from a central site and is accessible by a centralized DPA typing pool and secretaries at various remote locations. Access from distances that are inconvenient for running high-speed lines can be through standard telephone connections.

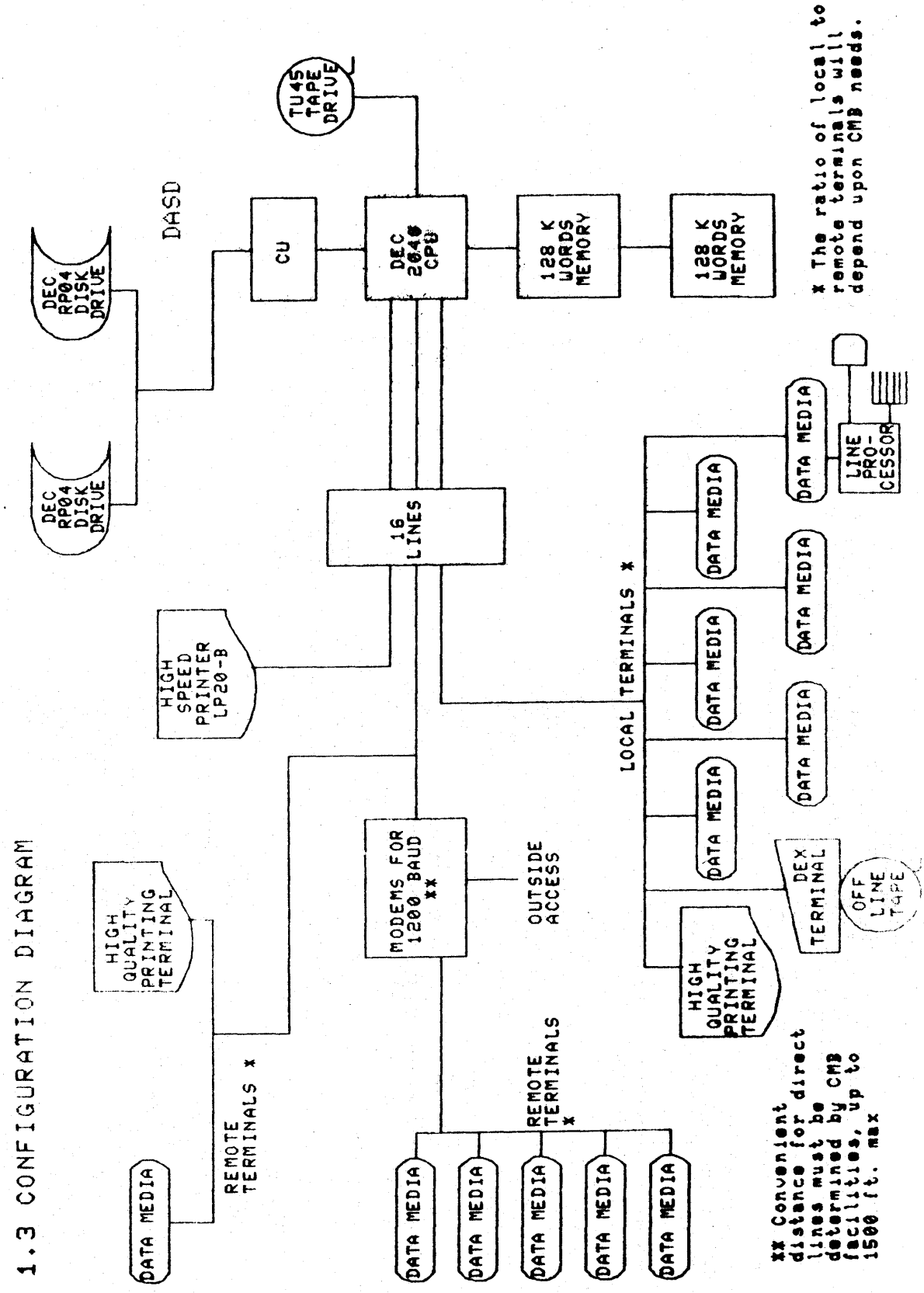
1.1.3.3 ARC believes that this proposed system will increase author and clerical productivity and will result in higher quality documentation. This has been demonstrated by our clients, whose costs are significantly less when using NLS-DP than with previous approaches. One such client is the Air Force, and a cost analysis for an application similar to CMB's is in Appendix II.

1.1.3.4 As indicated throughout this proposal, NLS-DP is designed for use by secretaries and typists as well as authors, editors, and programmers. It is currently used by clerical personnel in government and business. It provides for the maximum exploitation of magnetic media for storage, retrieval, and file control. The proposed configuration provides 20 (twenty) times the online storage required. (Five million characters are required; the minimum configuration provides more than 100 million characters online.) This large storage is managed by the operating system for the proposed computer, the DEC-20 (Digital Equipment Corp.). This operating system (TOPS-20) has one of the best file systems in the computing industry.

1.1.3.5 ARC will specify the entire system and provide the NLS-DP software, but CMB must procure the DEC-20 computer, related hardware, and terminals directly from the manufacturers. The Config-

uration Diagram in section 1.3 shows the hardware that is necessary.


1.2 OVERVIEW SYSTEM DIAGRAM
EXISTING DOCUMENTS ONLINE
IBM MAG CARDS
CONVERSION PROCESS
DOCUMENT STORAGE ONLINE
DOC. STORAGE OFFLINE
ONLINE EDITING
EXISTING DOCUMENTS OFFLINE
ONLINE KEYBOARDING
PRINTED DOCUMENT
REVIEW PROCESS
MARKED UP DOCUMENT
HAND-DRAFTED OR DICTATED DOCUMENT
OFFLINE KEYBOARDING
TAPE STORAGE
HIGH QUALITY PRINTED DOCUMENT


1.3 CONFIGURATION DIAGRAM
DASD
DEC RP04 DISK DRIVE
DEC RP04 DISK DRIVE
CU
TU45 TAPE DRIVE
DEC 2040 CPU
128 K WORDS MEMORY
128 K WORDS MEMORY
16 LINES
HIGH SPEED PRINTER LP20-B
MODEMS FOR 1200 BAUD **
OUTSIDE ACCESS
LOCAL TERMINALS *
DATA MEDIA
LINE PRO-CESSOR
DATA MEDIA
DATA MEDIA
DATA MEDIA
DATA MEDIA
DATA MEDIA
DEX TERMINAL
OFF LINE TAPE
HIGH QUALITY PRINTING TERMINAL
HIGH QUALITY PRINTING TERMINAL
REMOTE TERMINALS *
REMOTE TERMINALS *
DATA MEDIA
DATA MEDIA
DATA MEDIA
DATA MEDIA
DATA MEDIA
DATA MEDIA
* The ratio of local to remote terminals will depend upon CMB needs.
** Convenient distance for direct lines must be determined by CMB facilities, up to 1500 ft. max

1.4 Performance Data

1.4.1 The system has been tested for seven years. SRI will thoroughly test the CMB configuration. It is understood that CMB personnel will continue testing during the acceptance phase. ARC will provide qualified software personnel to diagnose and correct software problems and assist the hardware vendor's personnel in diagnosing and correcting problems that may occur during the acceptance phase and subsequently as negotiated.

1.4.2 The time frame for such assistance will depend on the magnitude and impact of the failure, but generally will not exceed one working day. This will be somewhat dependent upon the level of access we have to the system. If SRI maintenance personnel have long distance dial-in access to the system (our standard operating procedure), it will greatly facilitate maintenance, recovery, and other support.

1.4.3 The capabilities of the proposed NLS-DP system far exceed the Absolute Requirements specified by CMB, as shown in the following table:

1.4.4 REQUIREMENT	CAPABILITY
System available from 7:30 AM to midnight on working days	Anticipated system average availability greater than 20 hrs. per day, including the period 7:30 AM to midnight
1500 pages at 26 lines/ page keyboard input per day	Input capacity at least 1500 OP/day, limited primarily by typing speed of users
2000 output pages per day	well over 5000 pages per day on a high-speed printer, and over 500 pages per day on high quality typewriter terminal
12 online users	12 online users plus separate printing stations with system expandable to much larger numbers
5 million characters online storage	100 million characters online storage
100 million characters offline storage	Unlimited offline storage on a magnetic tape archiving system

1.5 Detailed Explanation of the System Conforming to the CMB Requirement

1.5.1 Required, Desired, and Conditional Functional Requirements Specified by the RFP:

1.5.1.1 Absolute Requirements

A.01 Standard Keyboard. The system supports text entry using Datamedia, Diablo, or TI standard typewriter keyboards. (See Terminal Section 1.5.5.2)

A.02 Identifiable Format. The system supports the viewing of text being entered in the form in which it is viewed by the system. Embedded formatting commands known as directives are easily recognizable by the user. They are always surrounded by delimiters that are unique and may be selected by the user. For example, <Center> <Font=TimesRoman> <Text[CMB]="Chase Manhattan Bank"> are directives with the delimiters "<" and ">".

A.03 Required Spaces and Hyphens. Required spaces between such logical units as Mr. and Jones can be supported so that lines end at logical breakpoints. A single character can be inserted between Mr. and Jones so that at the time of printing, it will be translated into a space and the two words will not be on separate lines. Words with hyphens will not be broken; the system ensures that lines end at logical break points. (See Hyphenation Section 1.5.3.2)

A.04 Upper and Lower Case. Upper and lower case characters are supported. All the characters of the ASCII character set are supported.

A.06 Documents Up To 13 Inches Wide. The system supports the printing of documents up to 13 inches wide to facilitate the printing of special forms.

A.07 Underlining. Character, word, and phrase underlining will be supported for Diablo terminals.

A.08 Line Centering. Through use of the directive Center, the user can indicate any number of lines to be centered when the document is printed. Additionally, other directives enable the user the specify that all lines at a particular level, e.g., all headings, will be centered with a single directive.

A.09 Tabs. Horizontal tabulation is supported for indentation and page formatting.

A.10 Automatic Pagination. Automatic pagination and page numbering of at least four digits is currently supported.

A.11 Line Spacing/Margin Reset. The user can adjust the spacing of a draft to be either single spaced or double spaced. For the final copy, the user can adjust the spacing to be anything she chooses. Margin settings and tab settings can also be adjusted for the final copy.

A.12 Prevent Page Breaks. Through the use of directives, page breaks within sections of text can be prevented.

A.13 Table Support. By the use of the subsystem XTABLE, an operator has the ability to decimally align numeric columns and to right and left justify columns, as desired.

A.14 Force New Page. With the use of directives (PES, PBS, PEL, PBL), the user can force a new page at any point.

A.15 Similar Page/Line Layout. Directives can be inserted so

that page and line layout of a document are the same, regardless of the output device used.

A.16 Automatic Hyphenation. There is a hyphenation dictionary that will automatically hyphenate words when desired. The user can add new words to the hyphenation dictionary.

A.17 Courier 72 Typeface, 10 Character/Inch. The system supports the Courier 72 typeface and a pitch of 10 characters per inch, plus changeable type fonts and 12 pitch through the high-quality printers.

A.18 Standard Format Support. Predefined formats already exist and can be easily modified to accomodate classes of documents with other specific formats.

A.19 Complete Editing Capability. The system has the commands Insert, Delete, Replace, Move, and Copy for Words, Text, and Statements (plus many more). This provides the ability to add, delete, replace, move, and copy words, phrases, and sections of text.

A.20 Global Scan and Replace. Global scans and substitutions can be performed on all or part of a manual to find all occurrences of a character, word, or phrase.

A.21 Paragraph Numbering/Renumbering to Six Levels. Paragraphs or sections are automatically numbered and renumbered to sixty-four levels.

A.22 Copy Text from Other Documents. Text (selected segments or entire documents) that is maintained by the system can easily be incorporated into a document that is being written or edited. Both the text being worked on and the text being copied can be viewed simultaneously by the user.

A.23 Easy Document Storage And Retrieval. Storing and retrieving text can be easily performed by the operator as directed by the the user from his terminal. If an attempt is made to name a new document with a name already being used, the system reports this to the user. Names of documents can be originated or changed easily at the keyboard.

A.24 Automatic Space Management for Storage. The operating system automatically allocates space to document storage up to a limit set by the administration.

A.25 Proofmarks. All text that has been changed since a particular prior version can be flagged with any character the user

chooses to place in either margin. The user can also have the changed statements marked with the name of the person who made the change, or with the date or time of the last change. A cumulative count of all the changes can be automatically kept. The user can also chose to print only those parts that had changes made to them.

A.26 Print Selected Pages Only. The user can specify that a single page or any group of pages of a document be printed.

A.27 Space Management Aids. The system has the capability of archiving and retrieving documents, as well as deleting documents. The space that is released by these procedures is reusable.

A.28 Document Location Indicators. Searches can be made by the user for both online documents and those that have been stored offline. Those that were transferred to offline storage can be easily reloaded onto the system.

A.29 Online/Offline Reports. For each online document, the system provides the name that the user has chosen to give it, the owner, the entry date, and online storage location. In addition, retention duration can be set by the system administrator, and a particular document can be marked to remain online permanently. Offline storage of a document is readily available. All of this information can easily be placed in a report which can be sorted on any one of the items.

1.5.1.2 Audit and Control Funtional Requirements--Absolute

A.30 Document Backup and Restore. The system does daily incremental dumps that will aid in the recovery if a document is erroneously updated or prematurely erased, or if the recording medium is damaged or destroyed.

A.31 Security. The system allows a user to protect his confidential documents by setting protection to prohibit unauthorized reading, updating, or deleting of the text.

1.5.1.3 Performance Requirements--Absolute

A.32 Volume. The system today can easily handle the 1981 volume projection of 2000 initial system and 1500 keyboarded pages (26 lines to a page) during a 14- hour day.

A.33 Storage. The system can easily provide a combination of 5 million characters of online storage and 100 million characters

of archival storage. The proposed system has 100 million online and unlimited offline stoarge.

A.34 Simultaneous Users. The system can simultaneously support at least 12 online terminals.

A.35 Software/Firmware Backup. The mechanism for software restoral exists on the TOPS-20 operating system.

A.36 98% Availability. The system availablity from 7:30 AM to midnight on working days will depend on the CMB operators running the TOPS-20 operating system on the DEC machines. Our service experience indicates that 3 hr/night is sufficient for maintenance.

1.5.1.4 Interface Requirements--Absolute

A.37 Mag Card Convert. The system can provide the ability to convert the IBM Mag Card II cards into a format suitable for maintenance on the system. (See Conversion - Interface Requirements Section 1.5.6)

1.5.1.5 Financial Control Functional Requirements

It is understood that there are no known Financial Control functional requirements.

1.5.1.6 Special Requirements

A.38 Designed for Typists. The system is currently being used by typists/secretaries.

A.39 Training Program. ARC currently has a well developed training program, covering all aspects of document entry, editing, storage, retrieval, print scheduling, optional features, and efficiency. In addition, continual training and additional materials are supplied, as is customer support staff to aid in setting up applications. (See Training Section 1.12.4)

A.40 Continuous Data Entry. The system provides for continuous data entry if all other components of the system are down through the DEX facility. (See Offline Text Entry 1.5.5.4)

A.41 High-Quality Output. By using a Diablo printer, the system has the ability to produce high-quality printed output. (See Printer Section 1.5.5.3)

A.42 Assign Print Priority. Through the operating system, TOPS-

20, the system can assign a print priority to output documents and facilitate an express printing facility.

A.43 Operator Statistics Report. The system will maintain statistics detailing the logon/logoff times, as well as the number of key strokes per user between any two points specified by the user.

1.5.1.7 Desired and Conditional Requirements

D.01 Shorthand. The system currently allows an author/operator to define a phrase and assign it an abbreviation. When this abbreviation is included in a document, the entire phrase will be output when the document is printed. This can be done through the use of directives or with the Substitute command.

D.02 Special Characters. The system can support the following characters: angle brackets, slash, square brackets, braces, slashes, and tilde. It cannot support a bullet, the English pound sign, the plus and minus as one character, the division sign or the fraction one half on the screen, which is based on the ASCII character set. However, any special character may be used by selecting the appropriate print wheel for the Diablo printer.

D.03 Documents up to 15 Inches. The system can support documents up to 15 inches wide.

D.04 Assign Start-Page Number. The system can assign a starting page number to any page in a document.

D.05 Qualified Page Numbers. The system can assign qualified page numbers that allow for the insertion of pages into existing documents, maintaining page number correctness.

D.06 Insert Nonsystem Text. With the use of directives, it is possible to indicate that a specific amount of blank space be provided at a particular point in a document.

D.07 Table of Contents Generation. The system can automatically generate a Table of Contents, supplying up-to-date page number references for section and subsection headings.

D.08 Heading and Footing. The system can automatically generate page headings and footings, defined at the beginning of a document, that will continue throughout an entire document. At any point in the document, the user can make a change to the heading that will affect all subsequent headings.

D.09 Overstrikes. The system can provide for overstrikes as an extra cost option. This is an extension to the underlining capability.

D.10 Footnotes. The footnote capability can be provided as an extra cost option.

D.11 Index Generation. The index generation capability can be provided as an extra cost option. The author must identify each word to be indexed.

D.12 Sort. The system has the capability to sort various fields in a document according to several sort-keys. As an extra cost option, the particular sorting mechanism that CMB desires can be provided.

D.13 Indirect Referencing. The system can currently support up-to-date, indirect referencing as long as the reference is made to some preceding part of the document.

D.14 Notation Text. With the use of the ignore text directive, the system provides the ability to maintain optionally printed text within a document. When the document is printed in final copy, this optional text will not be printed.

D.15 Multiple Typefaces/Sizes. By using the Diablo printer, the user can insert various type wheels for multiple typefaces and type sizes. The Diablo also allows for 10 or 12 pitch type.

D.16 Right Justification. As an extra cost option, the system can support right (full) justification.

D.17 Preprinted Forms. The system is currently able to print output on a sequence of preprinted forms without manual intervention.

D.18 Superscripts And Subscripts. As an extra cost option the system can support superscripts and subscripts.

D.19 "DATE" Parameter. The system is presently able to support a "DATE" parameter, which supplies the current date on the output document when this paramenter is encountered on input.

D.20 Macro Processor. Using the command Process Commands, the system executes a predefined series of commands tha can include the insertion of some defined text.

D.21 Print Changed Pages Only. The system provides the user with the capability of printing only those paragraphs that have been

changed since a certain date or only those paragraphs that have been changed by a specific author. The user also has the option of printing out only specified pages in a document.

D.22 Efficiency Monitor. As an extra cost option, the ability to generate trace statistics regarding the use of system components can be provided. This will enable the user to detect if an inordinate amount of the system's resources is being spent on a particular activity.

D.23 Automatic Archiving. The system currently archives those documents tha have not been accessed (either for reading or for writing) for a specified period of time, and this time period may be varied by the system administrator.

D.24 Additional Reports. The system provides the user with the following information about any document: length, date of last update, if the document is in the process of being modified at that time, the person who last updated the document, and the date of original creation. This is available online or as a sortable report.

D.25 Update Backoff. The system always keeps two versions of a particular document online which allows the user to back off to the prior version if an update was applied by mistake. This backoff is possible even if the new version has been printed. More versions may be retained at the administration's discretion.

D.26 Dial Terminals. The system currently supports dial terminals that facilitate the sharing of terminals and the use of currently available terminals.

D.27 20% Increase in Characters/Page. The system allows the user to increase the number of words printed on a page by adjusting the margins, selecting 12 pitch, and by reducing the space between the printed lines on the Diablo terminal.

C.01 Device/Text Compatibility. The Text Processing capability proposed here is a single, integrated system; the problem of multiple systems is not applicable.

C.02 Message Capability. The system has a message-sending capability that allows a user to correspond with the operator as well as other users. There is also a linking capability which allows users to have a dialogue with the operator and other users. When the user types at a terminal, the person linked to will immediately see the same thing at the receiving terminal. It is also possible to suppress this linking option during printing operations.

C.03 Static Line Numbering. The system is not "line numbered" oriented, but each paragraph has a static number that is associated with it throughout the edit operation.

1.5.2 Standard Features Not Specified:

The following functional capabilities and features are included in the basic software at no extra cost.

The HELP Online Question Answering System. An extensive data base about the use and function of the system is part of the software. Any time the user is online, he can ask questions about specific terms or concepts, or query the system for specific instructions on how to use a command. The latter may be done by merely typing a special character at any time during command specification. The system will then display instructions and description of the command with a menu of items for further information.

Split Screen Viewing and Editing. NLS-DP enables the user to divide the display into up to eight windows which may contain any text from any document he wishes. He may then copy, move, and such, text from document to document by pointing to the respective windows.

Online Assistance. NLS-DP provides online assistance in several forms (see Attachment I). There are prompts for the next command element; feedback about views, subsystems, commands, status, and so on; and a question mark facilitiy for listing all the commands available to the user at that particular point.

Filtered Editing. In addition to searching for and displaying all statements that contain the desired text, NLS-DP permits moving, copying, or deleting those statements.

1.5.3 Software Subsystems

The NLS-DP system is divided into functional subsystems that have the commands used to perform similar functions. The features of the NLS-DP system, described above (Section 1.5.2), are available by means of these subsystems. The following standard and optional subsystems are those currently available. They are described briefly below.

Standard Subsystems

Base	Publish	Useroptions
Modify	Executive	Letter
Format	Programs	Universal
Decimal	Hyphen	Spelling Checker
Table		

Optional Subsystems (not proposed here)

Graphics	Proof	Calculator
Message	Journal	

1.5.3.2 Standard Subsystems

Base: reading, writing, modifying, filing, and printing

The user is in the Base subsystem when he enters NLS-DP. Base is the home subsystem in NLS-DP. It has commands that permit the user to read, write, and modify information online and output it to hard copy, as well as other capabilities.

Reading and viewing information:

A user can read any NLS-DP file whose name is known, except a file whose access has been specifically restricted. After having specified a file, he can move around within its structure by "pointing" to a specific place. A user can "view" a file at his terminal in different ways with view "specifications" or can print it for offline reading. The ability to move through and between files while optionally changing the view specifications is available in all subsystems.

For example, a user may limit the view to any given level of depth in the hierarchical structure, limit the number of lines of each node displayed, set up content analysis filters, or request certain display formatting features (e.g., double spacing between paragraphs) or information about each node (e.g., by whom and when it was last edited).

One may follow pointers (links) to other views (possibly to views of other files). One may scan for content or for a specified node. One may also list or retrace previous views of a file and the previous succession of files.

Writing, creating, and modifying information:

Users can create new files, copy all or selected parts of existing files to other files, insert text by typing into existing files, and edit existing text. Access for these operations may be protected. The Base subsystem holds all the most frequently used commands, allowing the user to manipulate the content of files and the whole files themselves.

Modifying text:

A large set of commands is available that allow the user to freely modify information. He can work at the structural or content level, deleting, adding, moving, replacing, or transposing anything he sees displayed at the terminal. The optional mouse-controlled cursor is particularly effective for pointing at displayed information.

Manipulating files:

Entire files may be created, moved, renamed, or deleted. They may be made private or open (to everyone or to a specific list of individuals and groups).

Publishing:

NLS-DP provides the basis for flexible systems of creating, modifying, disseminating, and controlling documentation. By placing special formatting instructions in a file, a user can format the file for output on a wide variety of hard copy devices, including the terminal itself, a high-speed line printer, or Computer Output to Microfilm (COM) devices.

Modify: special-purpose editing commands

There are several commands in this subsystem that edit across large information structures. For example, the user can delete a column in several headings or lines, combine many paragraphs into a single paragraph, change the case of sentences retaining the initial capitalization and punctuation, add text to the beginning or end of many paragraphs or headings, and so on. There is also a command to insert a person's name and address at a specified place.

Publish: generating sections of documents

The Publish subsystem aids the user in document production. The subsystem is used to automatically generate a table of contents, references in standard formats, or an index keyed to statement numbers. The system can also count "words".

Format: automatic formatting using Output Processor directives

The Format subsystem formats an NLS-DP file according to a predesigned format. The automatically inserted Output Processor directives will create one of several formats that can be printed on a printer or published through COM (Computer Output to Microform).

Letter: formats a business letter

This subsystem automatically formats a letter according to standard formats, retrieves the sender's and receiver's names and addresses (if online) and adds them in the appropriate position, adds the current date, adds the salutation and signature block, and headers and footers if desired. Other formats can be added to this subsystem with a minimum of programming assistance upon request.

Programs: compiling, loading, debugging, managing, and adding subsystems to NLS-DP

The Programs subsystem contains commands for adding to the existing subsystems in NLS-DP. In Base, the user can write complex filters through which the user may view a file or programs which actually modify statements containing particular forms of text the user specifies. There is a "Compile" command for adding new subsystems or programs the user has written. The NLS-DP Dynamic Debugging Technique (NDDT) is available, along with several commands for handling special programming needs.

Executive: file handling, other tools

TOPS-20 is the time-sharing system that supports NLS-DP on the DEC-20. NLS-DP runs as a subprogram of TOPS-20 (which is called the "superior Executive" at this top level) and draws extensively on TOPS-20's file handling. In turn, TOPS-20 is available as a subsystem ("inferior Executive") of NLS-DP via the Goto TOPS-20 command.

Universal commands ("Supervisor"): help, jumping, calling subsystems

Universal commands are available in all subsystems. They allow the user to move among subsystems, within and among files, and get information about using NLS-DP.

Useroptions: adjusting interaction with NLS-DP

The NLS-DP user interface can be altered to fit the user's own equipment, use patterns, and style by specifying the parameters controlled by Useroptions. The effects of Useroptions commands hold for future NLS-DP sessions, until the commands are used again to change them specifically.

Decimal: formatting files in decimal format

This subsystem formats and adds decimal numbers to the appropriate headings or paragraphs in a file. The numbers are of the form, 1.2.5., depending upon the level of the headings or paragraphs. (the normal default practice in NLS-DP is to name paragraphs with an alternating sequence of letters and numbers, e.g., 1C4A. The user always has the option to specify that the names be expressed as decimal numbers.)

Hyphenation:

The Hyphenation subsystem provides aids for hyphenating documents through the Output Processor. Hyphenation works by comparing the words in the document being processed with a list of hyphenated words in the hyphenation dictionary. Only words in this dictionary will be hyphenated in the document. The Hyphenation subsystem contains commands to create an additions file, apply the hyphenation algorithm to words in it, and facilitate the manual correction process. When the additions file has been incorporated into the hyphenation dictionary, the document is hyphenated by applying the dictionary to the document.

Table

The Table subsystem provides commands for adding rows and columns of numbers, editing by row and column, editing row and column entries, justifying row and column entries to the left, right, and center, and other features.

1.5.3.3 Optional Subsystems

The following subsystems are available only as extra cost options, requiring extra training and maintenance, and are listed here to indicate the outward compatibility of the NLS-DP system.

They are being heavily used where they have been purchased, serving electronic mail and teleconferencing applications.

Message: immediate delivery messages

The Message subsystem enables the user to handle SNDMSG (a TOPS-20 program) communications through NLS-DP. With this subsystem, the user can automatically send messages through SNDMSG via NLS-DP, move his messages into NLS-DP, and sort messages.

Sendmail: sending and retrieving online documents

The Sendmail subsystem allows the user to send messages and documents to a list of people known to NLS-DP and have these messages cataloged and stored in the NLS-DP Journal. The recipients may receive hard copy or notice of the item in their "mail box" (with a link to allow immediate online access), or the item itself if it is short. There are extensive provisions for searching automatically generated catalogs using automatically assigned accession numbers, and titlewords, authors, and dates. This is the basis of the optional document retrieval module described in that section.

Graphics: creating and modifying diagrams and illustrations

The graphics capability of NLS-DP enables users to write, display, and output diagrams containing line drawings and text labels. Diagrams may also be printed through a photocomposition device, combined with the text of the NLS-DP statements. Diagrams and the text of NLS-DP statements are stored in the same NLS-DP file. It is necessary to use special graphics equipment to display and produce diagrams. The graphics work station basically consists of the alphanumeric display terminal, a Tektronix storage tube display, and some special interface hardware available from SRI.

Proof: checking COM formats on a Tektronix screen

The Proof subsystem presents pages as they would appear printed via COM (Computer Output to Microfilm) to allow preliminary proofing of formats that require COM or graphic arts production (i.e., a change of typefaces or integral illustrations). The Proof subsystem will display the layout of the page correctly but not the type font, and it will work only on suitable high-resolution display terminals (which SRI can specify or procure as an extra option). Proof commands allow the user to load a formatted COM file and provide several flexible ways of moving around in the user's file.

Calculator: arithmetic

The equivalent of a desk-top calculator (with ten registers) is available as a subsystem. Its power lies in its ability to interface directly to files, reaching in for data and placing the result in the file as commanded. This subsystem plays an important role where simple numeric analyses support a document (e.g., proposals, budgets, or financial analyses).

1.5.4 Software Architecture

1.5.4.1 Major NLS-DP Modules

A brief description of each of the modules follows.

1.5.4.2 Frontend-Backend Split

NLS-DP is organized into two main modules, the Frontend and the Backend. The Frontend provides all user interface and terminal control functions. The Backend contains the portrayal (formatting) modules, the file system and editing and other subsystem modules. The Frontend and Backend can reside on different machines or on the same machines. Given CMB's plans to have the mainframe hardware in the same building as the users and the desire to support only 12 terminals, the Frontend would reside on the same DEC-20 as the Backend, with a standard procedure call communication interface. ARC also operates NLS-DP in a computer network environment with the host remote from the users.

1.5.4.3 Frontend Modules

Terminal Control

NLS-DP isolates all terminal-specific drivers and data in either a microcoded processor or a separate software module. The NLS-DP approach to two-dimensional user interface and display use is unique in the industry. There are no known systems that provide random addressable cursor control and hierarchical file structure for pointing and for viewing documents.

NLS-DP uses the concept of a virtual display system to ensure that new displays can be added to the system and that the display code is contained at a level within the system that allows the higher parts of the system to process text and format displays without any knowledge of the particular device.

Command System

The user interface is implemented through the use of the Command Meta System that consists of the Command Meta Language (CML), the CML compiler, the Command Language Interpreter (CLI), and a communication interface between the CLI and the editor and other modules. (See Attachment II.) The user interface, commands, command feedback, and control conventions are described in the special high-level CML language. This description is compiled into a grammar for the user interface.

The CLI interprets the grammar to parse a user command and interact with the user. The object of the parse is a data structure that is passed to the appropriate Backend execution module.

For example, the Replace Character command prompts the user to provide the location of the character to be replaced, either by pointing with the mouse, positioning the cursor, or by typing an address. Then the CML directs the CLI to prompt the user for the replacement. These two data structures (the pointer to the character and the pointer to its replacement) are communicated to the Replace Character module that modifies the file and evokes the module that updates the display.

The interpreter uses a data base, known as the Useroptions data base, to determine the form and verbosity of the prompting, the type of command input the system will recognize, and to establish keyboard key meanings. The data in the Useroptions data base is manipulated by a subsystem that allows the users to tailor the system to their requirements.

Because of the high-level description of the user command set (CML), the interpretation of the language definition by the CLI, and subsequent invocation of a solution module, the system provides a flexibility and conciseness which is not matched by preprogrammed command systems found in other systems. This is important in tuning the user interface to different applications and installations and in providing flexibility in system evolution.

Communication Module

Communication between the Frontend and Backend is through a standard interface. For the CMB system, the normal, single-process, very high bandwidth procedure call and return mechanism will be used within the DEC-20.

1.5.4.4 Backend Modules

File System

The heart of the NLS-DP Backend is the file system. The file system module implements the hierarchical file organization pioneered by SRI over the last fourteen years. The hierarchical structure of the data is a powerful organization that is unique to NLS-DP.

The files are constructed of a simple tree of data nodes. These nodes consist of a ring element which contains pointers to the superior, next, and subordinate nodes of the file, as well as a pointer to a list of data cells called properties. In addition to the main branches of the tree that emanate directly from the file origin, any property may contain an inferior tree that may contain a tree of properties related to the parent property. This approach provides the flexibility to handle mixed text and graphics and to provide for future features and capabilities.

NLS-DP files are based on the file system provided by the DEC operating system and the DEC-20. Because the DEC-20 uses an 18 bit address, NLS-DP files have been limited to 256,000 words of 36 bits. (This results in a file size of about 750,000 characters when the structure and statement overhead is taken into account.)

Compared with users of systems with conventional sequential files, NLS-DP users may operate on larger files with a smaller penalty in file positioning time. That is, one can move around in an NLS-DP file with significantly more facility than with conventional systems. This flexibility requires that users exploit the structure by organizing their material into meaningful hierarchies. Our experience shows that the facility offered for moving within the file, the power of the system's editing and other features that can be built to utilize the file structure, and the natural relationship of the file structure to the way documents are normally organized more than justifies the cost in file storage overhead.

NLS-DP users have never found the 750,000 character NLS-DP file size to be a problem in itself. Virtually any material can be broken down into logical units which are well within this bound; however, the control of these units can be a problem.

Portrayal Generation--Formatters

Display Formatters

The display formatting system is composed of:

(1) A fast formatter and data structures that allow NLS-DP to modify portions of the display image in response to user modification of the files being displayed.

(2) User controls, such as the NLS-DP jump commands, that control what is portrayed and how much is shown.

This formatter can maintain images in several display areas at one time, updating them as necessary. Each area may display information from one file. A special formatter is invoked when a statement containing a graphic entity is encountered.

Typewriter Terminal Print Control

This is a formatter that is oriented toward printing parts of a file onto a typewriter terminal.

Hard copy Formatters

These include a relatively simple system, Quickprint, and a more complicated formatting program, the Output Processor. The Output Processor can feed to a variety of different devices, including printers and microfilm, and controls the formatting of the document according to directives embedded within the text. For details, refer to the "Output Processor Users' Guide" (Attachment III). Quickprint formats the text for printing as it appears through the display or typewriter terminal formatters.

Sequence Generator

The sequence generator is the module that passes through a file and tests each statement against system or user filters. An example of the system filters it observes in deciding whether the identifier of a statement should be part of a sequence is the level truncation viewspec that permits the display of only those statements above particular levels in the NLS-DP hierarchical file structure. Those sequences of statements that satisfy the filter conditions are used by formatters for terminal or hard copy

portrayal, by compilers, or by processors that manipulate files, such as the sorter.

User Filters and Reformatters

The user may specify and invoke additional filters that the sequence generator will use as a final acceptance test.

User Sequence Generators

The user can write his own sequence generators that can make use of any NLS-DP routines.

User Written L10 Programs and Subsystems

A user written program may be given control by the sequence generator in exactly the same fashion that a content analysis program is initiated. However, in addition to pattern matching, it may change the format of a statement being displayed and may modify the statement itself (as well as other statements in the file).

Users may also write their own subsystems using NLS-DP system primitives and CML to provide a user interface. User subsystems and user programs are placed in private or system libraries for future use. This capability is extensively used to extend the facilities of the system for special applications.

Editing Modules

File Manipulation Algorithms

These algorithms carry out the file manipulation commands of NLS-DP. They determine what is to be done by the textual and structural editing routines and in what order. Utility routines actually manipulate the NLS-DP files.

Some commands make use of textual editing routines exclusively (e.g., "Insert Text"), some use only structural editing routines (e.g., "Move Statement"), and others use a combination of the two (e.g., "Insert Statement"). These algorithms can move and copy text from one file to another through cross-file editing.

Structure Editing

These routines involve the manipulation of ring structure alone and do not alter the contents of the statement data blocks which contain the text.

Text Editing

These routines edit the text of NLS-DP statements. Content analysis features of L10 are used to determine where changes should take place. The string manipulation and SDB manipulation machinery then change the contents of the file.

Optional Modules

NLS-DP contains a number of other modules: calculator, message system, graphics system, additional document production modules, and so forth. These are all made available in a consistent manner to utilize the NLS-DP file system and command language for a coherent interface.

NLS-DP is a carefully designed modular system, implemented in the best software engineering conventions. NLS-DP is written in a high-level system programming language called L10. It is coded with reentrant code so that users share the code pages. Although it is a large system, only code pages in use are brought into main memory by the operating system.

The modular software approach of NLS-DP represents the only viable long term solution to the software problems of today. Software systems that are required to operate over long periods of time in a reliable way, in the face of changing requirements and changing hardware capabilities, require the highest level of design consideration and attention to implementation detail.

Over the last several years, NLS-DP has undergone major changes to improve its modularity. The file system, the command system, display control, the editor, the programming language, the portrayal generation system, the user program systems, and the Output Processor represent modules that work together to effect a viable living system.

1.5.5 System Hardware

1.5.5.1 SRI has chosen not to provide the hardware needed except for the lineprocessor, mouse, and keyset developed by SRI for NLS use; instead, as indicated in Mr. Stehle's letter of January 14, 1977, we are offering the software system only, complete with

documentation, training, and other assistance. This section will specify the hardware that CMB must obtain to meet the requirements of the RFP.

1.5.5.2 Terminals

A number of terminals are available for the lowest cost and the capability level of the proposed system. ARC has tested many terminals and has selected the Data Media for reliability, cost, and keyboard design. The Data Media display (about $2500, including keyboard) provides a relatively clear white on black display of 80 x 24 ASCII characters with no capacity for the display of special symbols.

Remote terminal locations can be connected via standard telephone lines. However, if it is desirable to maintain the high data rate recommended for optimum effectiveness, Bell Telephone modems should be procured and installed at either end of the phone connection. (This will permit data rates up to 120 characters per second, whereas the standard phone line alone can support 30 cps. Direct lines will support 480 cps, which we recommend for best performance. SRI would be glad to consult with CMB to help determine optional cost effective installation.)

Data Media Elite 2500

Twelve standard Data Media Elite 2500s with ASCII keyboard plus some function keys and random addressable cursor control (standard option) are to be procured. Cursor control is done from the keyboard using two methods that take advantage of the two-dimensional display: a single character coordinate specification and an incremental character or line at a time specification. These work stations provide the following capabilities:

(1) 24 lines of 80 characters.

(2) "Standard" 44-key keyboard. Any ASCII character may be entered with this keyboard.

(3) All commands are entered at the standard keyboard to enhance operator efficiency.

(4) Spacing is fixed at the terminal. Spacing for printing is set by Output Processor directives during output.

(5) Line and page scroll is handled by the computer. The

operator need only command the computer to show the information required.

(6) Command entry is through the terminal or through files.

(7) Status of the jobs in the system and the state of the system are available directly at the terminal.

(8) Both editing and input can be handled by the same terminal. Offline input is available if desired.

(9) Multiple commands can be performed from stored lists or directly by the operator.

(10) Cursor control is done through the standard terminal keyboard.

Lineprocessors, Mouse Cursor Control, and Keyset

Complete NLS-DP work stations developed at SRI consist of the same Data Media Elite 2500 and ASCII keyboard, plus an Intel MCS4 equipment multiplexor (the Lineprocessor), five-finger keyset, and a pointing device called a Mouse. Extensive experimentation has shown that the Mouse and keyset increase the effectiveness of operators. They permit pointing to the text to be displayed or edited and the specification of commands in the fastest way possible. By simply rolling the Mouse on a table top, the cursor can be positioned and the text marked any place on the display.

We are including one of these work stations to provide CMB with one case of the ultimate capability, while retaining the lower cost advantage of the display terminal alone for the rest of the work stations. The complete work station has the following additional capabilities:

(1) Cursor control for pointing is done by using the Mouse, providing immediate positioning by direct movement.

(2) The keyset permits one hand to enter all commands and short text, freeing the other hand for pointing. (The operator does not have to reposition his hands on the keyboard for pointing or commanding.)

It should be noted that the following printing terminals can also be used as terminals for editing, if that option is requested (extra training required).

1.5.5.3 Printers

Typewriter Quality Output Printers

Two Diablo Hyterm Communications Terminals, model 1610/1620 (or eqivalents such as the Xerox model 3010s), will be procured. These printers provide the following level of performance:

(1) Typewriter quality.

(2) Proportional spacing ability is available in the hardware. Special software will be required to use this capability (see Desired Requirements, extra cost options).

(3) Special characters are available by means of a demountable print wheel.

(4) Superscripts are available in the hardware.

(5) Subscripts as in (4)

(6) Technical symbols as in (3).

(7) English alphabet--upper and lower case.

(8) Arabic numerals.

(9) Speed of 30 to 45 cps possible. Special software and hardware needed to handle communication above 30 cps.

(10) Single or multiple page output.

(11) Single sheet or sprocket feed available.

(12) Form width up to 15 inches.

(13) Horizontal rules.

(14) Vertical rules.

(15) Underline.

(16) Multiple type styles as in 3.

(17) Space and half-line spacing as in 3.

Line Printer

One Dataproducts model 2230 (or DEC LP20-B) and serial communication interface have to be procured. The line printer provides the following level of performance:

(1) Easily readable print.

(2) Speed of 200 LPM (lines per minute, 2400 baud).

(3) Ability to produce one- to four-part forms.

(4) Ability to accept forms of width 8 to 15 inches.

(5) Upper and lower case character sets.

(6) Numerals and special characters compatible with the typewriter output printers.

The DEC LP20-B is basically the same as the above but with 230 LPM and 96 characters.

1.5.5.4 Offline Text Entry (DEX)

The system includes the Deferred Execution (DEX) capability that permits the capture of text on digital tape cassettes which may be later entered online at high data rates. This will meet CMB's requirement for continued entry even during computer system failures. Due to our limited knowledge of CMB's operations, ARC will specify only the minimum number of DEX work stations in this proposal.

Texas Instruments (TI) 733 ASR Dual Tape Station Terminal

One TI 733 30 cps thermal printing terminal is recommended to meet the minumum requirements. (However, offline text capture can be added to each work station as required.) The digital cassettes may be loaded into NLS-DP at any time in a two-step process, tape read-in and conversion into NLS-DP file structure.

TI 733 terminals may also be used for online work through our Teletype NLS-DP (TNLS). The tremendous advantages of using the two-dimensional display have led us to propose only the display NLS-DP. However, TNLS may be made available for the extra cost of training and documentation. This may be more practical at later stages in CMB 's implementation of text processing.

1.5.5.5 Computer Mainframe and Peripherals

It is probably most cost-effective for CMB to procure its own computer hardware, taking advantage of discount arrangements and the like. The following is the minimum configuration required for the central computer system.

DEC-20 System

The DEC-20 system is recommended although NLS-DP will run on PDP-10s. The new DEC-20 machine uses a fast KL memory and has been running NLS-DP for several months with the DEC TOPS-20 operating system.

The DEC-20 is a 36-bit machine and has full paging and memory protection hardware. The TOPS-20 operating system takes full advantage of this hardware to provide demand paging. The operating system is solid and provides for a highly reliable file system. The DEC-20 meets or exceeds all CMB mainframe requirements.

A model 2040-based configuration to serve 12 online terminals requires 256K of 36 bit memory, 200 million bytes of storage, tape drive, line printer, and 16 lines. This configuration is itemized in Volume II, Pricing Proposal.

The current version of the DEC TOPS-20 operating system can be improved in certain ways that will substantially increase the speed and capacity of the system for NLS-DP operation. SRI is currently implementing these improvements, in close communication with DEC personnel. DEC may include these features in the version of TOPS-20 scheduled for release in the fall of 1977. In any case, these features would be available from SRI if needed, subject to future negotiations among CMB, DEC, and SRI concerning use rights and future maintenance support.

The considerable advantages to CMB of using a DEC-20 NLS-DP system, besides the powerful capabilities of NLS-DP are:

(1) Minimal extra development costs.

(2) A thoroughly tested and reliable operating system supported by DEC.

(3) A system in the form of the 2040 appears to be cost competitive but considerably more powerful than a minicomputer-based system.

(4) A 2040-based system could be delivered in a 90-120 day time frame from order date.

(5) Cost of DEC-20 class machines will continue to decrease.

(6) The existence of larger, faster DEC-20 family machines, e.g., the 2050, offers considerable scaling potential.

1.5.6 Conversion--Interface Requirements

The NLS-DP system will accept information from the IBM Mag Card II system currently operating at CMB. Conversion of the 5000 IBM Mag Cards as specified by CMB will involve three steps: reading the Mag Cards into DEC equipment readable medium, converting the DEC stored Mag Card information into NLS-DP file structure, and reviewing the resultant online documents to ensure correct format and structure. The first step may be accomplished by using a communicating Mag Card machine for input to a DEC computer or by sending the cards to a service bureau. As indicated in the price quotation, Volume II, SRI will provide a program to complete Step two automatically where a standard format is used; the review is expected to be handled by CMB with very little effort.

1.5.7 Optional Document Retrieval Module

This optional module provides for the distribution, storage and retrieval of documents of any length through the use of automatically generated author, number, titleword, and keyword indices.

Distribution is aided via the system's facility; any individual may be designated by means of a unique set of initials that are maintained in a separate identification data base with the person's address and "mailing information." Also, a predefined group of recipients may be designated using a single name.

After specification of the source document and its intended distribution, a title is added. If comments (analogous to a preface or other notes attached to a report) are desired, a paragraph may be added to the collection of the foregoing fields. Other fields such as the date and time are added automatically. Less frequently used fields provide the computer basis for fairly complete bibliographic handling of documents.

During submission of the document, an originator has online computer guidance for filling out the bibliographic citation that will be entered into library-like, computer-held catalogs. The

submitted information item is automatically given an accession number and is stored (permanently) in a central location. Generally, a short citation is all that is delivered to the distribution list. NLS-DP will retrieve the item at any later date if given the accession number, i.e., the "Journal number."

Subcollections for groups or organizations can be optionally maintained. These are essentially the organization's management information, a record of its internal and external business documents. Typically, proposals, executive actions, contracts, plans, and such are interreferenced in the subcollection, replacing extensive arrays of file cabinets and greatly suporting document control.

1.5.8 Floor Planning, Environment, and Furnishings

SRI does not provide a formal floor planning module. However, we and our clients have had much experience with the environment of text processing systems. Our services in this area will be provided upon request, at a low level of effort which is included in the cost of training, or at a negotiated level of effort under separate agreement.

We generally recommend that the terminal areas be acoustically dampened by an acoustic ceiling, carpet, and acoustic dividers that absorb 50% or more of the sound. This will minimize the fatiguing effects of terminal fans or printers. If at all possible, we recommend that all printers be located in separate rooms which are dedicated to that purpose. Each terminal should be separated from other terminals and office functions by the dividers to minimize distractions, but not necessarily in separate rooms.

Work station furnishings will be needed, consisting of a table at least 2.5 by 3.5 ft. top area dimensions and a chair with height adjustability for individual users. Since the display and the keyboard both are on the same surface area, the table should be at typewriter level. Commercial workstation tables are available for about $200 each.

We recommend not having any nontechnical personnel use terminals in the same room with the computer system. Users should, however, be within easy access to the printing facilities they need. We have specified printer hardware based upon a relatively close proximity of the local users and remote users.

Lighting can be a critical factor when using a video display, particularly when combined with reading from printed copy. We recommend low-level indirect room lighting with individual lights

at each work station. Studies have shown that poor lighting can seriously hinder performance and can eventually resut in permanent damage to the users' eyes. In general, considering the cost of computer support to gain increases in performance, there should be attention to maximizing that gain through a humane environment.

1.7 Compatibility

1.7.1 If CMB chooses the document production system proposed here, the system will be successful and attractive. ARC believes that the CMB staff will soon want to expand the system to include other documents and related functions, and ARC understands that such expansion would be in harmony with CMB's long-term plans for increasing the productivity of its staff. In this connection, it is very important that NLS-DP is uniquely prepared to support expansion both in terms of hardware and administrative support.

1.7.1.1 Machine Expansion

In terms of hardware, as discussed in Section 1.5 the DEC-2040 is the minimum version of a machine architecture than can be expanded greatly in a cost-effective and orderly manner. Note particularly, for example, that provisions exist in the NLS context for adding the slave 11-40 machines that handle I/O as more terminal support is required. ARC believes the largest version of the DEC-20 now available would support about 30 simultaneous terminals for about $150,000 additional cost. The system's architecture indicates that DEC will announce modules for further expansion. Beyond the current DEC machines, DEC will offer compatible larger machines which provide further advantages of scale.

1.7.1.2 File Control

Adding machine capacity is the simplest part of expanding a document system. Any organized publications operation has a large investment in mechanisms to control flow and format. In manual systems, the investment consists of files and filing cabinets, inboxes and paper clips, and forms that control the format, approval status, and such of the document. In systems based on small-capacity CPUs and storage devices such as floppy disks or even disk packs, the investment consists largely of forms and storage rearranged to handle magnetic media. As the system expands to include more and longer documents and related functions, the limited directories of small-capacity CPU devices are increasingly useless for whole-system file control. In an NLS-DP-based system, these functions are largely or wholly within the machine and expand with system use without increasing complexity.

1.7.1.3 Cross-Document Viewing and Editing

Note that unlike systems that depend on transferring storage media or transferring files between CPUs, it is always possible to call to the screen any NLS-DP file on the system as easily as any other, except for privacy controls. This means any user can copy from or view any document with one command.

1.7.1.4 Accounting and Identification

As more people and work accounts are involved in document production, it becomes increasingly important to have tight, single-machine control of responsibility and expenditures. NLS-DP offers accounting service to monitor expenditures per operator or per file, or identification techniques to establish the author or editor of documents paragraph by paragraph. The identification techniques have been in regular use for several years among a community of hundreds of users.

1.7.1.5 Communication

As more users are involved in document production, particularly those who are not within walking distance of one another, ARC has found they increasingly exploit communication within the machine. NLS-DP offers the most comprehensive machine-based communication facilities in existence. In increasingly complex production environments, it is particularly important that these communications may be referred to automatic storage and retrieved by author, keyword, and various other categories.

1.7.1.6 ARC Experience

Note that the administrative support functions described here are not untried features. ARC and its customers have been using them in complex document production and related tasks for a number of years. The trainers prepared to assist CMB have been involved in such work, and the consultants who will try to help CMB make cost-effective use of the system have been designing its use and studying the effectiveness of their designs.

1.8 Degree of Risk (hardware, software, and system)

1.8.1 SRI is one of the world's largest research and development institutions, serving government and industry for over 30 years. The risk is extremely low that such a well established organization would not meet contractual agreements. Further, the Institute has a well known reputation for providing with the highest quality what it contracts for. (See section 3.0, Corporate Information.)

1.8.2 The Augmentation Research Center has been doing research and development in the computer support of text processing for over 14 years. There is little risk in contracting with the Center for our products, which have been purchased from us for over three years by the Federal government and major private corporations.

1.8.3 The computer hardware supplier, Digital Equipment Corp. is well known to CMB, which is currently using DEC equipment. The DEC systems are the result of years of careful evolution of a highly successful line of computers, that have ensured DEC's position as one of the major computer manufacturers in the world and the new DEC-20 line of systems. The TOPS-20 operating system has been recently released by DEC and therefore has not had the extensive shakedown given older software. However, it has been operating successfully on one of our computer hosts for over three months, and it is maintained by DEC's reputable and widely distributed facilities.

1.8.4 Data Storage and Software Safety

As in any time-sharing system, there is the possibility of losing documents or files. In the proposed system, the worst that can happen is that one day's work on a document would be lost. However, in our five years of experience with the DEC system, there has been an insignificant percentage of losses.

There are two backup features. Standard operating procedure requires that "incremental dumps" be done nightly to save the changes or input for the day on tape. Shorter-term loss is protected in system crashes because the system writes every change in a file (document) onto disk. Disk storage remains even during power failures that lose the contents of memory.

The backup made for system failure is complemented by backup for operator failure. All modifications to a file are made to a temporary partial copy of the file. Periodically, when the operator wishes, the temporary working file is merged with the permanent file to form a new version, completely separate from the previous file. Thus, if an operator accidentally deletes any part of the file, he may back up to the previous permanent version. Unique version numbers are assigned, permitting retrieval whenever backup is desired. The software system is essentially "fail safe," with losses of any kind occurring less than one tenth of a percent of the time.

1.9 Maintenance

1.9.1 The DEC 2040 and TOPS-20

ARC assumes that CMB would contract directly with DEC for 2040 hardware and TOPS-20 software maintenance, with assistance from SRI in coordinating any TOPS-20 changes with the NLS-DP software requirements.

1.9.2 NLS-DP

In order for NLS-DP service to be provided in a solid, well-maintained manner, SRI must provide software maintenance services to CMB and its NLS-DP users. Although we consider the NLS-DP software to be provided to CMB to be well tested through prior use and immediately useful in the CMB operating environment, we recognize the possibility of improvement opportunities that may arise through use in the CMB organization. As with other NLS-DP users, ARC expects that improvements in the system that can be introduced in a nondisruptive manner will be welcomed by all using organizations. ARC proposes to furnish the following services:

1. Maintenance and updating of the NLS-DP software for elimination of bugs or other software problems that may be reported by CMB or other users.

2. Participation in a joint CMB and SRI user feedback function, an essential part of smooth NLS-DP service as we have seen in our other NLS-DP service operations. This function is vital for effective technology transfer and for the further evolution of the system at CMB and other organizations using NLS-DP.

1.9.3 Terminals

CMB will obtain terminal maintenance directly from terminal vendors, except in the case of any special interface equipment provided by SRI. For those items, SRI will provide maintenance from Menlo Park, using spare equipment as replacements on site during repair of those items.

1.10 Reliability

1.10.1 The DEC 2040 and TOPS-20

The RFP specifies that the system should be running at a level necessary to continue normal operations 98 percent of a 5- day work week, 14 hour/day. ARC expects that this will be the case. However, since we are proposing to provide only the application

software, SRI cannot insure hardware or operating system software reliability at any level.

The system is expected to be available to users for only 14 hours, 5 days per week. This allows for adequate preventative maintenance during the off hours, more than we have required in our experience. This should decrease the probability of system failure.

For the past three years, operation of our service bureau shows that an uptime of 98 percent can be maintained in the NLS-DP system environment. Downtime due to terminal failure has been negligible with adequate maintenance provided by vendors.

1.10.2 NLS-DP

Our experience with providing NLS-DP to users from several different PDP-10 facilities demonstrates that the NLS-DP software has become highly reliable. It must be noted, however, that problems do arise with time-sharing computer systems' hardware and software, involving system and user files, subsystems, and their intricate interactions, that must be resolved by trained operations staff.

1.11 Quality Assurance and Control

1.11.1 NLS-DP software has been in constant use throughout its development by the ARC staff and during the past few years by subscribers to our Workshop Utility Service and seveal organizations who have NLS-DP on their own machines. In addition, the system is running on the facilities of the National Security Agency, (NSA); Bolt Beranack & Newman, Inc., Information Sciences Institute, and Xerox Corp. Through this process, NLS-DP has become what we consider to be a very high-quality system, particularly when viewed in terms of competitive alternatives.

1.11.2 As part of a dedicated long-term development and applications program, NLS-DP will continue to evolve and be refined on the basis of actual experience and needs of users such as CMB.

1.11.3 To carry on this evolutionary process, ARC relies on user feedback from the entire user community. The communications methods and links necessary between CMB and ARC software staff must be developed.

1.12 Training

1.12.1 Training Overview

The System Architect and Client Coordinator

Successfully training a group to perform with new tools, concepts, task procedures, and working methodologies is a complex operation. For the introduction of any new "system," a well organized plan must be developed that considers the social and personal aspects as well as the technical skills and procedures that must be learned. To this end, we have found that a properly selected, active supporter and coordinator within the client's organization is an absolute requirement for the successful installation of a working operation. We use the name "Architect" for this role since the prime responsibility is to coordinate, manage, and design the effective introduction of our capabilities into his or her organization.

The Architect serves as SRI's point of contact for training, consulting, and guidance. In addition to the obvious role of coordinating SRI visits and scheduling training classes, the Architect is SRI's main source of knowledge about the client's organization. This includes active discussions with SRI personnel. We feel that the better we understand the organization and its specific problems, the better our training and technical support will be. Furthermore, after SRI's direct assistance is reduced, the Architect becomes the principal in-house advisor on the office system. Because of these critical roles, the selection of an Architect must be made as soon as possible. It should be planned that this person will have a heavy commitment to this job in the first several months of the introduction of our system in addition to attending the entire series of training sessions.

As it is important for the client to have one key person to coordinate and advise on system introduction, so too it is vital for SRI to provide one point of contact. This role of client coordinator serves as the natural counterpart to the Architect, with similar responsibilities. A section below discusses these activities in more detail.

Training Methodology

Several types of assistance are provided as a comprehensive package for the proper introduction to the system's capabilities and for the continued development of user competence and capacity. Potential users of the system are given a series of courses that are carefully structured to provide the simplest method of learning the capabilities and to quickly enable useful work to be

done. The style of the instruction is to orient each course to specific applications that are peculiar to the client, thus providing meaningful and effective learning.

The training sessions are scheduled to have intervening periods, varying from days to weeks depending on the course level and student, allowing for sufficient practice, proper periodic review, and maximum retention of skills. Other important considerations for a successful training program include:

(1) An instructor to student ratio that permits maximum personal attention (3 to 5 students per instructor)

(2) At least one suitable terminal per two students

(3) Classroom environment conducive to training and away from possible interruptions

(4) A proper mix of formal instruction to informal "coaching"

(5) The preselection of homogeneous groups for any training session.

Point (5) stems from our experience in many organizations in training secretaries, programmers, managers, and analysts with varying backgrounds and skills. Although we endeavor to have "homogeneous" groups that hold similar organizational positions and have similar level of experience, it has been clear to us that none of these parameters can reasonably predict the speed of learning or eventual level of competency.

Between the scheduled training sessions, we expect that the users will spend a significant amount of time practicing the capabilities that were introduced during the course. Moreover, with guidelines given in the training sessions, individual exploration of additional parts of the system is encouraged. This is based on the presence of an extensive set of learning mechanisms that reside as part of the computer software. The method for using these computer-based aids will be discussed in the instructor-guided courses. Self-teaching tutorials and sample sessions are also provided so that users may practice on their own.

SRI personnel provide another form of assistance through phone and computer channels. With the facility to "dial-up" the computer from our offices in Menlo Park, California, the entire, expert SRI-ARC staff can investigate and advise on problems, demonstrate various aspects of the system, observe (with explicit terminal operator permission) the users computer interaction, and provide additional explanation and instruction. All this can be

accomplished with computer terminals, but is further enhanced by concurrent telephone conversations.

Instruction given in formal training or coaching sessions is supplemented (and complemented) with informal, personal help by an instructor who simply "stops by to see how things are going." This seemingly "casual" training is a particularly effective means to provide specific individual help and to remove any social or personal pressure that may be present in a more formal class situation. The combination of all these forms of assistance is a powerful method of training that dramatically increases the probability of a successful and speedy introduction of the system into an organization.

All formal sessions are supported with viewgraphs and courseware in addition to the documentation. These are discussed elsewhere.

1.12.2 The Client Coordinator's Role

Responsibilities

The overall responsibility of the client coordinator is to make the introduction of our system as successful, fast, and smooth as possible. The specific duties include the coordinating and scheduling of all SRI-ARC visits and training sessions, assisting in the training program (in particular in the area of informal coaching), advising the Architect on application areas, guiding the formation of specific system, organization, and social procedures, serving as prime contact for the organizations interaction with SRI-ARC, and keeping the client's management informed of the status of the project.

Coordinator's Schedule

ARC proposes that the client coordinator will spend a total of 10 weeks on-site at CMB in New York City during the 260 days after the contract has been signed. The exact schedule of his visits will be determined in conjunction with the Architect and based on, among other things, the installation of the hardware and training schedule. We anticipate an initial two weeks will be spent immediately after a contract signing for intensive discussions with the Architect and other CMB personnel. The client coordinator will also be remotely available from SRI on an as-needed basis.

1.12.3 Special Management Seminars

Both authors and reviewers, as well as all interested managers should attend a series of four half-day seminars that will

acquaint them with the overall system, provide them with an understanding of what happens after they pass on the text to the typist, introduce them to special procedures that may facilitate the entire text handling operation, and give them a glimpse into the future of office automation. Other topics included in this seminar will be the experiences of other organizations using our system for similar kinds of work and demonstrations through actual online experience with the system. These sessions will be given in one week, either in two full days or four half days, for a maximum of ten people. The client coordinator and one additional senior SRI staff member will conduct the seminar series. It is highly desirable to have these seminars as early as possible after the contract has been negotiated.

In addition to this series, the client may find it advisable to have additional seminars for writers and management personnel. Such advanced seminars can be arranged and contracted for in a separate agreement.

1.12.4 Terminal User Training

Formal instruction for users of the system will be provided in a series of six training sessions that are taken over a period of two or three weeks. A tentative schedule for these sessions, as well as additional special training sessions given in subsequent weeks, can be found below. We expect that users who begin instruction together will continue to attend classes as a group. The selection of the groups should be made at least one week before the beginning of the first session, and it is expected that all users will attend the six sessions. Although meaningful work can be accomplished after just one session, our aim is to give the user enough instruction and experience to maximize their efficiency and provide for long term growth of their abilities.

The required separation between each session is carefully controlled so that users will have sufficient time to practice on their own and away from a formal class situation. Included in each session will be time for each user to practice in the presence of a trainer. Additional help will be given by informal coaching when formal classes are not in session. Each session will be a minimum of two hours long with most being three hours. The instructors will endeavor to use specific applications that are relevant to the users. For this reason, it is important that discussions with the Architect begin as soon as possible. In addition to the client coordinator who will be frequently available on site for assistance, our staff in Menlo Park will be able to help via phone and computer on an as-needed basis. We feel this mode of assistance will be especially valuable as users become more proficient.

Outline of Session Content

Session 1

- Introduction to the system
- Identifying yourself to the computer
- Proper termination of terminal session
- File system rudiments including creating and naming a document
- Entering text into the computer
- Immediate editing of keystrokes
- Printing the text entered

Session 2

- Structure of files
- Viewing of files under different controls
- Addressing and editing files
- Trouble shooting and error recovery

Session 3

- Printing formatted text
- More addressing
- More editing of files
- Using the computer to get help

Session 4

- Elementary formatting controls
- Offline entry of text
- Message sending and receiving

Session 5

- Archiving and retrieving of files from magnetic tape

More formatting

Sophisticated editing

Session 6

More formatting

Table editing

Forms entry and printing

Cataloguing

Special Sessions

Selected topics

Tentative Schedule of Formal Sessions

Week:	Number of Sessions						Staff:
:	1:	2:	3:	4:	5:	6: S:	:
1:	4	3	3				: 3
2:	1	1	1	4	3		: 3
5:	1	1	1	2	3	2	: 2
8:					2	4	: 2
12:							3: 1
19:							3: 2
Total	6	5	5	6	8	6	6

The "week number" means weeks since the start of training. Changes in this schedule may occur due to the size of classes and the speed that the students become ready to continue to the next level of instruction. The number of available SRI-ARC personnel, the column marked 'Staff', includes the client coordinator. This schedule is based on a maximum of 30 users; if additional personnel are to be trained, an additional agreement with SRI is needed. In the event that less than 30 users need to be trained, any cancelled formal sessions will be devoted instead to informal sessions with the trainers.

1.12.5 System Operator Training

Since SRI is NOT proposing computer hardware as part of this proposal, ARC expects that computer operators will be initially trained by the appropriate vendor (e.g., Digital Equipment Corp.) and will obtain sufficient expertise to be judged competent computer operators for the attending hardware and basic operating system. This would include all items listed in paragraph 4.8.3.2 of the RFP. However, our system does have a considerably close relationship with the operating system; therefore, ARC will provide additional training to system operators by an SRI staff member. One week of instruction will be given when the operators are sufficiently knowledgeable about the operation of the computer hardware and operating system. Additional coaching and assistance will be provided by our staff at Menlo Park, California via the computer and telephone. In our experience with operators at several computer sites, this mode of assistance has proved to be very beneficial.

1.12.6 Technical Support Training

Two languages are used as the basis for our system. One, called CML, describes the user interaction (specifies syntax, command words, and so on); and the second, called L10, is an algorithmic programming language that directs the computer tasks. Competent programmers in Algol or similar languages should have no difficulty learning L10.

Assuming that considerable time is spent by the programmers in practicing CML/L10, we expect that two full weeks of intensive training in CML/L10 will be sufficient for experienced programmers to understand the system code and to begin writing user attachable parts (subsystems) to the system. These training sessions, which will be given one month apart, will be supplemented by remote assistance via computer and telephone from our Menlo Park, California offices. A total of one person-week of remote assistance will be provided with the anticipated contract. As with any sophisticated programming language, many weeks of practice and coaching will be needed to obtain a high degree of expertise in writing and debugging a large, complex code such as our system. Therefore, we strongly urge that an additional agreement be sought with SRI for more CML/L10 training, if this level of expertise is desired.

1.12.7 Continual Training

In our several years of training and observing users and organizations, we are convinced of the need for continual assistance and advice. It is very likely that authors and reviewers will

also begin to work with the system necessitating further training assistance. In addition to more involvement by authors and reviewers, the varied and extensive capabilities of our system provide the potential for it to be used in many new application areas. Another area that will require further assistance will be the training of trainers in the event that a sizeable group of users develops at the client's site. The further instruction (mostly coaching and advising) of programming support personnel is very likely if in-house expertise is desired. Based on these potential needs, we recommend an additional yearly contract with SRI for ongoing training assistance at a level of five person-weeks for the first year. The proportion of terminal operator, system operator, and support personnel training can be negotiated at a later date. Typical costs for such services are specified in the pricing section.

1.12.8 Need for Computer Resources

As was cited above in several places, our staff can very effectively give assistance to operators, programmers, and terminal users via the computer system itself. ARC encourages the use of this method whenever appropriate. This necessitates an arrangement to allow our staff access to the client's computer. Computer access does NOT imply any privilege to read or write on any client files. This must be granted by the 'owner' of the file explicitly on a file by file basis. The extent and exact terms of such an arrangement will be negotiated at contract time. In any case, the amount of time spent by our staff on the computer will never interfere with the client's work.

We assume that the necessary hardware will be available to students and trainers before the start of the first class. An arrangement can be made in a separate agreement with SRI for access to our system on another computer installation in the event that the hardware vendor cannot meet the required delivery or if training is desired to begin at an earlier date.

1.12.9 Summary

(1) The client, in conjunction with SRI-ARC, will select an Architect who will spend 50 to 100 percent of his or her time in this role.

(2) SRI will designate a Client Coordinator who will spend 10 weeks at the client's site.

(3) Authors and managers will attend a four session special seminar as an introduction to our system.

(4) A total of 42 formal training sessions will be given for those directly using the system.

(5) Approximately 18 informal sessions will be conducted by our training staff in the mode of observing and coaching users as they perform their work. This is in the time remaining when no formal sessions are scheduled.

(6) Operators will be trained by the appropriate vendor before Item (7) below begins.

(7) One week of training will be provided for system operators.

(8) Two weeks of training classes and one week of remote assistance will be provided for programmers in CML/L10.

(9) Users, operators, and programmers may get remote assistance from SRI-ARC staff on a reasonable and as-needed basis.

1.13 Documentation

1.13.1 Terminal User Procedure Book--User Guides

The Terminal User Procedure Book will include reference and tutorial documentation needed by the terminal operator to use all the capabilities described above in Section 1.5. Each copy shall be provided in three packages:

Tutorials

The Tutorial package will consist of seven step-by-step guides, each leading the terminal operator through a specific application task in one complete work session. They are ordered so that each follows the previous one in level of difficulty; they may also be used as stand-alone learning and practice sessions as well as for reference for the sequence of system functions.

The step-by-step guides include four graduated Editing Sample Sessions. Editing in this context covers functions needed to log onto the system, enter, edit, print, copy, merge, delete, and store documents, and log off the system. The File Viewing sample session, designed to follow the second Editing Sample Session in level of difficulty, covers the functions of reading, addressing, and searching in documents.

The Format Subsystem Tutorial describes how to automatically apply a predesigned format to a file. The Formatting Tutorial leads a more advanced user to design and change each specific feature of a file's format. A complete reference manual on all

formatting features is provided under separate cover (see Package 3 below).

Reference Guide

The Users' Reference Guide is organized to describe the function of each subsystem provided and to describe the use of each available command in the subsystem. An outline of the document follows:

Overview and Description of the Online System and its Environment

How to use the interface devices

How to read and use commands

How to use the documentation

How the system is organized--general terminology

The Base Subsystem

Introduction to the functions available in the Base subsystem

List and Description of the commands available in the Base subsystem

Other Standard Subsystems for Special Purposes

The Programs subsystem

Introduction to the functions available in the Programs subsystem

List and description of the commands available in the Programs subsystem

The User Options Subsystem

Introduction to the functions available in the User Options subsystem

List and description of the commands available in the User Options subsystem

The Format Subsystem

Introduction to the functions available in the Format subsystem

List and description of the commands available in the Format subsystem

The Table Subsystem

Introduction to the functions available in the Table subsystem

List and description of the commands available in the Table subsystem

The Spell Subsystem

Introduction to the functions available in the Spell subsystem (spelling correction)

List and description of the commands available in the Spell subsystem

The Publish Subsystem

Introduction to the functions available in the Publish subsystem (indexing, generating of tables of contents, word counting)

List and description of the commands available in the Publish subsystem

The Modify Subsystem

Introduction to the functions available in the Modify subsystem

List and description of the commands available in the Modify subsystem

The Letter Subsystem

Introduction to the functions available in the Letter subsystem (two alternatives are provided: a standard business letter or letter and memo formats that may be predefined by the CMB user)

List and description of the commands available in the Letter subsystem

Error Recovery

A section on how to recover from any error conditions and ambiguous situations will be included, in addition to the instructions and pointers that are in the foregoing sections.

Output Processor Users' Guide

This is a complete reference manual, in convenient separate book form, for the formatting of documents for publication. It details that all of the instructions advanced users can insert into files to custom design formats. How to apply predesigned formats and a description of general output functions and output equipment are included in Packages 1 and 2 above.

Optional Subsystems

Documentation for optional subsystems selected by CMB will be provided with each subsystem.

1.13.2 Operator's Guide

DEC TOPS-20 System Manual

The DEC-20 System comes with a detailed and complete system operation and programming manual. This includes all the operator functions listed in Section 4.8.3.2 of the RFP.

NLS-DP Operating Information

This guide will augment the DEC Guide with regard to specific NLS-DP functions not included in the DEC Operating System. Such items are: scheduling document printing and print priority; printing administrative reports; document archiving and administrative procedures; NLS-DP software maintenance;NLS-DP error detection and handling. Other functions, such as using optional features, setting defualt parameters for the interface and so on are covered in the Terminal Users' Guide.

NLS Programmers' Guide

The powerful programming language in which the backend of NLS-DP is written is called L10, an ALGOL-like language developed by SRI. The complete programing manual will be provided to support the training of technical support personnel in the use of this

language. This manual also covers the Command Meta Language (CML) in which the user interface is written. This documentaion coupled with training will permit programmers to understand general system operation, write customized programs, subsystems, and versions of NLS-DP. It will not, however, enable CMB programmers to modify the core code of NLS-DP.

1.13.3 Online Availability and Ongoing Updating of Documentation

Copies of all documents as described above will be made available online to all users of the system. An annotated index, called the "Locator," is maintained online to include current references pointing the user directly to the most recent revision of each printed document. All documents will be updated when necessary to reflect software changes and to improve their reference value to users.

1.13.4 Courseware

Training requires the development of a curriculum based on an analysis of the behavioral objectives for a computer based text processing system. We have developed our curriculum in the form of outlines for each level or "graduation" of the training. These provide for gradual slopes in the learning curve during which the user develops skills and confidence while having enough capability to accomplish some meaningful work. (See Training Section 1.1.2)

The courseware was designed with considerable attention to the selection of the commands, functions, and concepts that are included at each level. The criteria for the selection include: the difficulty of comprehension and usage of a particular command, concept, and so on; the relationship to the conceptual organization of the system; and whether or not command alternatives are useful but not necessary at lesser levels of expertise. The levels also serve as the basis for dialogue about proficiency, permitting reference to relative user capability and training experience.

Course length was influenced by considerations such as the minimum disruption of work schedules, as well as psychological and system factors. The courses are designed to be covered in a 2-day period of fairly intense interaction (4 to 6 hr/day). Since it is extremely important for users to have the opportunity to gain hands-on experience before receiving additional instruction, an attempt is made to include enough material to provide the impetus and capability to explore the technology.

The system is divided conceptually into ten categories for the

purposes of training. This organization is important (and consistent with learning theory) to establish some high-level relationship between task areas familiar to the user and those defined by the technology, for example, "typing text in." The categories are reasonably straightforward: getting to and from the computer, printing, editing, troubleshooting and help, formatting, programs, and customization of the system. This paradigm has been followed at lower levels of organization as well, and we find it more successful than typical approaches to computers (e.g., "partitioning memory blocks", "file dump and saving core images", and so on). The commands in each category can be used to perform the general task denoted by the category heading; the complete syntax is provided for each command phrase including feedback and field names.

2 MANAGEMENT APPROACH

2.1 Organization

2.1.1 SRI is organized along technical specialization areas into operating divisions. The Augmentation Research Center, directed by Dr. Bertram Raphael, is part of the Information Science and Engineering Division and is composed of two groups: Development and Applications.

2.1.2 Primary responsibility for the management of the proposed contract would be with the Applications Group under the direction of Mr. James C. Norton. The person at SRI responsible for the day-to-day provision of service to CMB is the Client Coordinator described in Section 1.12.2. He or she will be available to CMB at all times. Assistance from other SRI staff would be provided as appropriate.

2.2 Personnel and Manpower Controls

2.2.1 Primary contributors to the proposed effort will be permanent SRI staff members within ARC. (See Appendix III for biographies of the SRI staff expected to participate in the proposed project.) Definite assignments to the various tasks to be performed will be made with clear responsibilities given to each participant. It is standard practice at SRI to internally account for each staff member's time across our projects in terms of time actually spent on a daily basis. Thus, the staff and management will be able to apply what we estimate to be reasonable manpower levels of effort to this work.

2.3 Vendor/Subcontractor Relationships and Control

2.3.1 SRI anticipates no significant outside vendor/subcontractor relationships in the conduct of the proposed work, particularly since it expects that CMB will contract directly for computer facility hardware, terminals, and maintenance with appropriate hardware vendors. SRI has had a close working relationship with DEC and expects that they will be most cooperative with CMB.

2.4 Delivery Schedule

2.4.1 The delivery schedule will conform to that specified in the NLS-DP RFP. See the NLS-DP Events--Deliverables Schedule in Vol. II, Pricing Proposal.

2.5 Proposed Staffing (see attached bibliographies)

2.5.1 A one page biography is provided for each of the SRI ARC staff that are available to be assigned to this project.

2.6 Consultants to the Vendor

2.6.1 We do not anticipate the utilization of outside consultants for the work proposed herein.

2.7 Status Reporting Schedule and Approach

2.7.1 Status reports will be provided to the CMB project staff as specified in the RFP or if alternatives are desirable, negotiated separately.

3 CORPORATE INFORMATION

3.1 Experience with Similar Projects

3.1.1 General

SRI has been developing a computer based system for 15 years called NLS, the Online System. This system includes the majority of the capabilities for office automation, including teleconferencing, document production and control, publishing, personal and organizational information management, financial information management, decision support, and software engineering. This system currently has a display version (DNLS) and a typewriter version (TNLS). NLS-DP is a subset of NLS for document production--text processing that incorporates the display version. Our experience has been not only with the NLS-DP but with the much larger, complete NLS system, and thus the broader area of office automation that includes document production.

3.1.2 Current Usage

Gunter/Pentagon

The largest document production project using NLS is a joint effort by USAF Gunter Air Force Base in Montgomery, Alabama and the Systems Division of the Logistics Directorate in the Pentagon to maintain AFM 66-1.

AFM 66-1 is a large technical manual that has been used and maintained by the Air Force for many years. It contains about 300 1000-word pages (or about 1500 typewritten pages) and is published in 12 volumes. Some volumes are revised and redistributed at least once a year. Periodically, the entire manual is revised. In general, the Air Force regulation states that corrections will accumulate until 40 percent of the pages of a volume are effected. At this point, the entire volume is reissued.

This work was done manually using typewriters until 1975. In 1975, six volumes needed revision. Time pressures were so great that the officer in charge of revision realized the deadline could not be met with manual methods. He requested and received permission to use NLS.

The manual was not in machine readable form and the hard copy was not of a quality compatible with any available OCR device. The entire manual was typed onto MTST cartridges and translated through several steps into NLS files. Initial typing on the MTST and rough editing of the NLS files was done by one full-time operator in the six months prior to the scheduled rewrite.

For the first revision, 25 engineers, technicians, and technical writers were flown to Gunter AFS where NLS was being used via the ARPA network. Line printer copies of the six volumes were given to the writers who marked their changes (in pencil), the changes were then made in the files by online typists. The next morning, line printer copies of the revised pages were given to a review board that made further changes and/or sent copy back to the first level of revisors. Cycles of revision were repeated several times. After two weeks, when everyone was satisfied with the text, an automatic program imposed format and page layout. Following final formatting for insertion of diagrams, the formatted text was written on computer tape and sent to a photocomposition vendor who returned camera-ready copy. The camera-ready copy was supplied to another Air Force agency (Data Automation) for printing and distribution to the field.

Volume 10 of AFM 66-1 is now undergoing its second NLS revison. Air Force personnel have agreed to keep careful statistics on time spent.

ARC has received statistics from Gunter AFS on the number of pages revised, formatted, and printed, and the number of hours of effort expended by the secretaries doing the work up to this point.

The volume is approximately 172 250-word pages. Forty three percent of the paragraphs in the document were changed, and of these possibly half were changed more than once. During the two-week period when the writers and reviewers worked at Gunter AFS, approximately 2,277 pages of drafts were printed. Of these, about 111 were pages showing only those paragraphs that had changed since the previous edit. This work was done by two secretaries; they worked a total of 81 hours over the two weeks making changes, formatting, and printing the document. This is an average output of 28 pages printed an hour. This is an astounding figure when compared with page per hour output possible using other systems.

The statistics were broken down as follows: time spent making changes and additions was 61 percent, formatting (i.e., inserting format directives) was 17 percent, and running the formatter (Output Processor) and sending the formatted output to the line printer was 22 percent.

The entire operation has proved so cost effective that Gunter is planning to begin processing other large manuals through NLS.

The primary activity at Gunter is not the missle maintenance manuals, but development and maintenance of the Air Force Adminis-

trative Data Processing Program and its hundreds of thousands of pages of documentation distributed and updated world wide. NLS has been used successfully in several first cases for this documentation, and an internal Air Force proposal is under consideration to produce all the Station's documentation through NLS.

Rome Air Development Center

An 800-page JOVIAL Manual is being published at the Rome Air Development Center through NLS. Difficult page layout to show flowcharts and functional relationships within the computer language distinguish this document. The layout is being handled by a combination of NLS's flexible capacity to locate characters on a page and by leaving white space for drawings. The text was typed online with liberal use of single special characters to represent special effects in the final format. A local vendor of computer-based typesetting services bid $40,000 for the job, and the cost via NLS appears to be between $10,000 and $15,000 (although the figures are not strictly comparable because of overhead differences and the use of inhouse typists).

Rome intends to publish submanuals by means of the NLS capacity to cull on the basis of structure and content. These special-purpose submanuals would not otherwise have been economically feasible. Indeed, the project has not yet been completed largely because of delays in planning due to the large variety of alternatives offered by NLS.

Rome also publishes internal reports and has developed a special subsystem to handle certain types of internal forms.

ARC

For over 13 years, ARC has published its reports, proposals, user manuals, and the like through NLS. Current production is over 300,000 pages per year with several thousand pages a year of documents that are distributed in large quantities (on the order of 500 copies). Typically, input is by a typist using the version of NLS based on typewriter-like terminals (TNLS) or input to cassette tapes later read online (DEX), by authors usually at display stations, or occasionally by translation from sources on other computer systems. Document control during production is through established procedures, normally involving submission of small files by authors to a master file closely held by a coordinator. Editing is entirely online and reviews may be from on- or offline copy. Control after production is through the Sendmail system's automatic numbering and index features. Printing is via

offset from line printer copy or plates made from COM (Computer Output to Microfilm) film.

Most of the documents attached to this proposal were prepared in this manner at ARC.

Other

A number of other NLS subscribers publish reports, articles, and the like, amounting to several hundred pages a year, partly via various line printers and partly via COM.

3.1.3 Recent Development Work of Particular Relevance

The Defense Department and other government agencies have invested heavily in building up NLS as, among other things, an automated publication system and continue to invest. In cooperation with several DoD agencies, the Defense Advanced Research Projects Agency is managing a development project called the National Software Works. ARC has been a principal contractor in this work. Recent participation related to automated technical publication involves:

Development of a minicomputer-based Frontend that will support a powerful command meta language system to provide a consistent user environment to a distributed, multihost set of software services. This approach substantially lowers the cost of tuning the user interface for a particular installation. It has been used in tailoring NLS to fit CMB's needs and could be used again to modify the system after installation.

Further enhancement of the document creation and document production capabilities of NLS. RFP of the features of NLS that correspond to the Specifications of the Inquiry; for example, the Proof Subsystem, the Graphics Subsystem, and the Publish Subsystem were developed under sponsorship of the National Software Works which continues to sponsor development in this area.

Under a related contract with Rome Air Development Center, the Document Production and Control System and Design Study, ARC is analyzing the experience of several organizations producing very large documents, as well as surveying automated technical publications systems to establish clear and cost-conscious criteria for the design of such tools. The study consists of three phases and the development of a few new features. The second phase, nearing completion at ARC, describes the functions of an ideal computer-based system. The third will specify how to develop the ideal system from NLS. The contract includes provisons for the

implementation of a few features. The result will be the basis for planned development of NLS in this area.

3.1.4 The ARC Community Plan

In our experience, complex man-machine systems can evolve only in a pragmatic mode, within real work environments where there is an appropriate commitment to conscious, controlled, and exploratory evolution. In joining the community of NLS users, CMB would benefit from over ten years of planned system evolution in this environment. Evolution at first occurred only among users at ARC, but the second stage of application, involvement with an ever widening circle of users, has been under way for the last three years. ARC is continuing to involve a wider group of people so that we can transfer the fruits of our work to and among others and obtain feedback needed for further evolution from a wider spectrum of applications than is possible in our Center alone. NLS is now in use by more than 300 people in the organizations listed below.

3.1.5 Development Community and Utility

Elements of The Workshop Utility Service Relevant to CMB

Although several using organizations maintain their own machines, SRI also provides Workshop Utility Service (NLS) to clients through computer facilities operated for SRI by Tymshare Inc. in Cupertino, California. Experience with the Utility is relevant, because many features and the better part of the human services (training, consulation, and the like) were developed in the Utility environment.

The service includes:

Providing appropriate training in the use of the ARC online system (NLS): Display NLS (DNLS), Typewriter NLS (TNLS), and Deferred Execution (DEX) software subsystems.

ARC has experimented widely in training techniques, including, for example, video taping and training through computer-based linking of terminals. We currently have settled on a training technique based primarily on structured face-to-face sessions. The present ARC training staff of six people has been offering courses in NLS in general and its use for document preparation in particular to Utility clients for three years. This group will be available to train CMB staff. Several of these trainers have doubled as consultants or workers in document produc-

tion and are particularly and concretely knowledgeable in this area.

This technical assistance includes help in the development of NLS use strategies suitable to each organization's environment, procedures within each organization for implementing these strategies, and possible special-application NLS extensions (or simplifications) to handle the mechanics of particular user needs and methodologies.

Subscribing Organizations	Architect

Rome Air Development Center (RADC) — Duane L. Stone

RADC uses NLS for document preparation, internal and Network communications, and recently has developed a financial management system (FMS) for use by its staff in keeping track of funding information for over 100 projects that RADC sponsors. In addition, RADC has sponsored the use of NLS by TRW Inc. within the RADC allocation, as part of the National Software Works Program.

Augmentation Research Center (ARC) — J. Norton

ARC has subscribed for overhead use, supplementing other services at USC-ISIC.

AF Data Systems Design Center (AFDSDC) — Larry A. Crain

There has been an intensive documentation production effort at Gunter AF station in Montgomery, Alabama, since last summer. As shown below, they also have service from the USC-ISIC computer where ARPA provides them additional NLS access. Their present plans are for further expansion of NLS use in the documentation area, with possible involvement in COBOL programming.

Bell Canada (BELL) — Penny Napke

Bell is in its third year of use and concentration on document production and intra-office communications. It is conducting a survey of NLS user attitudes for its own use and for use by SRI subscribers.

Defense Army Material Command (DARCOM) — Ed H. Vongehren

DARCOM concentrates on small document preparation and message communications. We expect that DARCOM will soon increase its

use with more concentrated application of NLS to some of its activities.

Defense Mapping Agency (DMA) Chuck O. Hall

DMA is just getting started, having had communications difficulties until recently. It plans to focus on document production and personal information handling when the communications link is installed.

ARPA General ARPA Use and National Software Works

Many ARPA users use USC-ISI and BBN-TENEX computer systems for online message service (SNDMSG, READMAIL, TECO, and RD). Over 50 directories have been established at Office-1 for backup of those needs and as a step toward the gradual introduction of NLS into ARPA offices. Over 35 ARPA people have started using NLS in their work during the past few months. We expect an increasing use in program management activities by ARPA people.

NIC ARPA: Network Information Center Users

Under contract to the Defense Communication Agency, the Network Information Center (NIC) at ARC collects and distributes on- and offline information about the ARPA network (machines and documents available, subjects of special interest at different sites, addresses of individuals, and so on). Its specialized online NIC service is now being provided from Office-1 to over 40 user sites. The data base is being produced, accessed online, and published in the form of manuals and directories through NLS.

Ballistic Research Laboratory (BRL) Stanley M. Taylor

We are planning to develop a small management information handling subsystem for BRL. Otherwise, its use centers on the preparation of documents and communication.

Naval Ship Res and Dev Center (NSRDC) Frank G. Brignoli

NSRDC use NLS for communications between distributed groups of users involved with the development of a Navy computer network and on the development of documents within NSRDC. Several of the participating Navy laboratories are contemplating further extension of their NLS use for purposes other than team interaction, including document production, programming augmentation, among others.

SRI Glenn A. Sherwood

SRI uses NLS to support marketing information systems, document development, and interoffice communications. In addition, the Innovation Search Group has been using NLS to record ideas generated in "brainstorming" sessions for clients, the results are then sorted several ways for analysis and report preparation.

National Science Foundation (NSF) Paul Custer

NSF is using the service for its own document production and personal information handling. This is a concentrated effort at extensive augmentation of a single NSF office. ARC is assisting with architectural efforts.

National Security Agency (NSA) Jack E. Gillikin

NSA has subscribed for service at Office-1 to continue work on internal documents relating to the development of the NSA computer network. In addition, it has recently installed NLS on its own PDP-10. NSA will continue its participation at Office-1 to remain active in the user community.

Organizations Using NLS at USC-ISIC:

AF Data Systems Design Center (AFDSDC)

As mentioned above, there has been an intensive documentation production effort at AFDSDC since 1975.

Advanced Research Projects Agency (ARPA) Connie K. McLindon

ARPA uses the USC-ISIC facility and gets its training, consulting, and NLS support through a separate contract. Its use centers on the preparation and sending online of internal documents and documents distributed to contractors. Also, personal information handling is growing to include: special lists, addresses, integration of accounting, and contractual data.

Augmentation Research Center (ARC) Jon B. Postel

The ARC Development Group uses ARPA supported service at the USC-ISIC facility as part of the National Software Works Program under which it works.

3.2 Previous Chase Manhattan Bank Experience

3.2.1 SRI has provided the following services for CMB:

3.2.1.1 Security Personal Identification and Verification Seminar, 1974.

3.2.1.2 Bank Operations Technical and Assessment Improvement, June 1976.

This study identified a set of near-term, high-payoff applications for current data processing and business machine technology at CMB, identified other long-term technological opportunities, and raised organizational issues for CMB to consider with regard to becoming self-sufficient in the pursuit of process technology improvement. ARC believes this report made a contribution to the analysis of CMB's needs that appear in the RFP, and personnel who worked on this study are available at SRI to facilitate effective implementation of NLS-DP at CMB.

3.2.1.3 Outlook for the Securities Industry.

This study developed a comprehensive description of the structure and activities of the securities industry; analyzed and projected major economic, structural, legislative, and regulatory forces that will shape the future of the industry; and forecast probable developments in markets, services, and operations of participating institutions. It further determined the implications of these developments for institutions and organizations with a stake in the securities industry.

3.3 General Corporate Information

3.3.1 General Capabilities of SRI

3.3.1.1 SRI is an independent, nonprofit corporation performing a broad spectrum of research, development, and services under contract to business, industry, and government. Most of SRI's work is directed toward problem solving rather than research in the abstract. SRI is able to work with a client organization, understand its problems, and design a responsive program of services that provides realistic solutions to those specific problems. Typically, SRI has 800 to 1000 active projects at any one time that produce a total annual business volume of approximately $90 million.

3.3.1.2 The staff of SRI numbers over 3,019. More than 497 Institute staff members hold Ph.D. degrees, over 597 with master's degrees, and approximately 800 with bachelor's degrees.

SRI's professional and technical staff includes engineers, physicists, chemists, biologists, metallurgists, economists, computer scientists, psychologists, market analysts, educators, and people with a variety of professional and technical skills.

3.3.1.3 SRI's facilities include more than 1 million square feet of office and laboratory space and incorporate the most advanced scientific equipment including unique instrumentation developed by the staff. The bulk of these facilities and most of the professional staff are located at the Institute's headquarters at 333 Ravenswood Avenue in Menlo Park, California.

3.3.1.4 Facilities at SRI's main offices include extensive data processing, library, and laboratory support. The comprehensive technical libraries are well supplied with literature in the fields of document generation and handling systems analysis, computers, coding, and management control systems. The libraries have trained personnel to provide support for research activities through literature searches and the acquisition and distribution of technical documents. In addition to its home offices in Menlo Park, California, SRI maintains a major office in Washington, D.C., as well as offices in four U.S. cities and in five major foreign capitals, including London and Tokyo.

3.3.1.5 SRI has 17 in-house computer systems. These include a CDC 6400, a B6700 dual-processor system, and a PDP-10. Each major system contains random access memory units, and several have online interactive graphics terminals. Job processing can be accomplished in batch mode or online in time-sharing mode. Besides its own facilities, SRI has ready access to numerous other nearby computer facilities, including various IBM, CDC, and Univac systems.

3.3.1.6 Research operations at SRI are organized into eight divisions representing major disciplinary fields. Overall supervision of research is vested in the Office of Research Operations which reports directly to the Office of the President. Both formal and informal arrangements of long standing exist to facilitate interdisciplinary research and development among the divisions and their subgroups.

3.3.2 Information Science and Engineering Division

3.3.2.1 The activities of the Information Science and Engineering Division are carried out in three laboratories and four research centers: the Augmentation Research Center, the Information Science Laboratory, the Engineering Sciences Laboratory, the Sensory Sciences Research Center, the Transportation Research Center, the Artificial Intelligence Center, the Electronics and

Bioengineering Laboratory, and the Telecommunications Sciences Center. Each of the laboratories is composed of a number of groups with complementary interests and skills. The Augmentation Research Center is the core of development toward a broad-based computer support system that improves effective use of the human intellect in a highly communication-oriented society.

3.3.3 Augmentation Research Center

3.3.3.1 History

A brief description of some of the accomplishments of ARC over the past 13 years will attest to its leading position in the development of effective services for people working with textual information.

Early explicit recognition of the potential that online computer and communication technologies have in areas outside of straight numeric or accounting computation for enhancing the effectiveness and efficiency of managers, scientists, technical writers, engineers, programmers, and their supporting staffs in their daily work.

Participation in the implementation of the ARPANET, a nationwide network connecting over 3000 remote terminals to 150 different computers.

Early explicit recognition of the importance to system building of an integrated system of text handling and system building tools.

Publication of over 25 reports and papers on NLS-DP concepts and allied workshop topics and developments.

Demonstration to large professional meetings (FJCC 1968, ASIS 1969, SHARE 1974) to hundreds of visitors and via film of a working system. The FJCC 1968 conference was the first to show the power of coupled screens, video terminals, multiple display windows, and multimedia techniques (computer output, video pictures, and a voice link).

Pioneered the two-dimensional text work to be the foundation of an intelligent terminal system, and developed many highly interactive tools and concepts for working and browsing in an information space, e.g., view specifications, interfile links, split screens, cross-file editing, integration of text-graphic information, and numeric computation.

Pioneered input device and work station design. Early work

includes development of: video displays, mouse, keyset, desk, and work space. More recently, ARC developed the Lineprocessor that makes it economic for intelligent terminals to support two-dimensional NLS-DP display via network connections.

Pioneered in high-quality formatted publication hard copy through line printers, typewriters, photocomposition, and COM.

Pioneered the concept of an integrated coherent workshop of many office tools with a uniform user interface.

Considerable experience with online information management for an office or project environment, such as memos, user documentation and correspondence, full text storage and retrieval, indexing, and cross linking.

First with a comprehensive system for online message control, addressing distribution, delivery, individual and group identification, cross linking, and indexing.

A history of quality software engineering and a leader in applying new software engineering tools to aid the system building process.

Over one hundred thousand hours of hands-on console experience with the use of NLS-DP technology in daily work, both at ARC and at other sites.

Recognition of the importance of integrating into the system building process mechanisms for studying and facilitating technology transfer, including establishment of training and other application support services.

Development work on the TENEX time-sharing system used on the PDP-10 (and the basis of the DEC TOPS-20 system) and the Elf time-sharing system used on the the PDP-11.

3.4 Contractual Provisions

3.4.1 Terms and Conditions

3.4.1.1 We find that many of the provisions of the Standard and Special Clauses offered as terms and conditions for a resulting contract require clarification or are unacceptable to SRI as presently written. The final form of the contract terms and conditions will be subject to discussion during subsequent negotiations.

3.4.2 Ownership of Software

3.4.2.1 The program packages to be provided by SRI under a resulting contract, collectively called "NLS-DP" (including the subsystems Base, Modify, Publish, Format, Letter, Programs, Supervisor, Useroptions, Decimal, and Hyphenation), is considered proprietary to SRI. CMB shall not copy, disclose, or use this software outside the Text Processing System (NLS-DP) contemplated by this RFP. In lieu of the licensing alternatives discussed in this RFP, we request CMB's consideration of the following arrangement for programs developed for CMB under a resulting contract. SRI is continuously modifying and upgrading the software package, both through independent development and to meet specific requirements of users. If SRI has full rights to the use of these upgrades, they can be incorporated into the basic software package for the benefit of all users. We therefore request full rights to use the programs or program modifications developed for CMB. In turn, we will incorporate into the NLS-DP system the software upgrades and modifications independently achieved by SRI or to meet other users requirements during the period of this contract and thereafter.

3.4.3 Contract Form

3.4.3.1 This proposal is submitted on a firm fixed-price basis. The payment schedule proposed in the RFP is not acceptable, and will be subject to negotiations at the time the contract is negotiated.

3.4.4 Acceptance Period

3.4.4.1 This proposal will remain in effect until 31 May 1977. If consideration of the proposal requires a longer period, SRI will be glad to consider a request for an extension of time.

4 APPENDICES

4.1 Appendix I: Direct Support for Authors

4.1.1 In addition to supporting such activities as recomposition and retrieval, NLS-DP support can extend to authors and other individuals in the organization.

4.1.2 Author Support

4.1.2.1 The design of NLS-DP permits the extension of use to authors who are interested. Author usage includes the creation, condensing, filtering, reorganization, and storing of working text. This is analogous to a computer-based extension of the author's memory. It is important that equipment available to the user include the work station in appropriate physical environment.

The work flow begins with the individual at a terminal during the process of generating and composing his ideas. In this online composition mode, raw ideas are entered into selected places in the document structure. These "places" are defined by the computer-maintained hierarchical structure and selected by pointing to a statement in that structure. Each statement in the structure is a variable length text field (up to 2000 characters) that may contain very cryptic or expository information, e.g., headings or paragraphs. The hierarchy typically serves to represent the standard kinds of information relationships; level of detail, importance, quantity, quality, etc.

The hierarchically structured information also may have a "network" interconnecting the "ideas" (statements) regardless of their hierarchical position. The network of "links" is established by text in one statement that names the connected-to statement. The text of the link is a specially formatted citation, delimited by parentheses. When viewing the text contained in the citing statement, an online user may access the cited statement by simply pointing to the link. When the information at the linked-to statement is presented, the hierarchical context displayed may contain additional links, and so on, representing an network of information. This network can also include other users' information (following a set of practical conventions).

Idea composition typically evolves into forms intended for others, such as papers, publications, manuals, communications, and thinkpieces, through the insertion of ideas, text, and data into a growing hierarchy that will then be expanded into paragraphs, headings, tables, diagrams, and so forth. An author

may have several "files" on different work areas that he is developing and may pass the file to a secretary at any time for editing, formatting, and printing.

4.1.3 Author Collaboration

4.1.3.1 Extension of the individual support described above to groups of authors, with an intercommunication facility added, is easily done through time-sharing computers. Files containing the hierarchically stored information are available to all participants in the system, using a number of agreed upon options for privacy and access.

The application begins with the entry of the ideas and later the elaboration of idea statements into a narrative by each member of the collaborating team. In the case of a single product of the team effort (a proposal, report, study, etc.), agreements must be made to permit access. Participants will follow some protocols; for example, only one writer at a time can modify the shared file (a logical necessity). As each person manipulates, adds to, and studies the common information, it is similar to passing around a draft for comments. Differences are that there is no retyping phase; and the material constantly reflects the latest modifications.

Collaboration is possible with all online information that may be studied and perused by individuals where appropriate agreements have been made. Public data bases resemble libraries, containing, for example, information about the operation of the NLS-DP or containing online publications.

Expanded, shared spaces require some retrieval support, which can take many forms. For this application, the use of an online "table of contents" is the most pertinent. The table of contents for shared files (or private subsets) consists of lists of titles and names of files, abstract-like descriptions, and links to desired statements in each file.

Once any information is located (there are a host of searching mechanisms), it is available for direct copying and integrating into newly developing text. The availability of information to facilitate cooperation and collaborative synergism is the goal and the result to date. An authorship record is automatically maintained for each statement in each file, indicating the date, time, and author of the statement's creation or last change. But this is to promote coordination, not guarantee author credit. The facility to make all information available to every participant can be employed to significant benefit within a collaborative team or community.

Appendix II: Economic Analysis

Introduction

This Appendix is a preliminary economic analysis of the cost of preparing documents under the current methods, and the potential cost savings available using the proposed method. It is based on the best information currently available regarding the Air Force Data Services Center document production work load.

Unfortunately, this information is rather sketchy, as the Center currently does not keep detailed records from which exact information could be extracted, but it is indicative.

The analysis is done in terms of cost per page to produce a camera-ready master from either an existing document or from the author's initial rough draft.

It does not address costs involved in the author creating the information, as such costs are nearly independent of the methodology used to turn the author's information into print-ready masters.

It also does not address the issue of output media (hardcopy versus Microfiche); the system being developed will support either (or both). Given the administrative and political problems which must be weighed against the massive cost savings COM offers, it would be unwise to tie a decision about using automated aids to create and maintain documents to a policy decision about the acceptability of COM as a medium for general documentation.

The analysis is done by first identifying the various steps required to create the publication-ready document, then costing out the alternative means of accomplishing these steps. Finally, the total cost of each possible path is summed, providing a total cost per page for each alternative method.

Production Characteristics

The following production characteristics are used for the costing out of a document production model.

Productive time/month => 140 person-hours

Entry speeds

Typing (draft copies)	4 pages/hour
Intelligent Terminal	6 pages/hour
On-line entry	5 pages/hour (DNLS, TNLS, PCS/TEXT, or other Computer based system)

Editing

Transaction systems (PCS/TEXT, ATS, etc.)	4 pages/hour
Interactive one-dimensional (TNLS)	4.5 pages/hour
Interactive two-dimensional (DNLS)	12 pages/hour

Final copy

Typing (Camera-ready copy)	3 pages/hour
Selectric ("IBM 2741") printer	12 pages/hour
Daisy-wheel ("Diablo") printer	36 pages/hour
Computer Output Microfiche or	3600 pages/hour Photocomposition

Costs Of Various Text Capture Methods

The following table summarizes the monthly costs involved in capturing text in computer readable form via various methods. It also gives an estimated cost per page, based on the projected cost divided by the estimated throughput for each option.

CAPTURE METHOD	OPERATOR	TERMINAL	CPU TIME	SUPPLIES	TOTAL	THRUPUT (Pg/Mo)	COST/ PAGE
TYPEWRITER (a)	GS4 $670	$30	-0-	$20	$720	560	$1.286
INTELLIGENT TERMINAL	GS4 670	280	(b) -0-	60	1010	840	1.202
ON-LINE (TNLS)	GS5 750	125	(c) 420	40	1335	700	1.907
PCS/TEXT	GS5 750	125	(d) 490	40	1405	700	2.007
ON-LINE (DNLS)	GS5 750	250	(e)1050	20	2070	700	2.957

Notes:

(a) Not a means of keystroke capture. Provided for comparison purposes only.

(b) Assumes unattended use of normally idle processor power after duty hours.

(c) Cost based on user requiring 1/50th of a PDP-10 computer system owned by government and operated and with system support provided by contractors (total approx. $250K/yr).

(d) Assumes a cost of $3.50/working hour for connection time, processing, file space, etc.

(e) Cost based on user requiring 1/25th of a PDP-10 system

Costs of Various Revision Methods

The following table summarizes the cost per page for various methods of making corrections to a document which has already been captured, or has been typed in first draft, in the case of the current manual method. It assumes three revisions, with changes to 50, 35, and 15 percent of the document respectively.

CORRECTION METHOD	OPERATOR	TERMINAL	CPU TIME	SUPPLIES	TOTAL	THRUPUT (Pg/Mo)	COST/ PAGE
TYPEWRITER	GS4 $670	$30	-0-	$20	$720	187	$3.850
PCS/TEXT	GS5 750	125	(a)$630	50	1555	560	2.777
TNLS	GS5 750	125	(b) 525	50	1450	630	2.302
DNLS	GS5 750	280	(c)1050	20	2100	1680	1.250

Notes:

(a) Assumes a cost of $4.50/working hour for connect time, processing, files

(b) Cost based on 1/40th of a government owned, contractor operated PDP-10 system.

(c) Cost based on 1/20th of a government owned, contractor operated PDP-10 system.

Costs of Rewrite of Previously Captured Document

The following table summarizes the costs to make a rewrite of an existing (already captured) document. The rewrite effort involves a keyboarding work load equal to 75 percent of the total document. This step replaces the Text Capture and Revision steps for documents already being supported by an automated documentation system. It replaces the initial typing and revision steps for manual documents.

CORRECTION METHOD	OPERATOR	TERMINAL	CPU TIME	SUPPLIES	TOTAL	THRUPUT (Pg/Mo)	COST/ PAGE
PCS/TEXT	GS5 750	125	(a) 630	50	1555	745	2.807
TNLS	GS5 750	125	(b) 525	50	1450	840	1.726
DNLS	GS5 750	280	(c)1050	20	2100	2240	.938

Notes:

(a) Assumes a cost of $4.50/working hour for connect time, processing, files

(b) Cost based on 1/40th of a government owned, contractor operated PDP-10 system.

(c) Cost based on 1/20th of a government owned, contractor operated PDP-10 system.

Author Proofreading Costs

The following table summarizes the costs involved in proofreading a document by the author, reflects the total number of times he must proofread the entire document, and estimates the rate at which this proofreading can take place. The rate is assumed to be the same for all computer-based systems, even though DS, which provides access to automatic spelling check facilities, could probably increase this rate somewhat.

PRODUCTION METHOD	PASSES	RATE	AUTHOR SALARY	THRUPUT (Pg/Mo)	COST/ PAGE
MANUAL TYPEWRITER	5	10pg/hr	$950 (a)	280	$3.393
COMPUTER-AIDED SYSTEMS	2.5	15pg/hr	950	840	1.131

Notes:

(a) Based on average AFDSDC Military personnel cost factors.

Costs to Prepare Camera-Ready Copy

The following table summarizes costs per page for preparing a camera-ready copy from an approved final copy of a document. In the case of manual typing, it assumes a retype rate of 5% due to errors. Automated systems assume no errors.

CAMERA READY COPY	OPERATOR	TERMINAL	CPU TIME	SUPPLIES	TOTAL	THRUPUT (Pg/Mo)	COST/ PAGE
TYPEWRITER	GS4 $670	$30	-0-	$20	$720	400	$1.800
PCS/TEXT	GS5 750	125	(a)$560	40	1475	1680	.878
TNLS	GS5 750	180	(b) 700	60	1690	5040	.335
DNLS (PARALLEL HC)	1/10@GS5 75	170	(b) 700	60	1005	5040	.199
PHOTOCOMPOSITION / COM	---	---	$3/PG x (50% reduction in pages)=				2.000 (c)

Notes:

(a) Computer support charges at $4.00/working hour.

(b) Costed at 1/30th of a PDP-10 system.

(c) This reduction in pages also allows a significant reduction in printing and mailing costs. Reproduction of COM (microfiche) masters rather than hardcopy allows further massive savings in these costs. Reproduction and mailing costs of 48X fiche are as little as one 200th the per/page cost of hardcopy. (See Appendix 3 for a more complete COM discussion.)

Total Cost per Page for Possible Systems

This table gives the total cost per page for completed documents for all systems under consideration.

CREATION METHOD	TYPE/ ENTRY	EDIT/ REVISE	CAMERA RDY CPY	PROOF	TOTAL COST
Intelligent terminal/DNLS	1.202	1.250	.199	1.131	3.782
TNLS entry/DNLS edit	1.907	1.250	.199	1.131	4.487
Intelligent terminal/TNLS	1.202	2.302	.335	1.131	4.970
DNLS	2.957	1.250	.199	1.131	5.537
TNLS	1.907	2.302	.335	1.131	5.675
PCS/TEXT	2.007	2.777	.878	1.131	6.793
Manual (typewriter)	1.286	3.857	1.800	3.393	$10.336

REWRITE METHOD	TYPE/ ENTRY	EDIT/ REWRITE	CAMERA RDY CPY	PROOF	TOTAL COST
DNLS	---	.938	.199	1.060	2.197
TNLS	---	1.726	.335	1.060	3.121
PCS/TEXT	---	2.087	.878	1.060	4.025
Manual (typewriter)	1.286	3.857	1.800	3.393	$10.336

4.3 Appendix III: Biographies

PAMELA K. ALLEN

Research Associate
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Instruction for users of computer systems; assistance to clients in planning computer-related applications; Development, writing, and editing of training documentation.

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1975)

Instruction in use of computer systems

Gathered statistics based on Feedback from users of computer system. Participation in evolving role of Feedback, an interface between clients and ARC.

Development of instructional materials, including writing and editing.

Direct involvement with clients on specific projects. Assistance to Innovation Search Group at SRI in 1976.

Interacted directly with client in document production.

ACADEMIC BACKGROUND

B.A. Anthropology/Sociology

University of Georgia, 1972

DONALD I. ANDREWS

Research Engineer
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Systems programming; compiler writing and compiler writing systems; time sharing systems, interactive systems, analysis of system efficiency; micro computer systems; distributed systems

REPRESENTATIVE RESEARCH ASSIGNMENT AT SRI (Since 1966)

Design and implementation of special purpose language for implementing command languages

Design and implementation of TREE META compiler writing system

Basic design and programming of NLS interactive system

Analysis of efficiency of, and modifications to TENEX time sharing system including design and implementation of a subsystem for monitoring TENEX performance

Design and implementation of Lineprocessor microcomputer device

Design and implementation of L1011 cross compiler for L10 language (compiles on PDP-10, executes on PDP-11)

Design and implementation of terminal (TTY and display) controller for NSW Frontend

Program coordinator for NSW Frontend development effort

OTHER PROFESSIONAL EXPERIENCE

Suppe's Computer Based Laboratory, Stanford University; developed compiler writing system on PDP-1

University of Washington; implemented small computer emulator on B5500

ACADEMIC BACKGROUND

B.S. in Physics (1965), University of Washington

M.S. in Computer Science (1967), Stanford University

PUBLICATIONS

Coauthor of "Tree Meta, a Meta Compiler System for the SDS 940," SRI internal report (1967)

Author of "Line Processor: A Device for Amplification of Display Terminal Capabilities for Text Manipulation," Proc. AFIPS 1974 NCC.

Coauthor of "User Interface System for a Computer Network Marketplace," submitted for 1977 NCC presentation.

JAMES H. BAIR, JR., RESEARCH ANALYST
AUGMENTATION RESEARCH CENTER
INFORMATION SCIENCE AND ENGINEERING DIVISION

SPECIALIZED PROFESSIONAL COMPETENCE

Man-computer systems development and analysis; information system design and operation; psychology of human communication and group dynamics; organizational behavior research; teaching

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI

Research Analyst: supervisor, Applications Development Group; leader, technology transfer program analysis; courseware design and user training for the Online System (NLS); analysis of man-computer interaction systems; coordination of user-system documentation; leader, ARC Seminar Program

OTHER PROFESSIONAL EXPERIENCE

Rome Air Development Center: Project Officer--Behavioral Scientist; evaluation and analysis of computer text processing systems (task leader); USAF Coordinator for R&D in man-computer communication; project monitoring for system development; research in human information processing

College instruction, Syracuse University, Mohawk Valley College, and Pennsylvania State University: conducted courses in social psychology, group dynamics, and human communication

ACADEMIC BACKGROUND

M.A., psychology of human communication systems (1967), Pennsylvania State University; B.S., mass communication (1965), Utah State University

PUBLICATIONS

"The Future Designers of Computer Systems, Social Scientists?", TELECOMMUNICATIONS POLICY, Feb., 1977; "Strategies for the Human Use of Computer Based Systems," NATO PROCEEDINGS ON MAN-COMPUTER INTERACTION, Amsterdam: Nordhof, 1977; Coauthor, "A Time Series Approach to the Evaluation of Office Automation," XEROX Workshop, May 1976; "Sociometric Measures of Computer Systems Impact in Non-Programming Applications," Presentation, ASIS, 1975; "Technology in Instruction and Education," In: TECHNOLOGY TRANSFER: A STATE OF THE ART SURVEY, T. Anyos and K. Hirschberg (Eds.), SRI Report, 1975; With D. Conrath, "The Computer as an Interpersonal Communication Device: A Study of Augmentation Technology and its Apparent Impact on Organizational Communication," PROCEEDINGS OF THE ICCC, Stockholm, August, 1974; "Experience with an Augmented Human Intellect System," PROCEEDINGS OF SID, Sept., 1973; "Evaluation and Analysis of an Augmented Knowledge Workshop," RADC Tech. Report, 1973; "Augmented Human Intellect System: A Revolution in Communication," ICA Paper (1972); "Human Information Processing in Man-Computer Systems," ICA Paper (1971); and several other technical reports and papers

PROFESSIONAL ASSOCIATION

Chairman, Human-Computer Communication Working Group, International Federation for Information Processing; American Society for Information Science (Session Chairman, Representative); International Communication Association (Officer, Session Chairman, Symposium Chairman); Speech Communication Assoc. of America (speaker); IEEE (Speaker); Human Factors Society.

JEANNE M. BECK

Research Associate
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Technical writing and editing; documentation of computer systems, software and hardware; development of instructional materials and strategies; problem-solving and training people in the use of computer systems

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1973)

Writing of user-system documentation for the development of an advanced, computer-based interactive text-handling and information retrieval system; participation in online composition and printing of reports and proposals

Development, writing and operation of an interactive computer help system

Direct on-site assistance at ARPA (Advanced Research Projects Agency): office systems analysis, consulting, documentation and training in use of computer systems (5 months)

Teaching and development of tutorial materials for the online language

Training of users and integration of computer-based services into working environments

ACADEMIC BACKGROUND

B.A. in Futures Research (With Honors, 1974)
California State College College, Sonoma

DOUGLAS C. ENGELBART, MANAGER
Augmented Knowledge Workshop Program
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Man-computer systems; circuits, special componets, logical design, and programming of digital computers; vacuum- and gas-discharge techniques; large intercommunication systems; wind tunnel drive and control systems; electromechanical control systems; and information systems

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1957)

Expanded and developed for the Institute the basic concepts for the Augmented Human Intellect program which he had developed independently since 1950; program is aimed at improving human intellectual effectiveness through real-time computer aid

Formulated a comprehensive conceptual framework for man-machine studies with both broad and specific research goals; many of its specific goals have been translated into the establishment of a computer-based experimental laboratory and a number of on-going projects within a coordinated and growing program

Basic development work on magnetic componets for computers and with other fundamental research into the physical techniques of computers

Analysis of impact of tactical war on U.S. intelligence and electronic systems in the European theater

Research, analysis, and development of descriptive models of intelligence and warning systems

Foreign battlefield acquisition and systems analysis

Analysis of foreign electronic warfare capabilities, appplications, organization, and effectiveness

OTHER PROFESSIONAL EXPERIENCE

Formed and directed Digital Techniques, Inc.; corporation did development work on his inventions

Consultal to Marchant Research, Inc. (Oakland); development work has been carried out on patents bought from him

Assistant professor, University of California; associate in electrical enginering

Electrical engineer, Electrical Section, Ames Laboratory (Moffett Field, California)

ACADEMIC BACKGROUND

B.S. in electrical engineering (1948), Oregon State College; E.E. (1953), University of California; Ph.D. in electrical engineering (1955), University of California

PROFESSIONAL ASSOCIATIONS

Association for Computing Machinery; IRE PGEC (chairman of the San Francisco Chapter, 1959-60); ISE (member of the Solid State Circuits Subcommittee 4.10); Institute of Electrical and Electronics Engineers--Group on Computers (Electronic) and member of the Cybernetics Committee; National Academy of Sciences (member of the Information Systems Panel under the Computer Science and Engineering Board)

JON DAVID HOPPER
Research Mathematician
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Interactive display-oriented computer systems programs; timesharing systems programs

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1965)

Exploratory computer programming for the automatic design of cellular arrays for computer logic

Programming and modifying CRT display-oriented systems programs for the CDC 3100

Programming and modifying timesharing systems programs on the SDS 940 computer for use with interactive display-oriented programs

ACADEMIC BACKGROUND

B.S. in physics (1960), M.S. in mathematics (1962), and additional graduate work in mathematics (until 1964), Stanford University

PUBLICATIONS

Coauthor of "COPE: An Assembler and On-Line-CRT Debugging System for the CDC 3100," SRI Technical Report

MARGARET ROSE HYSMITH

Research Associate
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Implementating of computer-based text-handling, communication, documentation and information-retrieval systems to office environments by means of planning and developing applications, instructing, documenting and tailoring of computer systems functions to meet individual user groups needs

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (Since 1974)

On-site consulting at Advanced Research Projects Agency (Office of the Secretary of Defense); developing, integrating and instructing communication, text-handling, and information-retrieval computer systems within office environments; writing of specialized documentation; consulting on software and hardware selections; assisting in personnel selection; problem solving (20 months)

Implementing of data analysis, communication and documentation systems to build prototype for a defense energy information system (12 months)

Consulting, training and assisting users with the integration of computer-based systems into their office management procedures

Demonstrating computer systems for marketing purposes aimed at potential customers

OTHER PROFESSIONAL EXPERIENCE

Manager of retail store: responsible for personnel hiring and scheduling, inventory control, marketing and bookkeeping

ACADEMIC BACKGROUND

Attended George Mason University, majored in History

HARVEY G. LEHTMAN

Research Engineer
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Design and development of large software systems; man-machine system analysis; software engineering tools and techniques; tutorial database systems; office automation systems; text formatting systems; distributed computing systems

REPRESENTATIVE RESEARCH ASSIGNMENT AT SRI (Since 1970)

Development of the computer system and associated organizational techniques at the Augmentation Research Center

Software engineering: tools and techniques for aiding in the development of large software systems

Development of information retrieval and tutorial help systems

Two dimensional display terminal formatting

Random file system revision: addition of property lists

Distributed operating system version of NLS

Report writing; languages and project reports

OTHER PROFESSIONAL EXPERIENCE

Teaching assistant in computer science and programming, University of California (San Diego)

Research in experimental high energy physics, University of California (Berkeley) and University of Chicago

ACADEMIC BACKGROUND

University of California (Berkeley): BA in Physics (with honors, 1966)

University of Chicago: MS in Physics (1967); work toward PhD in Physics (through 1969)

University of California (San Diego): graduate work in Computer Science (1970)

Stanford University: MS in Engineering-Economic Systems (earned 1976); current PhD candidate in Industrial Engineering with specialization in man-machine systems

ROBERT N. LIEBERMAN
Research Analyst
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Research and design; computer systems software development; learning and management methodologies; data management; quality programming techniques

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (Since 1974)

Project leader for DARCOM consulting contract

Supervisor of Application Services, including all Center trainers and consultants

Project leader for NSF consulting contract

Demonstrator and consultant on use of our large software system

Project leader of a Navy contract

OTHER PROFESSIONAL EXPERIENCE

Mathematician and computer specialist, Naval Ship Research and Development Center; evaluation of and experience in the AED compiler-compiler system; study, design, and implementation of data management systems; study of quality programming techniques; investigation of and experience in computer networking

Graduate Research Assistant, Computer Science Center, University of Maryland; study, design, and implementation of list processing systems; dissertation in directed graph theory

Junior Research Mathematician and programmer, Radiology Department, University of Pennsylvania; pattern recognition and picture processing

ACADEMIC BACKGROUND

B.A. in mathematics (1964), University of Pennsylvania

M.A. in mathematics (1970), Ph.D. in mathematics (1972), University of Maryland

PUBLICATIONS

"A Knowledge Workshop for the Navy: An experiment in Technology Transfer", Final Report, SRI; Coauthor of "DECsystem-10 Computer Study", NSRDC Technical Note; "RSVP - Relational Structure Vertex Processor", University of Maryland Technical Report; coauthor of "SLIP - A Fortran List Processor", University of Maryland Technical Report

ELIZABETH K. MICHAEL
Programmer
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Design, implementation, and development of computer systems in the following areas: interactive time sharing systems, system measurement and performance evaluation, user accounting and billing, terminal control programs, and text editing; interactive and batch management information systems; payroll and general ledger; information retrieval

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1972)

Design, programming, and implementation, under ARC NLS, of a calculation subsystem to permit the user to perform simple and complex arithmetic calculations based on values entered from a keyboard or retrieved from files and to specify format of results

OTHER PROFESSIONAL EXPERIENCE

Stanford Computation Center, Stanford University; design, implementation, and administration of system measurement and user accounting system for an IBM 360/70 computer supporting 100 interactive terminals while processing 3000 plus batch jobs a day

Administrative data processor, Stanford University; supervision and training of programmer analysts; design and implementation of all University Administrative Computerized Tasks, including student registration and records, alumni information, business, and accounting

Research statistician, Office of the Dean of Students, Stanford University

ACADEMIC BACKGROUND

B.S. in physical science/organic chemistry (1974) and M.A. in economic statistics (1948), Stanford University

PUBLICATIONS

Various articles and manuals for the Stanford Computation Center; articles on computer measurement and accounting for the SHARE Computer Measurement and Evaluation Project

PROFESSIONAL ASSOCIATIONS

Association of Computing Machinery (former member)

JAMES C. NORTON, ASSISTANT DIRECTOR
AUGMENTATION RESEARCH CENTER
INFORMATION SCIENCE AND ENGINEERING DIVISION

Specialized professional competence

- Research and timesharing computer service management; human-computer system development and operation; information system development and operation

Representative research assignments at SRI

- Augmentation Research Center
  - Assistant Director: operational management of advanced timesharing computer services (hardware and software) and marketing; user methodology development; technical services; program management for integration of Augmented Knowledge Workshop technology into working environments of commercial and government organizations
  - Senior Research Analyst: operations administration; system development, including Dialog Support System (Journal), catalog development (production aids), special user subsystems and basic feature development for Augmented Knowledge Workshop

- Information Science and Engineering
  - Administrative Manager; financial performance analysis and reporting; project administration (government and commercial); proposal cost estimating; budget preparation; computer facility planning and accounting; supervision of clerical staff; liaison with SRI central service activities

Other professional experience

- Pacific Telephone and Telegraph Co.
  - Traffic Engineer; planning studies for long and short range equipment additions and rearrangements; studies for the California Public Utilities Commission on cost analysis of proposed extended service and new exchanges; forecasting future call volumes and resulting toll circuit and other facility requirements
  - Traffic Assistant; central office management; supervision of operators, force and load planning, employment, training, and performance analysis

Academic background

- B.A. in economics (1953), Stanford University

Publications

- Coauthor of paper, "The Augmented Knowledge Workshop" (June 1973)
- Coauthor of SRI reports: "Online Team Environment - Network Information Center and Computer-Augmented Team Interaction" (May 1972); "Network Information Center and Computer-Augmented Team Interaction" (July 1971); "Advanced Intellect-Augmentation Techniques" (July 1970); "Computer-Augmented Management-System Research and Development of Augmentation Facility" (April 1970)

BERTRAM RAPHAEL, DIRECTOR
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Question-answering systems; heuristic problem solving; symbol manipulation techniques; theorem-proving methods; robotics; expert systems; research management

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1965)

Development of data structures and deductive techniques for on-line question-answering systems

Direction of system design for an experimental "intelligent" robot

Surveys of special-purpose computer languages

Director of the Artificial Intelligence Center

Management of a wide range of Computer Science research activities

OTHER PROFESSIONAL EXPERIENCE

Lecturer in electrical engineering and computer science, University of California (Berkeley); lecturer in computer science, Stanford University; instructor of many short courses and seminars

Fulbright lecturer, Technical University of Vienna

Consultant, International Institute for Applied Systems Analysis (Laxenburg, Austria)

Consultant, Computer Science Department, RAND Corp. (Santa Monica)

Assistant research scientist, University of California (Berkeley)

Research staff, Bolt, Beranek and Newman, Inc. (Cambridge, Massachusetts)

ACADEMIC BACKGROUND

B.S. in physics (1957), Rensselaer Polytechnic Institute; M.S. in applied mathematics (1959), Brown University; Ph.D. in mathematics (1964), Massachusetts Institute of Technology

PUBLICATIONS

More than 20 papers in technical journals and in proceedings of national and international computer conferences

Associate editor of Artificial Intelligence

The Thinking Computer: Mind Inside Matter (W. H. Freeman & Co., 1976)

PROFESSIONAL ASSOCIATIONS AND HONORS

Association for Computational Linguistics

Association for Computing Machinery (national lecturer, 1967-68; founding editor of Newsletter; group on artificial intelligence)

International Joint Conferences on Artificial Intelligence

Sigma Xi

DIRK H. VAN NOUHUYS
Research Analyst
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Technical writing; all types of writing; technical publications management; application of computer-based techniques to technical publications; teaching writing

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1970)

Technical writer: developed an advanced, computer-based interactive text handling and information retrieval system; organized and participated in online composition and printing of reports and proposals; participated in design and debugging of the command language; taught and developed tutorial materials for the online language; developed and operated interactive retrieval and cataloguing systems; coordinated and promoted development of computer-based text processing systems

OTHER PROFESSIONAL EXPERIENCE

Management of the Resource Data Center, TRW Systems (Redondo Beach): wrote proposals

Technical writer and editor, Western Regional Research Laboratory of the USDA (Albany)

ACADEMIC BACKGROUND

B.A. in writing (1956), Stanford University; M.A. in contemporary literature (1957), Columbia University; additional study in physics, psychology, French, and English

PUBLICATIONS

Coauthor of three SRI technical repoots on computer system development of text processing systems, training in use of online computer systems, and interactive question answering systems; coauthor of four technical movies or video tapes

PROFESSIONAL SOCIETY

Society of Technical Communication

KENNETH E. VICTOR

Research Engineer
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Design, implementation, and development of time-sharing operating systems, interactive editing systems, interactive debuggers, and tools and techniques for software engineers.

REPRESENTATIVE RESEARCH ASSIGNMENT AT SRI (Since 1970)

Maintenance, development, and measurement of the TENEX Operating System (a BBN developed operating system for the PDP-10), its Executive and various subsystems

Design, development, implementation, and maintenance of NLS

Served on the ARPA Network Graphics Committee

Design and implementation of a multiprocess, multimachine, multilanguage interactive debugger

Maintenance of ELF operating system (an operating system for the PDP-11)

Design of programming practices for ARC

Maintenance and development of the IMLAC operating system (an intelligent terminal system)

Design and implementation of a small information retreival system

Design and implementation of man-machine interface systems

Design of network protocols

Design and implementation of an online programming library system

OTHER PROFESSIONAL EXPERIENCE

IBM: worked on FORMAC (a symbol manipulation extension facility for PL/I), CPS (a conversational PL/I system), and an interactive file manipulation and text editing system

Hewlett-Packard: designed and implemented a dedicated real-time system; designed an operating system for a new medium sized computer

ACADEMIC BACKGROUND

B.A. in physics (1968), Brandeis University

PUBLICATIONS

Coauthor of IBM manuals for FORMAC and CPS

Coauthor of numerous Augmentation Research Center reports

Coauthor of A COMMAND META LANGUAGE FOR NLS

Author of THE DESIGN AND IMPLEMENTATION OF DAD, A MULTIPROCESS, MULTIMACHINE, MULTILANGUAGE, INTERACTIVE DEBUGGER

ANN C. WEINBERG

Research Associate
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Technical writing; educational writing, educational publications; educational consulting; psychological counseling; elementary teaching

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (XXX)

Technical writer: development of an advanced computer based interactive text handling information retrieval system; participation in on-line composition of reports and proposals; participation in design and writing of the on-line help data base

Teaching and development of on- and off-line tutorial materials for the on-line language

OTHER PROFESSIONAL EXPERIENCE

Westinghouse Learning Corporation (Sunnyvale, California)

Designing, writing, and editing of learning units, tapes, and filmstrips for an individualized computer managed learning system

Instructing and consulting in the implementation of an individualized computer managed learning system

ACADEMIC BACKGROUND

B.A. in psychology (cum laude, 1969), Connecticut College (New London, Connecticut); M.A. in counseling psychology (1971), Stanford University

PUBLICATIONS

Various learning units and teacher materials for Project PLAN, Westinghouse Learning Corporation

Various tapes and filmstrips for Project PLAN, Westinghouse Learning Corporation

PRISCILLA ADELE WOLD
Research Associate
Augmentation Research Center
Information Science and Engineering Division

SPECIALIZED PROFESSIONAL COMPETENCE

Training; conduct training sessions in the use and capabilities of computer software systems, as well as provide assistance to clients in planning computer-related applications.

Development, writing, and editing of computer courseware documentation.

Classroom teacher, expertise in Reading Curriculum

REPRESENTATIVE RESEARCH ASSIGNMENTS AT SRI (SINCE 1975)

Conducting training sessions for software system clients

Writing and editing of course related documentation and development of other course related materials

Providing direct assistance with ongoing client system applications

Participated in Feedback role, direct interface with clients and system designers

OTHER PROFESSIONAL EXPERIENCE

Classroom teacher, grades 1-12 concentrating in Reading curriculum

ACADEMIC BACKGROUND

B.S. in Education 1972
Wheelock College
Boston, Ma.

M. Ed. 1974
University of Virginia
Charlottesville, Va.

STANFORD RESEARCH INSTITUTE
Menlo Park, California 94025 · U.S.A.

15 February 1977 38930

CLIENT PRIVATE

Proposal for Research
SRI No. ISC 77-20

A TEXT PROCESSING SYSTEM FOR CHASE MANHATTAN BANK

Volume II: Pricing Proposal

Prepared for:

THE CHASE MANHATTAN BANK, N.A.
Contracts Administration
Data Processing Area
1 New York Plaza, 21st Floor
New York, New York 10004

Prepared by:

Augmentation Research Center

PRICING PROPOSAL

PRICE SCHEDULE: First Year ($)

SRI PRICE SUMMARY

50,000	Basic Software Package and Source Code
50,900	Features not Included in Basic Software Package
	Conversion Program for IBM Mag Cards
	Special Requirements
	Desired And Conditional Functions
50,000	Training
	Terminal User Training
	System Operator Training
	Technical Support Training
28,000	Basic Documentation Package
37,000	Optional Document Retrieval Module

Also see Hardware Estimates below for:
Computer Facility Equipment
Terminals

ITEMIZED SCHEDULE: ($)

50,000 Basic Software Package and Source Code
Includes installation, technical assistance, and corrective software maintenance.

NO CHARGE Preventative Software Maintenance

50,900 Features Not Included in Basic Software Package

4,700 Conversion Program for IBM Mag Cards
SRI will prepare a program for converting IBM Mag Card data from ASCII sequential files on standard 9-track magnetic tape into normal NLS-DP files. This estimate assumes, as indicated in the Conversion Interface Requirements section, that CMB will be responsible (possibly with help from an independent service bureau) for converting the 5000 IBM Mag Cards into data on ASCII sequential files for the DEC tape drive specified in System Hardware, Volume I, Section 1.5.5.

PRICING PROPOSAL

4,700 Special Requirements
The system will maintain statistics, by operator, detailing the logon/logoff times, number of key strokes (per session, per document), documents accessed, and type of activity (initial entry or revision). To accomplish this, SRI will implement a mechanism to count and report the number of key strokes between any two points indicated by the user. Logon and logoff time are listed by the system on the operator's console, and the time used in a session is displayed to the user at logoff time.

41,500 Desired and Conditional Functional Requirements

4,700 The system will be modified to allow for overstrikes. This is the same modification that will be done for underlining.

9,000 The system is presently able to provide a limited amount of manipulation with footnotes. This present primitive capability will be enhanced to meet CMB's needs by completing the footnote capabilities of the Output Processor.

4,700 The system will generate an author-identified keyword index, supplying up-to-date location references for each keyword.

4,700 The system will have the capability to sort various fields in a document according to the sort-key a user specifies.

9,000 The system will be modified to support right and full justification.

4,700 The system will be modified to support superscripts and subscripts. This capability will be available for the Diablo terminal only.

4,700 The ability to generate statistics regarding the use of system components is desired. This will enable the user to detect if an inordinate amount of the system's resources is being spent on a particular activity, such as local printing, index generation, or command sequences causing multiple passes

over the text of a document. A trace facility can be provided to assist in determining portions of the system that could be better utilized.

50,000 Training

39,000 Terminal User Training
All costs for material, labor, etc. in support of the formal and informal training sessions are included. In addition, the Client Coordinator and Special Management Seminars are provided. The client coordinator will spend 10 weeks on site at CMB during this contract period and will provide some remote assistance from SRI, Menlo Park, California until final acceptance of this contract's deliverables is made. The cost for this level of effort is included. Any additional on-site visits will be at a rate of $2020 per person-week during the initial contract period. The cost of the four half-day management seminars, given by the client coordinator and a senior staff member, is included in the total price of this proposal.

3,500 System Operator Training
We assume that CMB will contract directly with DEC for their standard TOPS-20 facility operator training. SRI will provide additional training in operations pertaining to the NLS-DP system operation. All costs in support of a one week on-site training session are included in the proposed price. Occasional remote assistance until final acceptance of the contract deliverables is also included.

7,500 Technical Support Training
All costs for material, labor, etc. in support of the two weeks of training are included in the proposed price. Occasional remote assistance until final acceptance of the contract deliverables, is also included in the total price of this proposal.

28,000 Basic Documentation Package

PRICING PROPOSAL

Terminal User Procedure Book--User Guides:

(1) Tutorials

(2) Reference Guide

(3) Output Processor Users' Guide

Online Availability and Updating of Terminal Users' Documents

All documents will be delivered online as well as offline. This is included in the basic price. All online and offline documents will be updated when necessary to reflect software changes and to improve their reference value to users.

NO CHARGE Documentation for Optional Subsystems

The costs for documentation of any of the optional features, capabilities, or subsystems is included in the quoted price for those options.

NO CHARGE Workstation Acquisition, Maintenance and Installation Assistance

37,000 Optional Document Retrieval Module
Cost of Journal subsystem, with keyword indices.

5,000 Yearly operation cost if provided by SRI.

Extra Cost Options Not Requested

The following subsystems are available only as extra cost options, requiring added training and maintenance, the costs for which are included in the charges show below:

5,000 Message: immediate delivery messages

20,000 Graphics: creating and modifying diagrams and illustrations

10,000 Proof: checking COM formats on a Tektronix screen

5,000 Calculator: arithmetic

PRICING PROPOSAL

Hardware Estimates

Computer Facility Equipment Costs

A Digital Equipment Corporation (DEC), Model 2040, using the manufacturer-supported operating system TOPS-20, appears to be the best choice for the support of NLS-DP at this time. We estimate that such a computer facility can be obtained (not allowing for potential CMB discounts) for about $430,000. As an alternative to purchase, we suggest that CMB consider DEC leasing arrangements for the equipment.

The minimum DEC 2040 facility configuration we recommend is shown below. It should be noted that as CMB user requirements increase, facility capacity upgrading is expected to be available for higher levels of user support, utilizing additional memory and disks to effect the expansion.

Item	Description
2040*	Basic System
MA20-A/E	Memory (an additional 128k)
RP04-A	1 additional Disk Drive
LP20-B	Line Printer
DC20-AA/DA	1 additional 8-line group

* includes CPU with 128k memory, one 8-line group, one RP04 disk, and one TU45 tape drive.

The current version of the DEC TOPS-20 operating system can be improved in certain ways that will substantially improve the speed and capacity of the system for NLS-DP operation. SRI is currently implementing these improvements, in close communication with DEC personnel. DEC may include these features in the version of TOPS-20 scheduled for release in the Fall of 1977. In any case, these features would be available from SRI, if needed, subject to future negotiations among CMB, DEC, and SRI concerning use rights and future maintenance support.

Terminals

As outlined in the technical proposal (Volume I, Section 1.5.5.2), we recommend that CMB acquire the suggested terminal equipment directly from terminal vendors with the exception of the mouse, line processor, and keyset, which should be obtained from SRI. The total estimated cost of the suggested

terminal equipment configuration is shown below, followed by further discussion of the complete display workstation and a breakdown by equipment item.

1 set, mouse, line processor, keyset from SRI	$ 3,000
12 NLS-DP Display Workstations	34,820
2 Xerox 1700 Diablo Printers	4,000
1 TI 733-ASR Dual Cassette Terminal	3,000
Estimated Total Initial CMB Terminal Costs	44,820

Complete Display Workstation

The single complete display workstation proposed will consist of a Data Media display, NLS-DP display keyboard, mouse, keyset, workstation table, and lineprocessor. The connection between the workstation and host NLS-DP computer would be via three wires (ground, send and, receive). CMB would be responsible for completing the installation and purchase of the display with NLS-DP keyboard, and the workstation table. SRI would provide the mouse, keyset, and lineprocessor.

Maintenance

SRI will also provide replacement maintenance for the mouse, keyset, and lineprocessor at the rate of $750 per year for each set purchased. When one of these items is determined faulty, SRI will replace the unit or component part from SRI stock in Menlo Park. No on-site maintenance will be provided.

PRICING PROPOSAL

Cost Per Item for Terminal Equipment

Cost	Item	Description
2,500*	Data Media Elite 2500-SRI	NLS-DP display
420*	Data Media Elite NLS-DP keyboard	NLS-DP display keyboard
400*	Data Media maintenance	display and keyboard maintenance
450	SRI-mouse	display cursor control
250	keyset	supplementary keyboard
2,300	lineprocessor	mouse, keyset, display multiplexor
4,000*	Xerox 1700 Diablo Printer	high quality printer
8*	print wheels-Diablo	1000 pages each
5*	ribbons-Diablo	1000 pages each

* Estimated costs for equipment and maintenance CMB will purchase directly from equipment vendors.

PRICING PROPOSAL

Offline Text Entry (DEX)

$3,000 Approximate Cost

Configuration:

For deferred execution (DEX) we propose a TI-733 dual cassette terminal. CMB will be responsible for purchase, maintenance, and installation of this item.

Cost	Item	Description
$3,000	TI-733 ASR	Upper/lower case hard copy terminal with all available options except acoustic coupler
$10ea.	Tape Cassettes	Offline text storage (approx. 100pp. ea.)

PRICING PROPOSAL

CONTINUING SERVICES--PLANNING ESTIMATE: ($) Second--Fifth Years

10,000 per year	Continuing Documentation--rates for ongoing provision and updates to correspond to software developments and improvements on an ongoing basis, based on feedback from CMB and other NLS System users.
20,000 per year	Software Updates and Maintenance
2,200 per week	Continuing Training and Assistance--Approximate The cost per person-week of additional assistance is listed below for one year beyond the initial contract. It is assumed that these training sessions can be held at the client's site. Costs for years beyond the second year would be be negotiated on a yearly basis. For planning purposes, one person-week of assistance can provide 10 half-day sessions.
$2,103 per week	Terminal Operator Training
$2,326 per week	System Operator Training
$2,326 per week	Technical Support Training

TXTP EVENTS/DELIVERABLES SCHEDULE

Item Description	Product Type	Cost	CMB Scheduled Delivery Date
Implementation Phase			
Vendor Work Plans	Document	No charge	20
Terminal User Guide	Document	28,000	40
TUBP Updates	Document	2,000/wk.	70
Operations Project Guide	Document	Inc.in TUBP	50
OPB Updates	Document	2,000/wk.	80
Hardware	Hardware	Other	110-125
Recording Media	Supplies	Other	120-130
TXTP System	Software	100,900	120-130
Terminal Operator Training	Support Materials	39,000	130-175
System Operator Training	Support Materials	3,500	130-155
Technical Support Training	Support Materials	7,500	80-100
Development/Acceptance Phase			
Development/Acceptance Test	CMB Activity		130-155
Corrections for Deficiencies	Software/Support	No charge	170
TUBD Updates	Document	2,000/wk	170
OPB Updates	Document	2,000/wk	170
Development/Acceptance Report	Document	Other	190

TXTP EVENTS/DELIVERABLES SCHEDULE

Item Description	Product Type	Cost	CMB Scheduled Delivery Date
Conversion/Parallel Phase			
Mag Card II Conversion	Service	4,700	175-200
Systems Modifications	Software	10,000/mo.	240
System Maintenance Software	Support		Ongoing
Document Updates	Document	No charge	240
Final Development/Acceptance Test Report	Document	Other	260
Subsequent Phases			
System Modifications	Software	20,000/yr.	Ongoing
Documentation Updates	Document	10,000/yr.	Ongoing
System Maintenance Suppport	Support	10,000/yr.	Ongoing