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SYSTEM CONCEPT STUDY FOR A CARGO DATA INTERCHANGE SYSTEM (CARDIS)

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FINAL REPORT

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16. Abstract

This report presents the analysis of functional and operational requirements of CARDIS. From these requirements, system sizing estimates are derived. Three potential CARDIS concepts are introduced for consideration in subsequent analysis. Their characteristics are described and interface considerations with users and foreign systems developed. Functional flows of typical CARDIS transactions are presented with flow charts. The CARDIS alternatives are compared and a plan presented for CARDIS development.

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PREFACE

This report presents the results of a preliminary investigation of alternatives for implementation of a Cargo Data Interchange System (CARDIS) in support of transportation of international and domestic shipments. This effort included an overview of potential quantitative and functional requirements for data interchange and access, the formulation of alternatives for providing necessary data services to users and the development of a tentative plan for the more exhaustive analysis necessary to arrive at a CARDIS design.

The work was sponsored by the Department of Transportation through the Systems Division, Office of Telecommunications and the Documentation and Procedures Division, Office of Facilitation. The ideas and concepts developed are preliminary and are intended to stimulate discussion and suggestions from potential domestic and international system users in industry and government.

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1. INTRODUCTION

This report contains the results of the System Concept Study for a Cargo Data Interchange System (CARDIS). The major objective of the effort was to determine CARDIS feasibility in light of potential requirements. Accordingly it was necessary to formulate an initial estimate of quantitative requirements for CARDIS based on available sources. These results are preliminary, indicating potential requirements rather than the actual requirements to be forthcoming from related CARDIS efforts.

Nevertheless, a consensus was reached with industry and government during the course of the investigation indicating the applicability of these rough estimates for system sizing. Based on these requirements with provisions for system expansion it is felt that the technical feasibility of CARDIS has been amply demonstrated as being within the state of the art.

Further investigation will produce the more precise requirements data necessary to develop system concepts to the point where meaningful tradeoff analysis can be performed. This work is essential if CARDIS is to be developed based on a validated set of system requirements and with the industry concurrence so essential to its eventual success.

CSC wishes to gratefully acknowledge the cooperative efforts of the CARDIS Review Committee members and NCITD and TDCC representatives both during the initial investigation and in their review of the material presented in the interim reports. As suggested by the Review Committee the contents of the earlier reports are repeated herein modified to reflect the inputs of the committee members. This report is self contained, including all previous material generated during the course of the investigation.

We particularly would like to acknowledge the continued support of the Department of Transportation Contract Monitor and other representatives of the Transportation Systems Center, Office of Facilitation and Office of Systems Engineering.

1. INTRODUCTION

TOPIC 1 SUMMARY OF EFFORT

Functional requirements and sizing have been developed for CARDIS from analysis of potential data elements and access. Three CARDIS concept alternatives have been identified for additional analysis.

The first task of this project was devoted to an analysis of CARDIS requirements in terms of (a) the overall role of the system in the interchange of data; (b) identification of the specific functions to be included in the system; and (c) the type and amount of data needed to support government and industry users. This aspect of the study provided the basis for developing system concept alternatives.

The approach included a review of the activities involved in international trade with emphasis on the information requirements of the participating parties. Estimates of the type and amount of data needed for each shipment were compiled and access requirements for both entering (or modifying) and retrieving data developed.

The analysis effort relied heavily on secondary research materials including data elements lists from previous related studies and describing other cargo oriented systems. Interim results of this analysis were reviewed with industry and government representatives who provided additional inputs (as primary sources) and generally confirmed the findings presented, although these are preliminary in nature.*

The results of the Item 1 requirements are presented in Chapter 2. Background data is included in Appendix A.

In conjunction with the requirements analysis of Item 1, effort was directed to formulating viable approaches for CARDIS. As a result three alternatives were described, each typifying a representative or generic concept for the system.

One approach or concept for CARDIS is that of a Unified Data Base in which all shipment data is entered into system files and made available to all users on a need-to-know basis. This concept offers a common file structure and data management capability whether centralized or geographically separate processing facilities are used.

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*While a review of the data was undertaken, the nature of the data is preliminary anticipating much more exhaustive studies now under way directed at defining these parameters precisely. Since the purpose of this initial data element investigation was to assess system feasibility, the quantitative estimates do serve as an adequate base to obtain "ball park" transaction rate and file size estimates.

A second concept views CARDIS as a Data Transfer facility in which messages conveying shipment data flow between users via CARDIS centers operating basically as message switches having routing and editing capabilities. No system maintained data base would exist but access to user data bases would be possible.

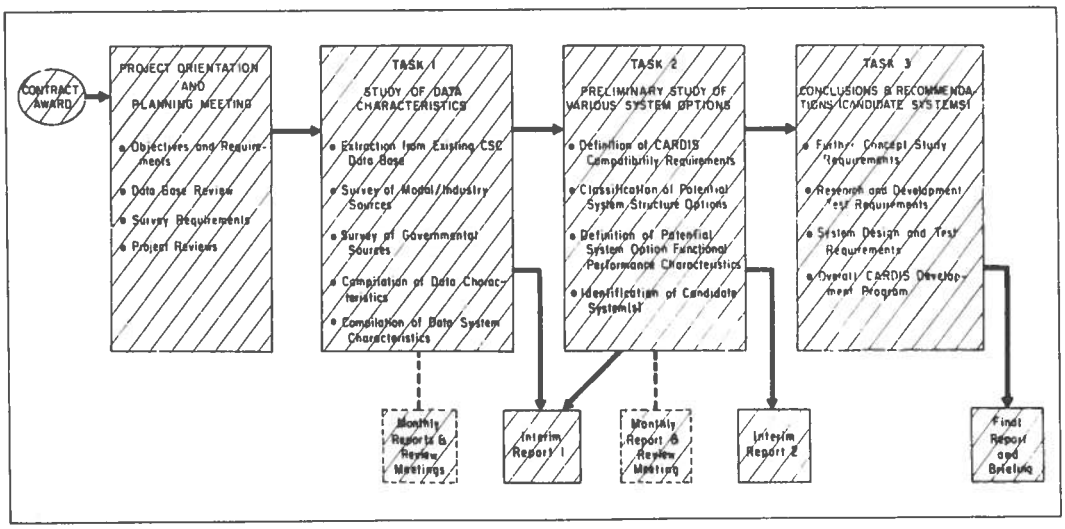
A third alternative is the Multiple CARDIS Concept in which a series of interconnected CARDIS centers each maintain a partial shipment data base for its geographical area or user community.

Each of the systems could be developed as a dedicated CARDIS facility or could evolve from other systems expanded or modified to include specified standard functions so as to become "CARDIS RATED" systems.

Chapter 3 presents these concept alternatives in more detail and describes a Message Transfer capability as an optional service to system subscribers. Chapter 4 describes the considerations involved in interfacing CARDIS with other systems and with individual parties both domestically and overseas. The report concludes with Chapter 5 which discusses the general information flow of CARDIS and describes typical flows of major user transaction.

Chapter 6 presents the major conclusions of the study. The three basic alternatives and their variants are ranked with respect to technical characteristics and factors associated with implementation and operation. Finally, a development plan for the initial phases of CARDIS is presented to indicate steps by government and industry associations necessary to validate CARDIS requirements and functions and to determine the course for CARDIS development.

PROJECT SUMMARY



2. CARDIS REQUIREMENTS ANALYSIS

2.1 Operational Characteristics

TOPIC 1 FUNCTIONS OF CARDIS EMPHASIZE DATA INTERCHANGE

To facilitate international shipments, CARDIS must accept, transfer, and manage the information and documentation for the U. S. Export/Import cargo industry, and interface with both foreign and domestic systems.

CARDIS will use automated techniques to facilitate the information flow associated with the conduct of international trade. CARDIS computers and communications facilities will make data readily available to government and industry elements engaged in the movement, control, planning, financing, and insurance of shipments. A primary CARDIS objective is to make necessary data accessible in a timely manner to support the information requirements of each party and reduce the costs associated with the flow of that information.

Parties served by the system will include shipper/exporters*, freight forwarders, carriers, government agencies, banks, insurance companies and brokers, and consignees*. All users will have access to specific shipment data elements in which they have a legitimate interest. In this way, the information each user requires to perform his function will be readily available and necessary documents can be automatically produced when required.

In order to perform this data interchange function, CARDIS will provide the basic facilities for maintenance and management of the shipment data which it transfers among users. The system must assure that the latest most accurate data on each shipment is available, and must be capable of providing this data where and when the users require it. Data privacy must be protected by limiting access to data about a shipment to those with a legitimate interest and also by further restricting access to specific items within the shipment data record on an individual user basis. These constraints must be individually imposed for controlling the access and the entry or modification of data elements. Additionally, the system must prevent fraudulent data manipulation or tampering by incorporating adequate security provisions in the processing, storage, and communications elements of the system.

Another function of the system will be the maintenance of an audit trail of all transactions. This serves as a means of detecting and diagnosing possible security and privacy violations, of providing a back-up capability in the event data

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*These elements are served during the course of their actual contact with the shipping process, e.g., from the time the shipper contacts a forwarder to the time the consignee reconciles the shipment after arrival. Further breakdown within each of these general categories is possible making the user community even more complex in some cases.

is lost due to failures or errors in the system, and provides a source of historical data for statistical analysis, summary reports, system management information, etc.

An important aspect of the system will be its ability to interface with foreign systems so that the total information requirements, from shipper to consignee, can be accommodated.

CARDIS FUNCTIONS

- FACILITATE SHIPMENT DATA TRANSFER
- MAINTAIN AND MANAGE DATA BASE
  - CURRENCY
  - PRIVACY AND SECURITY
  - ACCURACY
  - RELIABILITY
  - RESPONSIVENESS
  - INTEGRITY
- PRODUCE SHIPPING DOCUMENTS OR DATA FOR GOVERNMENT AND INDUSTRY
- PROVIDE AUDIT TRAIL
- INTERFACE WITH FOREIGN SYSTEMS
- PROVIDE FOR MAINTENANCE OF TRADE AND TRANSPORTATION CODES
  - COMMODITY CODES
  - DUN'S NUMBER OR OTHER PARTY IDENTIFIER
  - LOCATION CODES
  - SHIPMENT NUMBERING CONVENTION

2. CARDIS REQUIREMENTS ANALYSIS
2.1 Operational Characteristics

TOPIC 2 CARDIS OPERATIONS CONTRAST WITH USER APPLICATIONS

Prominent operational characteristics essential for CARDIS to perform its intended functions include data interchange functions, security, modularity, interfaces, document generation and audit.

To facilitate data interchange by CARDIS, automated data processing is necessary for management functions, access control, data editing, file maintenance, communications control, report generating, etc. The system as presently conceived will emphasize these functions as opposed to those generic to the users' internal operations. For example, CARDIS itself will not offer steamship companies a means of scheduling loading operations or sailings, or performing booking functions. Rather, it will be capable of interfacing with user systems performing such functions and thereby serve as a source of data needed for such systems.

This interchange capability will accommodate both import and export shipments on a nationwide basis. It will encompass both the domestic and international transportation of these shipments by all modes: rail, truck, air, and ocean.

Operational security features of the system are extremely important in protecting the proprietary information of the users. The system must examine each attempted access to determine that the source is a legitimate system subscriber, that a valid interest in the specific shipment exists, and to verify the authority to acquire the data being sought or to enter or modify data. Provisions are needed to prevent intentional or accidental program or file tampering which could not only compromise security and privacy, but also cause system errors or failures.

To be viable in the ever changing and growing environment of the international trade, CARDIS must be modular so that functional revisions can be incorporated without unduly disturbing normal operations. Similarly, increases in capacity to support expanding shipping activity--an enlarging user community--and additional domestic and foreign system interfaces must be accommodated as the system evolves.

To interface operationally with user and foreign systems CARDIS must comply with standards for data and communications. Codes and formats, communications disciplines, data rates and transmission techniques must be compatible. Carefully specified standards are required to define the interface characteristics between CARDIS and each domestic user system and foreign interchange facility to be connected.

Even with CARDIS, a need for some documentation in conventional forms will still exist. The system therefore must have the ability to prepare such documents. Either in response to specific user request or when certain prescribed criteria exist, CARDIS will print out appropriate documents according to standardized formats. This can be accomplished directly at user terminal printers or by using printers at CARDIS facilities from which the documents will be sent by mail to the recipient.

System audit trail capabilities will exist in two forms: on line and off line. On-line audit information consists of the retention in accessible form of modifications to shipment data including such items as the party making the modification, the time it was made, the data entered, etc. This allows disparities in shipment information to be recognized and brought to the attention of the parties involved for reconciliation. In addition, an off-line audit trail consisting of all transactions made to enter or access data will be maintained on a lower speed, lower-cost media such as magnetic tape. Specific guidelines and controls must be established to govern the nature of the data to be recorded, the retention cycle, access criteria, storage protection, disposal procedures, etc.

CARDIS OPERATIONAL REQUIREMENTS

INTRINSIC CHARACTERISTICS
- PRIMARILY DATA INTERCHANGE
- LIMITED COLLATERAL APPLICATIONS
- PROVIDE DATA FOR USER APPLICATIONS
- U.S. EXPORTS/IMPORTS
- ACCOMMODATE ALL SHIPMENT MODES

SECURITY
- TWO CLASSES OF ACCESS
  - DATA ENTRY/RETRIEVAL
  - RETRIEVAL ALONE
- COMPANY PROPRIETARY DATA WILL BE PROTECTED

DOCUMENT PRODUCTION
- AT SYSTEM FACILITIES
- AT USER FACILITIES

MODULARITY
- EXPANDABLE THROUGH ADDITION OF HARDWARE AND SOFTWARE MODULES
  - FUNCTION
  - USER COMMUNITY
  - CAPACITY
  - INTERFACE

DOMESTIC AND INTERNATIONAL INTERFACES
- CODES
- DISCIPLINES
- DATA RATES
- TRANSMISSION TECHNIQUES

AUDIT
- ON–LINE FOR DATA ENTRY
- OFF–LINE FOR DATA ACCESS

2. CARDIS REQUIREMENTS ANALYSIS
2.2 Data Characteristics

TOPIC 1 CARDIS USERS INCLUDE ALL SHIPMENT PARTIES

To serve the international trade industry, all parties to a shipment with a validated need-to-know must be served.

It has been estimated that some 46 different types of industry and government organizations participate in international cargo shipments and therefore require shipment information. Tens of thousands of individual commercial establishments and government agencies fall within these categories, with many performing multiple roles which could classify them in several categories. As many as 28 separate companies and agencies have been associated with a single shipment. This is some indication of the size and diversity of the potential CARDIS user population.

Each party to a shipment has a different need for information depending on role and individual method of operation. Classifying shipment participants and their access can therefore only be approximate based on typical activities. For example, the duties of freight forwarders with respect to shipments varies greatly from company to company. Typically a forwarder will have different agreements with each shipper served, delineating the specific services to be rendered in each instance.

Therefore CARDIS users will have a wide range of access requirements which must be reflected in the access control elements of the system. To a certain extent the need to retrieve specific data elements can be related to the various classes of participants. Similarly, the ability to enter or modify items can be associated with the parties usually considered as sources of the information. For purposes of this study nine major access categories have been defined.

The Data Element Analysis presented in Appendix A shows the type of access (i.e., entry and retrieval, retrieval only or no access) of each user category with respect to each data element. The data shows that shippers and forwarders acting in behalf of shippers will be the primary suppliers of information, with the other parties primarily limited to retrieving elements to which they have a valid interest. For example, the government would be restricted from access to commercial invoice data for export shipments as would other parties to the shipment such as carriers who have no need for the information and who might subject such information to inadvertent breaches of security. On the other hand, this data is important to customs in determining charges to be assessed on import shipments. Therefore system access controls must be designed to reflect the dissimilar aspects of import and export shipments.

USER ACCESS CATEGORIES

- SHIPPER/EXPORT
- FREIGHT FORWARDER
- INLAND CARRIER
- INTERNATIONAL CARRIER
- GOVERNMENT
- BANKS
- INSURANCE
- CONSIGNEE
- IMPORT BROKER

2. CARDIS REQUIREMENTS ANALYSIS
2.2 Data Characteristics

TOPIC 2 DATA ELEMENTS ANALYSIS FOR RECORD SIZING

Analysis of required data elements shows a need for shipment record sizes in the range of 2000 to 4000 characters.

CARDIS data analysis indicates that approximately 100 separate data elements are needed to identify and describe a shipment.* These items were divided into eight data categories as shown in the chart on the facing page. Data item lists from six reference sources were consolidated to determine the required items and the resulting list was reviewed with cognizant industry and government representatives.

For each item, available information from the reference sources was compiled to determine the field sizes required (i.e., characters of storage). A range of estimates was developed by considering the minimum and maximum size of each field. The minimum size is based on partial use of coded information (especially in the Parties and Physical Description categories for which standard coding structures are being developed). The maximum size assumes that no coding is used.

A third estimate was made based on the assumption that coded data would be used to the fullest possible extent. The detailed estimates appear in Appendix A. Summary totals for each of the eight data categories appear on the facing page.

Based on consultation with industry it was determined that, on the average, shipments contain four commodities and for each commodity an average of ten items are represented.** Thus, in the Physical Description category, data elements referring to specific commodities were allotted space four times the size needed

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*This accounts for a large majority of shipments although some shipments need many fewer items (perhaps as few as 50 or 60) and others may require more.

**It has been noted that the estimated average of four commodities per shipment may be excessive. (For example, it is the practice of the Census Bureau to use an average of 1.4.) Also it is recognized that the number of items per commodity varies widely (estimates from 5 to 500 are not uncommon) so that the use of 10 as an average may be too low although no definitive information has been found to substantiate a revision. In light of the above counterbalancing considerations, it has been decided to use the original estimates for the purposes of this study recognizing that further investigation will be required to obtain more reliable estimates prior to detailed system design.

for one commodity. In the Commercial Invoice category, fields representing individual items were allotted 40 times the unit size (i.e., ten items for each of four commodities).

Note the effect of the Commercial Invoice data on each of the estimates. This category requires 1291 bytes in each case since all the data elements in it are values, counts or dates rather than textual and because of the large number of items (40) that must be generally accommodated.

As shown in the table, approximately 3000 to 4000 characters are required for each shipment depending on whether partial coding or no coding of elements was used. The opportunity for reducing this to 2000 characters exists through maximum use of coding, assuming that standard codes are available and in use on an industry-wide basis. The use of codes for storage also implies the incorporation of translation tables permitting system outputs to be produced in clear text in cases where human interfaces exist. The use of codes also requires that a code maintenance activity be established to assure that code lists used in CARDIS are complete and current.

SHIPMENT DATA

DATA CATEGORY	NUMBER OF CHARACTERS			COMMENTS
	MIN.	MAX.	ALL INFO. CODED	
Parties	910	1,366	130	
Physical Description	373	833	373	Assumption of Avg. of 4 Commodities / Shipment
Commercial Invoice (Requirement for Descriptors Has Been Established)	1,291	1,291	1,291	10 Items per Commodity.
Freight Charges	200	200	200	All Coded
Government Data	85	85	55	All Coded
Routing Information	68	179	55	
Letter of Credit	114	190	40	
Insurance	67	67	67	
Total	3,108	4,181	2,211	
Total Less Commercial Inv.No.	1,817	2,890	920	

2. CARDIS REQUIREMENTS ANALYSIS
2.3 System Performance Requirements

TOPIC 1 BASIC SYSTEM PARAMETERS NEEDED FOR DATA BASE SIZING

Quantitative data and time characteristics form the basis for deriving data base requirements for CARDIS.

In the "Paperwork or Profits?" report, U.S. import/export shipments were reported to total 18 million for fiscal year 1971, including 10 million exports and 8 million imports. This figure was based on available government data on shipments exceeding $250 each and estimates for shipments under that value. Similar Census Bureau data for 1973 shows approximately 7.75 million export shipments and 3.4 million import shipments totaling 11.15 million shipments over $250 in value. With this as background the CARDIS system should be designed to handle between 10 and 20 million shipments on an annual basis to accommodate projected shipments likely to be incorporated in the data base. Each shipment will require between 2000 and 4000 characters of storage as shown previously. Domestic shipments are expected to require somewhat less storage; however, additional investigation is needed to determine the amount.

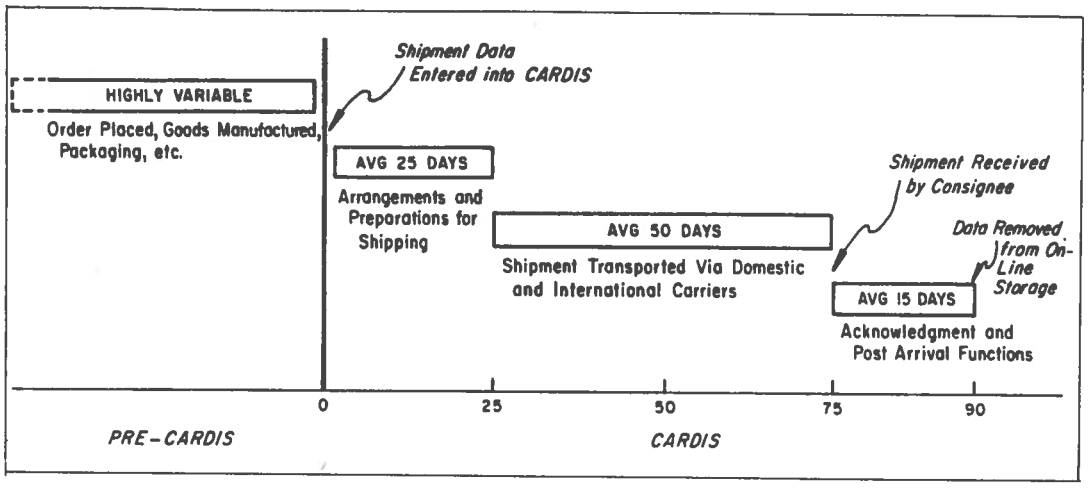
The length of time that shipment data is kept in accessible, on-line storage directly impacts on the size of the system data base. Based on the views expressed by knowledgeable industry and government personnel, CARDIS shipment file origination occurs when arrangements are begun for the shipment. This is subsequent to buyer/seller negotiations, order placement, manufacturing, assembling and packaging functions and typically occurs when the shipper initiates booking preparations either directly with the carrier or in conjunction with a freight forwarder. The freight forwarding function, whether independent or part of a company, is a logical point for shipment genesis since this is the earliest true party to a "shipment". This concept has been confirmed in contacts with LACES and SITPRO staff.

Shipment data must remain accessible (i.e., on line) throughout the inland and international transportation phases including the time necessary to move the cargo and all delays both inter- and intra-modal. After the shipment is received by the consignee the data will remain on line for sufficient time for acknowledgment of receipt to be received and for any other post-arrival functions required by the parties involved. At that point the data will be transferred to inactive status and stored (probably on magnetic tape).

As shown in the diagram, it is estimated that international shipments will remain in active status for approximately 90 days on the average including shipment reconciliation once it is in the hands of the consignee. Totally domestic shipments will have a shorter life cycle. If CARDIS involvement stops at

delivery, approximately 20 percent reduction in shipment "length" and hence in the size of the data base may be anticipated. As will be shown, these estimates have a considerable range due to other uncertainties. The system must have expansion capability of more than a factor of four with the result that considerable variation in operation is possible within the same set of system design parameters.

INTERNATIONAL SHIPMENT LIFE CYCLE



2. CARDIS REQUIREMENTS ANALYSIS
2.3 System Performance Requirements

TOPIC 2 SYSTEM DYNAMIC CHARACTERISTICS AS A BASE FOR THROUGHPUT ANALYSIS

Accesses and terminal requirements establish the basics for system throughput, grade of service, and communication requirements.

Accesses per Shipment

The number of accesses to shipment data is a function of the total information needs of all parties throughout the shipment process regardless of the time the shipment is active. Typical accesses are entry and modification of basic shipment data, requests for data needed in the planning and transportation functions, production of shipping documents, entry of acknowledgments at transfer points, etc. Review of activities associated with international shipments indicates there are about 50 occasions for the average shipment requiring accesses of these types. Previously, an estimate of 100 was made in view of the large number of documents and copies now produced. This extensive use of documents was viewed as an indication of additional needs for information and, therefore, additional accesses to the system. Recently stated opinions of knowledgeable government and industry sources indicate the original estimate of 50 accesses per shipment is more appropriate especially in view of the expected decrease in information requirements resulting from ongoing standardization and simplification activities. Therefore, an estimate of 50 transactions per shipment has been reflected in the system sizing analysis.

Access Methods

User access to CARDIS may be classified into four categories:

- Interactive - This involves the use of remote terminals such as teletype or keyboard/CRT units to obtain specific elements of shipment data needed to support user activities. These inquiry transactions will generally involve rather brief input messages (in the order of 20 characters) to identify the user and data required. The system will provide the requested data with appropriate labels and headings in a format designed for user convenience. These outputs will be in the order of 400 characters. On the average, three interchanges (user inputs and system outputs) will constitute an interactive transaction including such overhead functions as entry of identification and security codes and output of usage summary data. Such transactions involving an average of 1260 characters [(400 + 20) x 3] will require two minutes of operator (i.e., terminal) time on the average including operator functions, system processing, and file access and communications time. They will constitute in the order of 50 percent of all system transactions.

- Computer-Computer - Many users will interface with CARDIS via their own computer or by subscribing to other systems interfacing with CARDIS. Accesses in these cases will involve the interchange of information between computers with the user computer relaying data or inquiries from its operators or generated by its own processing functions. CARDIS in turn will provide information to user computers for use in support of its functions. Interchanges in this category will require less data than equivalent interactive accesses (about 300 characters instead of 1260) since labeling and formatting essential to terminal operations will not be required between computers. About 30 percent of CARDIS transactions will be of this type.

- Bulk Input - This type of access provides for off-line preparation of data (e.g., cards, paper tape, etc.) for entry using a batch input terminal at a much faster rate than an interactive terminal. Inputs using such terminals will include basic shipment data as well as batched inquiries that encompass many data elements or shipments. Bulk inputs averaging 1000 characters each will constitute 10 percent of CARDIS transactions.

- Document Preparation - Printing of shipment documents and reports too lengthy for low speed terminals will be directed to batch printer terminals at either CARDIS or user facilities. This will be the major output capability and will account for about 10 percent of all transactions. An average size of 2000 characters is estimated.

From these estimates a measure of average system workload may be derived. However, the system must be designed to handle expected peak demands for service without excessive deterioration in response time. Typically a peak factor of 3 or 4 is used for on-line systems. It has been suggested that a peak factor of four would be appropriate for CARDIS based on experience in the communications field and fluctuations occurring in the transportation industry due to such factors as daily and seasonal variations, weather, and strikes (i.e., the system will have to handle four times the average workload during peak periods).

BASIC SHIPMENT PARAMETERS

SHIPMENTS/YEAR	10-20 MILLION
AVG RECORD LENGTH	2000-4000 CHARACTERS
AVG ON-LINE TIME IN SYSTEM	90 DAYS
NO. OF ACCESSES PER SHIPMENT	50
– INTERACTIVE	50%
– COMPUTER-COMPUTER	30%
– BULK INPUT	10%
– DOCUMENT PREPARATION	10%
OPERATOR TIME PER INTERACTIVE TRANSACTION	AVG 2 MIN
PEAK FACTOR	4

TOPIC 3 BUFFER MEMORY SIZING

I/O buffers for both peripheral devices and communications dominate memory requirements in CARDIS processors.

A significant portion of processor memory is required for buffer areas needed to hold data while servicing user transactions. Data base information must remain in memory long enough to respond to inquiries or to accept new entries or changes. In either case data must be brought into memory from the files and held until the processor's operations are completed; that is, until data is extracted for retrieval or new data is entered and the record returned to the file.

To estimate the size of memory buffers needed to process transactions it is assumed that data from files will reside in memory for an average of approximately one second and that typically 1000 characters of data will be required. Based on a peak rate of 64 to 128 transactions per second (see Topic 6 of this section), 64,000 to 128,000 characters of memory are required. For some transactions it will be required that data remain in memory for a longer period. In the case of updates, for example, it may be assumed that data from files will remain in memory until new data is received and edited, which may be expected to require the entire transaction time of two minutes. Assuming that 10 percent of transactions will fall into this category, additional memory buffers in the order of 768,000 to 1,536,000 characters will be required; that is,

> 10 percent of 64 to 128 transactions x 100 char x 120 secs
> = 768,000-1,536,000 characters

Additional buffers are required to hold data destined to be written on tape as an audit trail of all transactions. The size of these buffers depends on the number, speed, recording density, and configuration of tape units as well as audit record sizes for updates and inquiries, and record blocking factors. Also, software capabilities especially in the operating system and input/output packages will have a bearing. Considering these variables, tape buffer capacity of the order of 100,000 to 200,000 characters is included for initial memory sizing purposes.

Buffer areas for input/output operations of the disk system are determined by similar system design considerations as for tapes. However, these buffers may be expected to be somewhat larger in view of the larger number of disk channels required and the longer individual disk record increments (1000 bytes) as opposed to audit record elements (100 bytes). Other factors affecting disk buffers are the overall configuration of the disk subsystem and the capabilities of the drives, controllers and channels used. For example, by having a lower

drive to controller ratio more simultaneous disk seeks can be issued which could speed up disk access but would require additional buffer space. Also, the ability of the subsystem hardware to handle multiple disk operations concurrently in the same controller and to release the channel during part of the search time may also impact on the size of the disk buffer areas. As in the case of the tape subsystem, the features of the operating system software and the input/output routines also impact buffer size. For preliminary estimating purposes disk buffers of the order of 200,000 to 400,000 bytes are included.

BUFFER SIZING

BUFFER TYPE	CHARACTERS (BYTES)
INQUIRY, ETC.	64,000 TO 128,000
UPDATE, ETC.	768,000 TO 1,536,000
TAPE OUTPUT	100,000 TO 200,000
DISK I/O	200,000 TO 400,000
TOTAL	1,132,000 TO 2,264,000

2. CARDIS REQUIREMENTS ANALYSIS
2.3 System Performance Requirements

TOPIC 4 RESIDENT SOFTWARE SIZING (SYSTEM CENTRAL PROCESSORS)

Processor memory must accommodate resident software including operating system, file management, I/O handlers and applications.

Processor memory required to support all programs necessary to conduct on-line system operations must be provided. Included in this category are such software elements as:

Operating System (OS) - Overall control of all processor activities

File Management - Access and update shipment records and provide indexing features

Security - Protect system files and software from unauthorized access and manipulation

I/O Handlers - Control all operations involving peripheral devices

Miscellaneous - Includes such programs as editing, report generation, administrative functions, etc., as well as common storage, program linkage, etc.

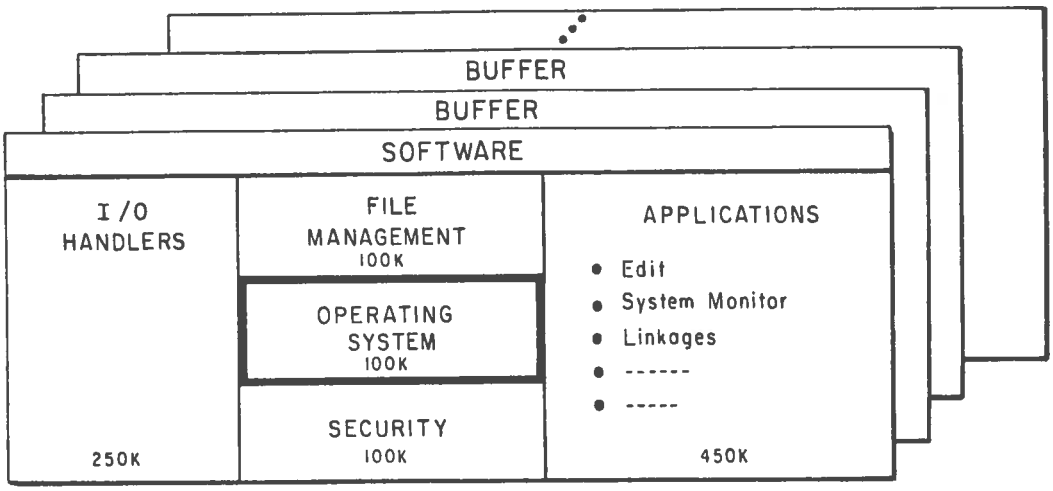
The amount of memory needed for these software elements is, of course, highly dependent on the software system design, available standard packages, characteristics of the hardware selected, languages used, and many other factors which must be addressed during system design and implementation phases. The following estimated memory requirements are considered indicative of what will be needed.

SOFTWARE SIZING

TYPE	CHARACTER (BYTES)
OPERATING SYSTEM	100,000
FILE MANAGEMENT	100,000
SECURITY	100,000
I/O HANDLERS	250,000
APPLICATIONS AND MISCELLANEOUS	450,000
TOTAL	1,000,000

These memory size estimates are very preliminary and may later be shown to have substantial inaccuracies. However, they indicate that CARDIS requirements are well within the realm of existing technology and will be achievable using available hardware and software elements.

CARDIS MEMORY ALLOCATIONS



Note: The memory sizing estimates presented here are for total CARDIS. For system implementation involving several computer facilities (for example, the Multiple CARDIS concept described later in this report) it may be expected that the memory allocation for software will be repeated in each computer while buffer allocations will be distributed among the computers in proportion to their workloads. Also, communications line handling and protocols are assumed to take place in separate front-end hardware. Thus the core allocations shown here account for I/O between communications processors and the main frame. Additional buffering will, of course, be necessary within the front-end processors themselves.

TOPIC 5 FILE STORAGE SIZING

On-line and off-line storage capabilities required are sizable but within the capabilities of modern computer systems.

On-Line Storage

Files in the CARDIS system will contain information on active shipments which must be readily accessible to service user update and retrieval requirements. The great number of international shipments and the amount of data required for each results in a storage requirement well into the billions of characters which will rank among the larger data bases currently implemented but one that is well within the state of the art of storage and processing systems.

For ten to twenty million shipments per year on line for an average of ninety days (1/4 year), the data base will contain data for 2.5-5 million shipments at any given time. With from 2000 to 4000 characters of basic shipment data, the data files require from 5-20 billion characters. In addition, to maintain on-line audit information sufficient to record all data updates and modifications including their source, time of entry and similar data, it is estimated that a 50 percent expansion of the basic data is required. This results in an on-line storage requirement of from 7.5-30 billion characters. Based on currently available disk packs with capacities up to 200 million characters, 38 to 150 packs could contain the total on-line data base.

Off-Line Storage

Data which must be maintained but which need not be accessible during on-line operations will include an audit trail of all transactions handled by the system. In addition, for back-up purposes, the entire on-line data base must be accommodated in off-line storage. Based on retaining 100 characters of audit trail data per transaction, and on-line data base information for one year, the following off-line storage estimates apply.

Transaction Data Audit Trail

10 to 20 million shipments/year x

50 transactions/shipment =

.5 to 1 billion transactions/year x

100 characters stored/transaction =

50 to 100 billion characters of audit data/year

Using 6250 b/i tapes, a standard 2400 ft tape holds 120 million characters allowing approximately 1/3 of total capacity for interblock gaps.

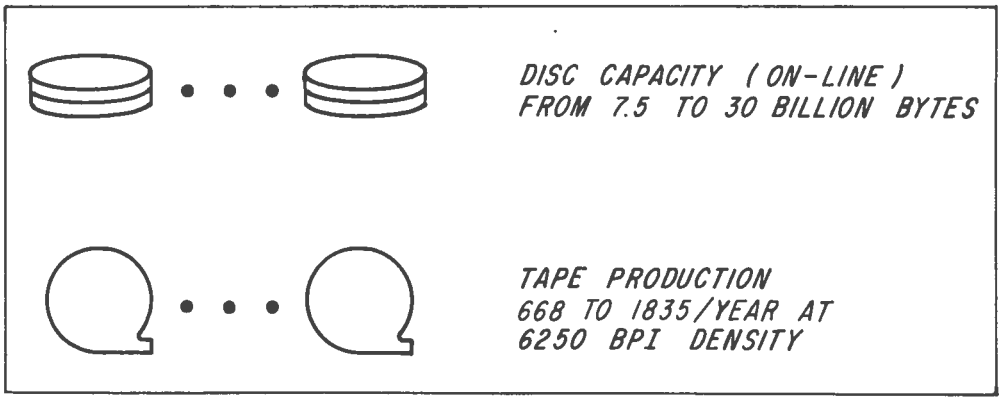
Therefore, 418 to 835 tapes/yr are required for transaction audit data.

By using 9600 b/i tapes, which are anticipated in the near future, 270 to 540 tapes are needed.

Adding to this the 30-120 billion characters required to store a year's data from the on-line data base (4 times the amount on-line at any given time), the tape requirements becomes:

668 to 1835 tapes at 6250 b/i or 440 to 1220 tapes at 9600 b/i

STORAGE REQUIREMENTS



TOPIC 6 THROUGHPUT/WORKLOAD PARAMETERS

The number of users expected to be on line and the resulting transaction rates yield CARDIS workload measures.

Transaction Rate

As previously derived, from .5 to 1 billion transactions per year are anticipated. Assuming 365 day - 24 hour operations these transactions will be handled over 8760 hours which is approximately 57,000 to 114,000 per hour or 16 to 32 per second. Applying a peak factor of four, 228,000 to 456,000 may be anticipated in the peak hour and 64 to 128 in the peak second.

Terminals

About 50 percent of the yearly CARDIS transactions will be interactive and these will have an average transaction time of two minutes (see Topic 2 in this section). This results in 114,000 to 228,000 transactions which, at a rate of 30 per terminal per hour, indicates that 3800 to 7600 terminals will be on line simultaneously.

As mentioned previously the balance of the transactions will be handled by computer-to-computer access and by high speed automated batch terminals for bulk data entry and document production. The higher speed of those units and the absence of interactive operator involvement results in a much higher workload capacity for these terminals. It is estimated that from 100 to 200 terminals will be on-line to accommodate non-interactive transactions.

A communications line requirement in the order of 350 to 700 lines will support this terminal population assuming an appropriate polling discipline and reasonable distribution of users.

Disk Seeks

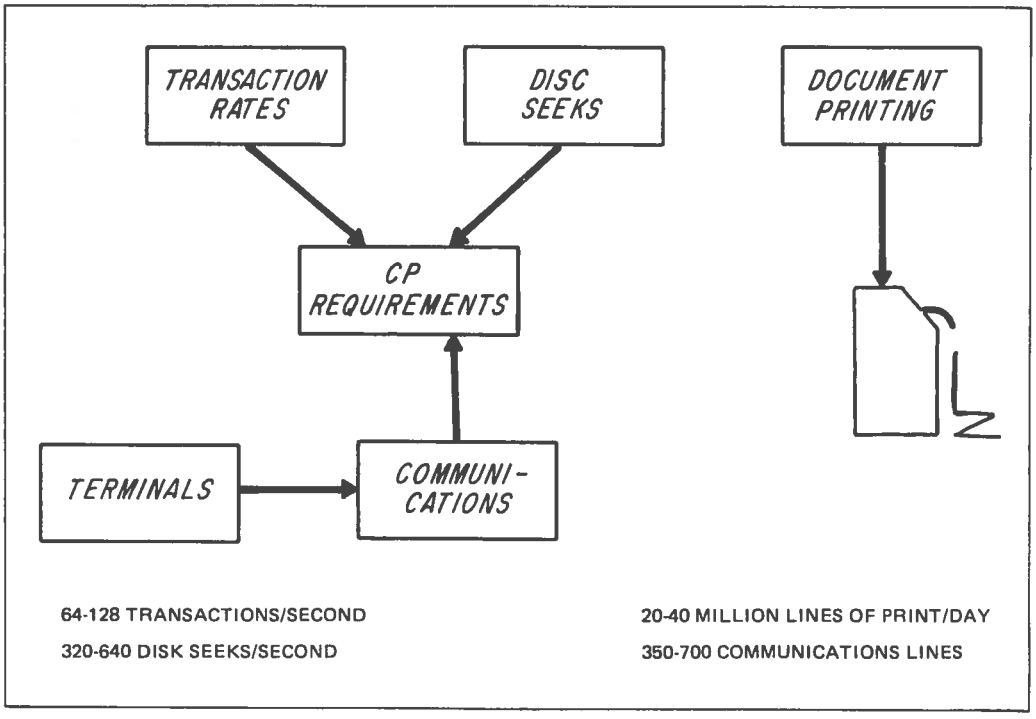
To process each transaction initiated by a user several accesses to the files will be required. These typically include references to an index file to determine the storage location of the data required, references to the basic shipment file to obtain the information needed, additional accesses to rewrite data which has been changed by the transaction, and possible reference to the program library for routines needed to process the transaction. Assuming that disk storage will be the medium used for system direct access files, it is estimated that five accesses (disk seeks) will be required per transaction. During peak periods,

this results in 320 to 640 accesses per second. This anticipated activity level will have important implications in selecting computers, storage system devices and file controllers.

Document Printing

Currently, estimates are that 46 documents are required for the average shipment. Anticipating that this will be reduced by 50 percent as a result of simplification and standardization efforts and estimating that approximately 50 percent of the remaining documents will be replaced by automated interchange of data under CARDIS, approximately 12 documents per shipment will be produced by CARDIS--a total reduction of about 75 percent. Based on 50 lines per document, an annual printing workload of 6-12 billion lines (10-20 million shipments x 12 documents x 50 lines) or approximately 20-40 million lines per day results. Operating at a 1000-line-per-minute rate on a 24-hour, 365-day basis, approximately 15-30 printers are required. The expected availability of printers having several times this speed will proportionally reduce the number of printers required.

SYSTEM THROUGHPUT



3. CARDIS CONCEPT ALTERNATIVES

TOPIC 1 OVERVIEW

CARDIS will provide information interchange functions for numerous elements in the international trade community through a variety of communications facilities.

In general terms it is essential that CARDIS interact with three distinct elements shown in the diagram on the next page to achieve the required interchange of information needed to conduct international trade.

Users

The commercial companies and government agencies particpating in international trade constitute the CARDIS user community. Access to the system may be gained through a variety of data terminals and computer systems that these users may have or acquire, or through service centers established to accommodate those who lack the necessary facilities.

Communications

To connect the user terminal equipment to the system, communications facilities will be required. Here, too, a multiplicity of techniques apply. Individual terminals may be connected to communications concentrators which in turn are connected to the system. Either conventional dialup facilities or leased lines may be used depending on the economies of the situation based on traffic requirements. Message switching networks using a variety of technologies may also be used.

Foreign Systems

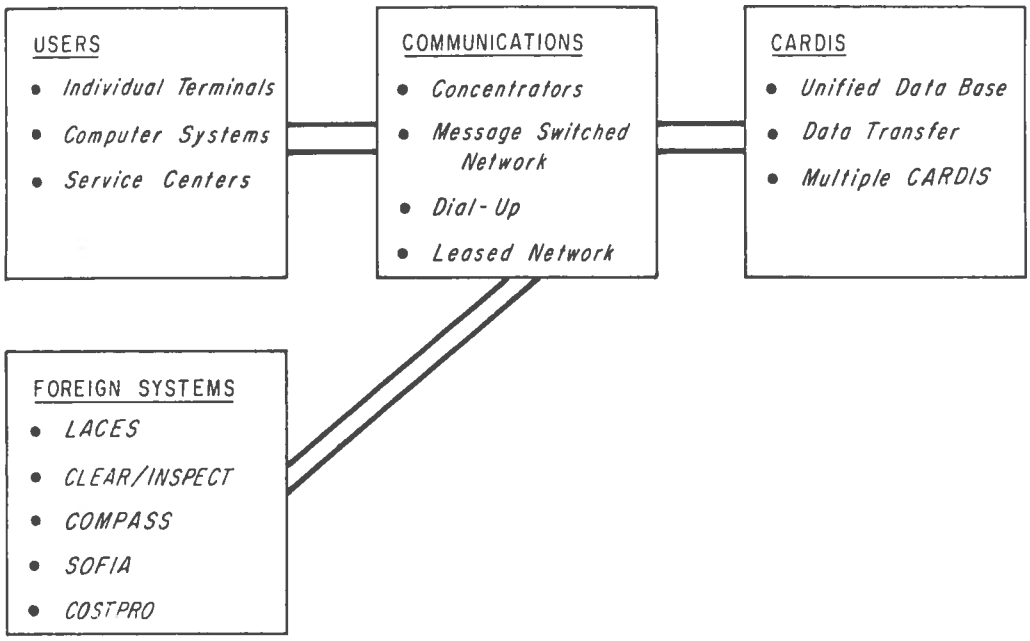
On an international level, an increasing number of systems relating to various aspects of cargo transportation are being developed. These may also be viewed as a type of user requiring access to CARDIS. Again, communications facilities will provide the means for information interchange. These systems may be directly interfaced with CARDIS or may be connected via special interface centers designed to achieve the necessary compatibility.

CARDIS

CARDIS provides the facilities for accepting, maintaining and providing access to information required by the users. Via the communications facilities CARDIS will interface with the members of the user community and support their requirements for information about shipments in which they participate. The remainder

of this section presents descriptions of three alternative approaches or concepts which may be used for CARDIS. While the actual user interactions are quite different for these approaches, all interface is through a similar complex of communication facilities.

CARDIS OVERVIEW



3. CARDIS CONCEPT ALTERNATIVES

3.1 Unified Data Base Concept

TOPIC 1 DESCRIPTION

This concept for CARDIS provides a data base which appears as a single point entry to users.

The unified data base concept or variants of it represents the most straightforward approach to implementation for the CARDIS functions previously defined. Applications tasks for various industry users, when not performed by CARDIS, are executed by reference to the data base maintained by CARDIS as a source of all pertinent data for shipments.

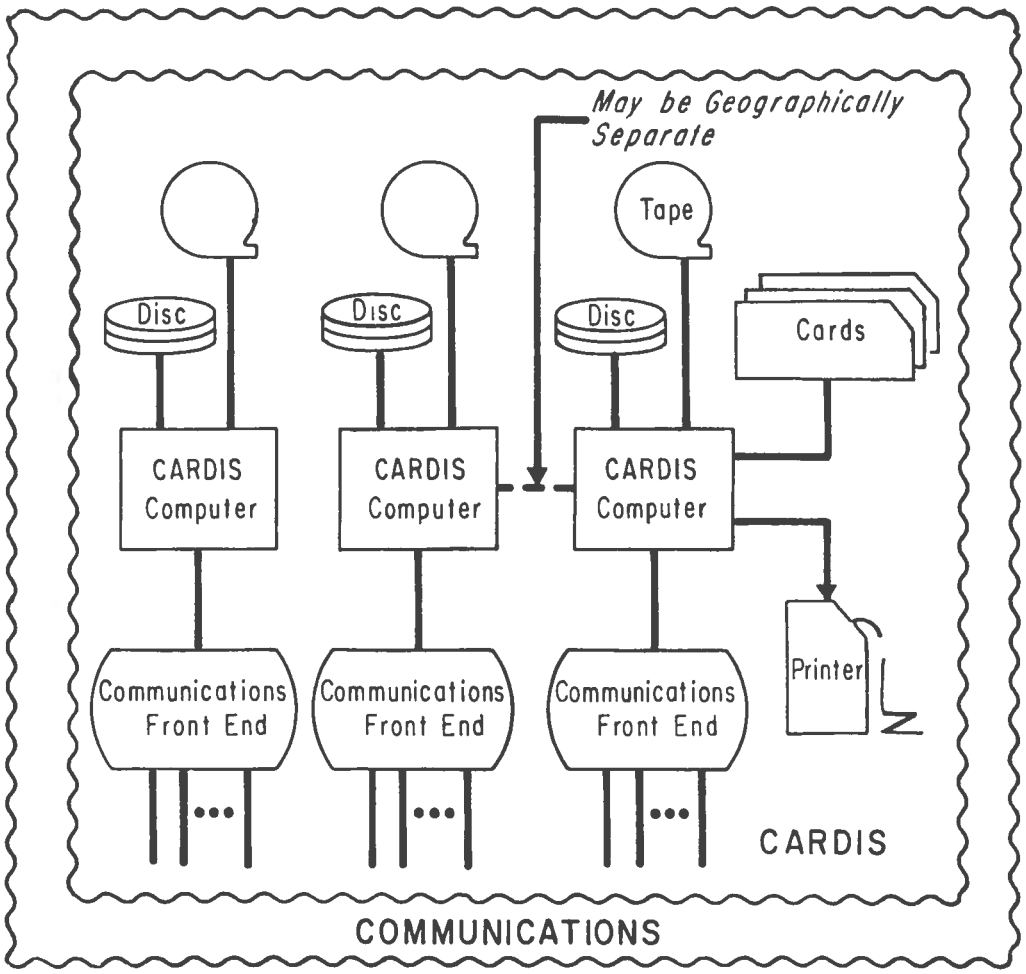
The concept utilizes a computer configuration to access and maintain necessary on-line and off-line data bases in support of CARDIS information transfer. Depending on tradeoff analyses, the data base can be either centrally located or dispersed in response to geographical traffic distribution. From initial system sizing, it is well within the state of the art to service the required data base using a single computer complex and associated peripherals.

Front-end processors at CARDIS data base facilities provide the interface with the communications network. These handle the housekeeping and other repetitive communications functions to economize on main frame processing time. Provision is made for handling message traffic using a series of specified user protocols and formats (in some instances provided by additional network interfaces) as well as for interfaces to foreign points via remote CARDIS elements.

The unified concept offers advantages in programming and system maintenance and operation. Complete control over system operation permits orderly upgrading and expansion of system functions with a minimum of coordination. Similarly, the addition of interfaces to foreign systems is greatly facilitated.

On the other hand, the unified concept does present problems with respect to the initial startup. A considerable investment must be made to get the system to initial operation. Also, agreements must be reached among all parties involved concerning such matters as location of facilities, development approach, operational jurisdiction, cost allocation, and system responsibility. Thus, despite the economies of scale and uniformity, considerable difficulty in initial implementation is foreseen.

CARDIS UNIFIED DATA BASE CONCEPT



3. CARDIS CONCEPT ALTERNATIVES

3.1 Unified Data Base Concept

TOPIC 2 OPERATIONAL CHARACTERISTICS

Basic CARDIS functions are greatly facilitated by the CARDIS unified data base architecture.

Accessibility

In this CARDIS concept, access to all shipment data is provided through a single address to the appropriate file within the data base. Files are structured for optimum access (via timing and directory guidance). The system directs data to users as a result of instructions from the controlling element or of inquiry from the recipient under carefully controlled protocols for access.

Data Base Maintenance

The characteristics of all records within the data base will be the same. Thus, user and system access is standardized regardless of the particular segment of the data base addressed. Communications between geographically disparate segments of the data base (should this option be used) provides a transparent facility to the user for access and entry.

Currency of the data base including shipment status is maintained by a process whereby each access is used to immediately update data fields as applicable. Since all data is available for system monitoring, it becomes possible to incorporate such features as automatic notification based on time and status checks for shipments. Other features such as checking for data consistency are also feasible.

Customs reporting and statistics generation are facilitated through access to the data base by software residing on system peripherals and brought into play during hours when the system is off line.

Access to the data base is controlled by software keys built into the files as part of each shipment record. Additional system safeguards will be necessary to check terminal and user configurations for access to both files and software.

Shipping Documents and Data Generation

Access to the data base by the system facilitates the automatic preparation of shipping documentation either by user command or automatically in response to changes in system status. A bulk processing facility for data preparation is an easily implemented off-line facility. This may be centrally located or at CARDIS centers adjacent to network communication nodes or concentration points.

Audit Trail

Since in this concept all transactions in the system are routed through the processing facility or facilities servicing the CARDIS data base, it becomes a relatively simple matter to provide comprehensive audit trails for all transactions. Audit of all inquiries, both accepted and rejected, may be kept off line on tape or other bulk storage media. Changes to the data base itself may be kept on line until variances are reconciled between the parties to the shipment.

The audit trail will include all transactions (e.g., data entry in addition to inquiry and update) to facilitate system recovery in the event of failure.

Foreign System Interface

The Unified Data Base concept provides a single point interface with foreign systems. Under this concept, all formatting and protocol is accomplished within CARDIS facilitating data transfer abroad. Interface abroad may encompass overseas CARDIS facilities to provide entry and exit to foreign parties as well as communication links which interface with foreign systems.

ACCESSIBILITY

- QUERY & UPDATE VIA ACCESS TO DATA BASE
- STRUCTURED FOR OPTIMUM ACCESS
- ON–LINE AND OFF–LINE ACCESS

SHIPPING DOCUMENTS & DATA GENERATION

- BULK DOCUMENT GENERATION LOCALLY AND AT SPECIFIED CENTERS
- OTHER DATA SENT VIA COMM NETWORK FROM DATA BASE TO AGENCY

AUDIT TRAIL

- ALL TRANSACTIONS ON TAPE
- FILE CHANGES ON DISK TO ALLOW RECONCILIATION BETWEEN PARTIES

DATA BASE MAINTENANCE

- ALL ENTRIES UPDATE CARDIS DATA BASE
- FULL DATA MANAGEMENT CAPABILITY
- SECURITY VIA SOFTWARE
- AUTOMATIC NOTIFICATION POSSIBLE
- CHECKS FOR CONSISTENCY AND INTEGRITY
- BACKUP AND REDUNDANCY VIA EQUIP–MENT AND SOFTWARE
- SHIPMENT STATUS AVAILABLE

FOREIGN SYSTEM INTERFACE

- SYSTEM FORMATS DATA

3. CARDIS CONCEPT ALTERNATIVES
3.2 Data Transfer Concept

TOPIC 1 SYSTEM DESCRIPTION

The concept derives from a role for CARDIS as a specialized message switch facilitating data transfer between user data bases.

This concept for CARDIS facilitates data interchange between shipping parties by providing a network of interconnected CARDIS centers which serve as message switches in routing data between concerned users. The concept of a sole message transfer concept for CARDIS has found favor among a number of industry users because of the lack of an accessible data base with its attendant problems of security.

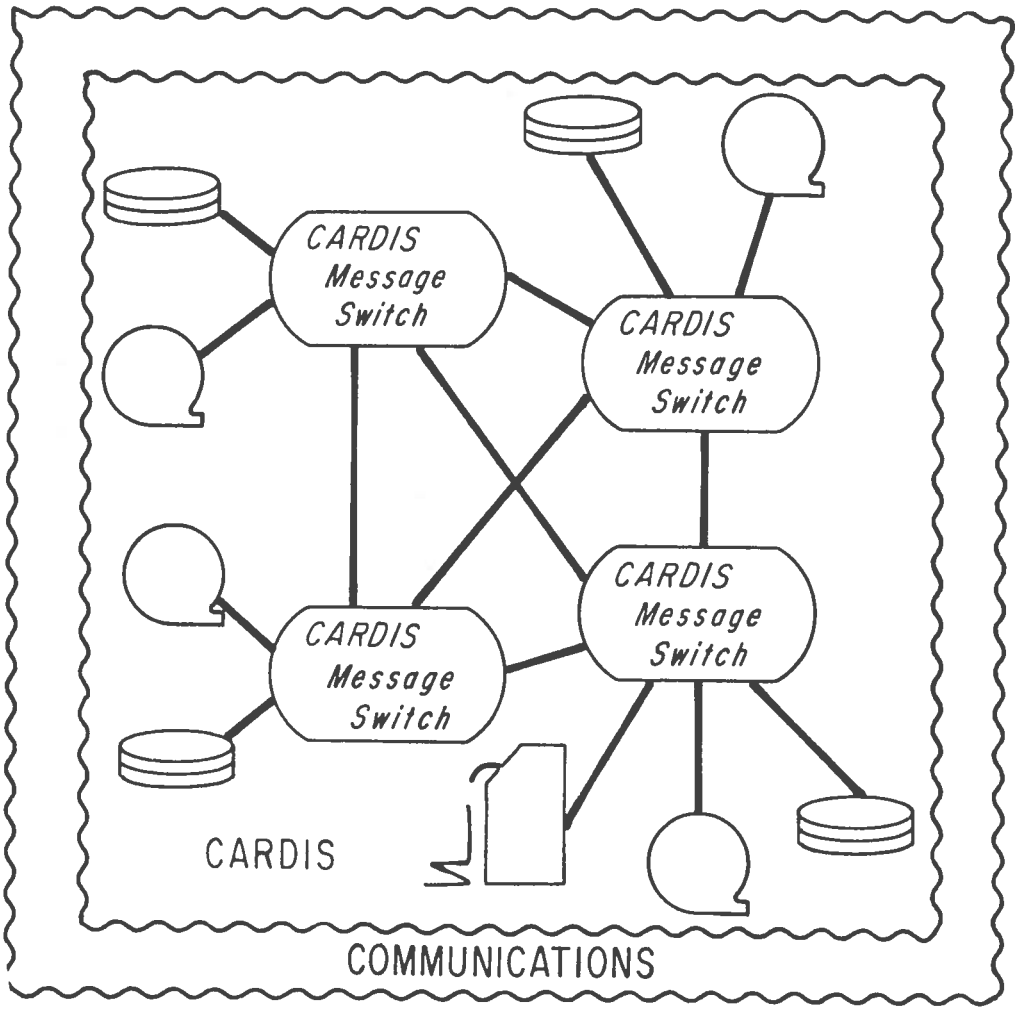
The accompanying figure suggests a number of CARDIS centers which serve as message switches to route data between users. The significant features will be the maintenance of directories which facilitate this data transfer by reference to sources and sinks within the shipping community. On-line storage is required for system message buffering and to maintain directory information. This could become quite large. If the concept is extended to include routing by shipment directory, file sizes and maintenance could assume the proportions of that necessary to retain the data itself; especially in view of the need to duplicate directory information at the switching centers.

Alternatively a directory could be kept at one of the CARDIS transfer centers for access in those cases where users need assistance in routing messages. This approach increases message traffic as a result of directory overhead.

Since there is no shipment data base in this concept, buffer storage and off-line storage are oriented toward routing directories and temporary message queues. The amount of storage required in both categories will depend on the number of switches in the system, the number and distribution of users and, of course, the amount of message traffic between users.

If the store and forward (along with directory and recordkeeping) functions are not required, then a value added network would suffice for CARDIS data interchange. Time zone changes and the need to queue messages for busy terminals, however, suggest that CARDIS message transfer offer true store and forward capability. CARDIS centers could then work as an adjunct to value added networks should this prove an economical approach for system users.

CARDIS DATA TRANSFER CONCEPT



3. CARDIS TRANSFER ALTERNATIVES
3.2 Data Transfer Concept

TOPIC 2 OPERATIONAL CHARACTERISTICS

In this concept, reliance must be placed on user systems to cooperatively provide some of the basic CARDIS features.

Data Accessibility

The data transfer concept does not provide for an accessible data base maintained by the system. Accordingly, in this alternative the data base exists in various forms at user facilities participating in CARDIS. Since various parties to a shipment are generally interested in selected portions of the data base (albeit with a degree of overlap) total information concerning a shipment does not exist at any location unless specific arrangements have been made (e.g., a shipper might retain a complete shipment file).

Dispersal of the data base makes inquiry somewhat difficult unless the inquiring party is able to direct his inquiry to the appropriate segment of the data base. Alternatively, complex directory procedures within CARDIS could route the inquiry message to an appropriate data base based on directories kept by reference to shipment. However, the maintenance of such directory information is complex--almost approaching that of maintaining a CARDIS data base. Also, duplicate directories are required unless shipment directories are maintained at one CARDIS node and accessed by each transaction directed to a specific shipment. This additional message requirement could be somewhat mitigated by resorting to directory assistance by exception--users entering destination routing for message traffic in most instances. This directory load is additional to normal directory functions associated with message switching systems.

Data Base Maintenance

To assure data base currency, it may be necessary within this concept to generate multiple messages to each of the data bases associated with a given shipment when updates to shipment status are generated. Again, this implies maintenance of a quite sophisticated directory including data access "need to know".

System security is of necessity limited to the assurance of message integrity and checks to determine that recipient and inquiry terminals are within the system roster. Individual user data systems must provide the critical software to assure appropriateness of inquiries and selective release and updating of data fields.

Quality of service (e.g., grade of service and message integrity) is a function of both the capability of CARDIS to handle traffic and that of the individual user systems to handle inquiries and updates. Accordingly, a degree of non-uniformity in response times may be anticipated depending on the specific user system operating in conjunction with CARDIS. Since format of messages need only comply

in signaling and codes with that of the Data Transfer CARDIS System, it is possible for user systems to establish quite individual protocols and formats. Customs and foreign system interchange data will, however, tend to enforce a degree of standardization.

Editing and other ancillary CARDIS aids to the user can be incorporated through each of the CARDIS nodes. This also implies a degree of standardization within the industry.

Shipping Documents and Data Generation

Required documentation would, for the most part, be produced in this system by messages sent from user to user and printed at the recipient facility. Should bulk printing facilities be desirable, messages may be sent to print facilities used for documentation preparation and envelope stuffing.

Audit Trail

Because of the difficulty in logging all messages, audit capability may have to be limited. It is possible for user systems to provide individual audit trails although much of the simplfication and accuracy desirable in CARDIS may suffer as a result. CARDIS audit of inquiries and updates implies maintenance and exercise of off-line data to validate shipment records and to assess user functions and propriety of inquiries. Monitoring of inquiry propriety can be accomplished by reference to logs of rejected inquiries (by inspecting "reject messages" as they traverse the system). However, monitoring of data base accuracy on currency is really only possible by user processing since such information does not exist within the system.

Foreign Systems Interface

CARDIS under this concept can assure appropriate communication protocol, data rate, and error performance with respect to foreign systems. Format and content of message addressed to foreign systems such as LACES, SOFIA, CLEAR, etc., will be a responsibility of the user system.

ACCESSIBILITY
- NO DATA BASE STORED AS SUCH
- QUERY CAPABILITY?
- ROUTING DIRECTORY
- SHIPMENT DIRECTORY?

SHIPPING DOCUMENTS & DATA GENERATION
- PRODUCED AS MESSAGES FROM USER TO PRINT FACILITY OR APPROPRIATE AGENCY

FOREIGN SYSTEM INTERFACE
- USER HAS DATA RESPONSIBILITY
- CARDIS AFFECTS COMM INTERFACE

DATA BASE MAINTENANCE
- MULTIPLE MESSAGE GENERATION
- ACCESSIBILITY TO USER DATA BASES
- SECURITY A USER FUNCTION
- GRADE OF SERVICE AND INTEGRITY ARE SHARED FUNCTIONS
- EDIT PROVIDED BY CARDIS

AUDIT TRAIL
- ALL MESSAGES LOGGED – A MONUMENTAL TASK

3. CARDIS CONCEPT ALTERNATIVES
3.3 Multiple CARDIS Concept

TOPIC 1 DESCRIPTION

The multiple CARDIS concept provides for a number of systems performing basic CARDIS functions.

The basic functions of CARDIS have been previously described. In this concept, flexibility in the development of CARDIS is achieved by incorporating the basic features of CARDIS into host systems designed for other applications within the cargo handling industry.

Referring to the figure, a system developed for use by a Port or industry group (banking, shipping, forwarding, etc.) may become "CARDIS RATED" by adding to its repertory of user services a set of basic CARDIS functions to be established and specified. These include basic Accessibility, Data Base Maintenance, Document Preparation, Audit and Interface characteristics specified to assure uniformity of service to the user community. Upon incorporation of these features, the system becomes entitled to CARDIS rating and is licensed to offer CARDIS services to users.

Where host systems do not exist, systems may be established to provide basic CARDIS functions (this may obtain in geographical areas or industries where automation for other cargo handling functions does not warrant the investment). Both CARDIS-rated and dedicated CARDIS systems will interface making the sum total of the data base available to all users for all systems with established need to know.

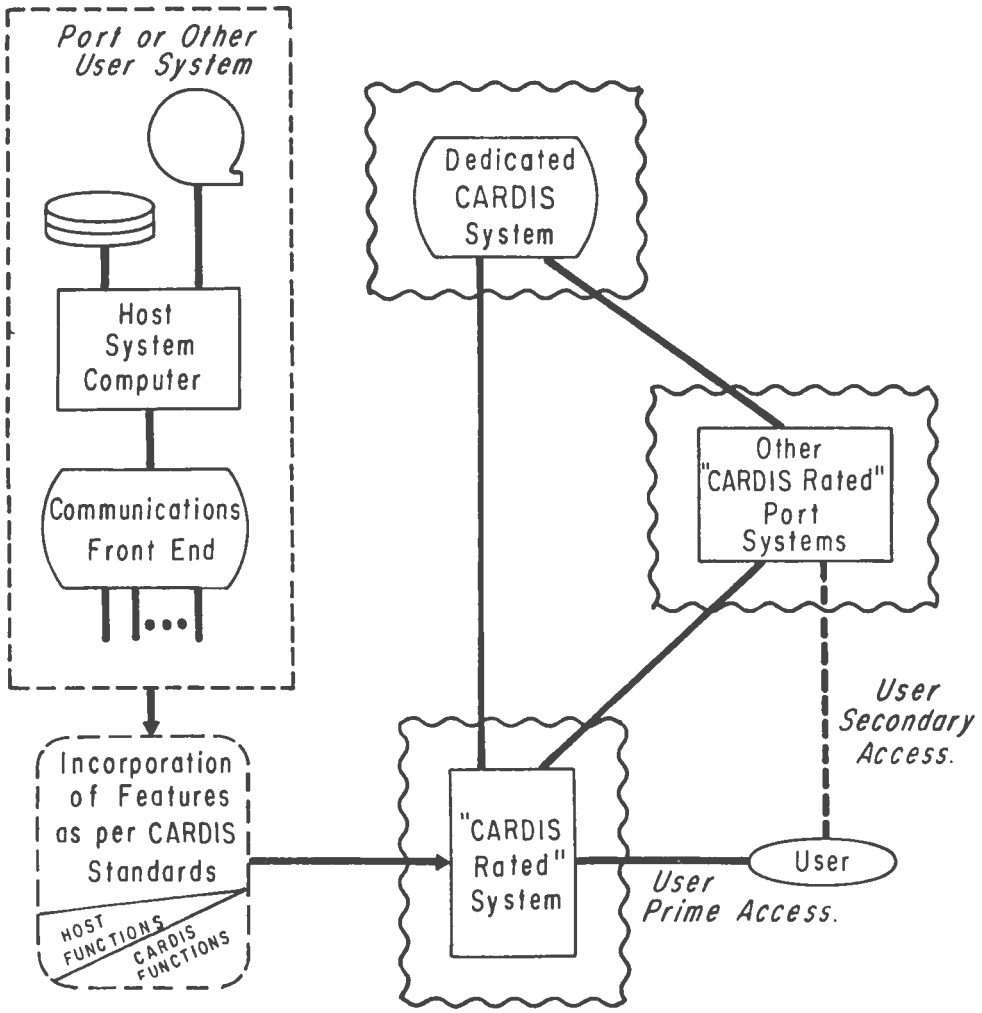
Under this concept users with access to one of the systems access the entire data base via inter-CARDIS links (provided, of course, that a "need to know" is established). The concept thus includes a significant message switching function as well as data base management. For large users it may be advantageous to maintain access to more than one CARDIS system to facilitate communication. Also, the multiple interface problem for foreign systems must be solved, perhaps by a CARDIS "clearing house" node to facilitate such interface.

This concept has the advantage of a dispersed development which can use hardware already in existence or planned for implementation to serve other functions of the shipping industry. Also, it provides for local control of the system which may find favor within elements of industry as well as regional authorities.

The difficulties with this concept are those of duplication of software to be developed and the multiple interfaces with foreign and other systems which must be maintained. The latter can be somewhat alleviated through development of a

set of standards for data formats and protocols. However, it will become difficult to incorporate changes to the system under conditions where a number of software packages must be updated. Uniform standards for coding and sharing software packages as is done in SOIS can provide some relief for this problem. Careful attention must be paid to the development as well as to interfaces to assure currency of CARDIS operation throughout the country.

MULTIPLE CARDIS CONCEPT



3. CARDIS CONCEPT ALTERNATIVES
3.3 Multiple CARDIS Concept

TOPIC 2 CARDIS RATING

CARDIS rating establishes uniform CARDIS functions provided by a diversity of government and industry association systems.

Under the concept of multiple CARDIS rated systems, it is proposed to develop a set of criteria and performance requirements for systems which, when implemented, entitle the system sponsor to offer CARDIS services to the industry at large. While a final determination of all such criteria is premature, a number of these are set forth as examples to be used in subsequent analysis.

Provide Essential CARDIS Functions

To become CARDIS rated, each system seeking the designation must provide basic features of ACCESS, data base maintenance, security and audit in accordance with established standards. This will assure that inquiries traversing systems, e.g., from one CARDIS system to another, can be presented in a specified manner and that users therefore have knowledge of what to expect.

Serves a Broad Community of Users

To achieve CARDIS rating, the services should be made available to multiple users within an area or other boundary criterion on a non-discriminatory basis. This will assure availability of CARDIS services to the industry at large.

Interface with Other CARDIS Rated Systems

The formats and codes for message interchange between CARDIS systems must be adhered to. A primary objective will be to make all CARDIS data available and each CARDIS rated system must facilitate this function with acceptable quality and grade of service.

Foreign System Interface

CARDIS rating will imply interface with a specified roster of foreign systems. This list will expand as automation is brought to the shipping industries of foreign powers. Similarly, industry and port systems which are not CARDIS rated but do represent a significant impact on trade must be accommodated.

Accounting and Billing

Uniformity of these procedures will assure fairness to users and minimize preferential or unfair practice throughout the industry.

Security and Reporting Audit

Procedures for security must be stipulated to assure data base integrity and protection of user information. Audit of user access is important to make sure that terminals are not being used in an attempt to gain unauthorized information from the system.

CARDIS RATED

- PROVIDES ESSENTIAL CARDIS SERVICES
  - ACCESS
    - DATA BASE MAINTENANCE
      - SECURITY
        - AUDIT
- SERVES A BROAD COMMUNITY OF USERS
- INTERFACES WITH OTHER "CARDIS RATED" SYSTEMS
  - APPROVED COMMUNICATIONS FORMATS
    - STANDARD CODES
- INTERFACES WITH OTHER FOREIGN AND INDUSTRY SYSTEMS
- ACCEPTABLE ACCOUNTING AND BILLING PROCEDURES
- ACCEPTABLE AUDIT PROCEDURES FOR SECURITY COMPLIANCE AND REPORTING

TOPIC 3 OPERATIONAL CHARACTERISTICS

Operational characteristics for the multiple CARDIS concept are similar to those encountered in the unified data base concept. Dispersal of the data base requires the addition of suitable message switching and interchange characteristics.

Accessibility

Although in this concept the data base is dispersed amongst a number of systems, data for each shipment exists as a complete record at a specified point in the system. Under normal system operation, it is to be expected that the data will be in a CARDIS system to which the majority of parties to that shipment have primary access. Inter-CARDIS data access would then be by exception serving to minimize data flow between systems.

Data Base Maintenance

Under the concept of CARDIS rating, procedures are standard with the result that all CARDIS data bases are maintained to system standards in accordance with established principles. Security for access and change will be a responsibility of the system to which the transaction is addressed.

Shipping Documents and Data Generation

These are provided in a similar manner as for the Unified Data Base Concept with the exception that each CARDIS will probably serve as a bulk preparation center.

Audit Trail

Each CARDIS rated system will provide audit trails in accordance with established CARDIS standards.

Foreign System Interface

Each CARDIS rated system under this concept maintains a repertory of foreign system interface software along with procedures for access via communication lines or other digital data transfer facilities. Agreement with respect to a foreign CARDIS hub for data interchange can greatly facilitate the foreign data transfer process and may serve as a method for presenting uniform CARDIS interface to overseas systems and users.

ACCESSIBILITY

- DATA BASE DISPERSED AMONG SYSTEMS
- SHIPMENT DATA IN ONE DATA BASE
- USER ACCESS VIA COMM NETWORK TO HOST DATA BASE PRIMARILY
- INTER CARDIS DATA ACCESS BY EXCEPTION
- ON-LINE AND OFF-LINE ACCESS PROVIDED

DATA BASE MAINTENANCE

- SAME AS FOR DATA BASE CONCEPT
- SECURITY RESPONSIBILITY OF INDIVIDUAL CENTERS
- INTERCONNECTION OF CENTERS

SHIPPING DOCUMENTS & DATA GENERATION

- SAME AS FOR DATA BASE CONCEPT

AUDIT TRAIL

- AUDIT PROVIDED BY EACH "CARDIS RATED" SYSTEM

FOREIGN SYSTEM INTERFACE

- ACCOMPLISHED INDIVIDUALLY VIA COMM LINES OR DDD. FOREIGN CLEARING HOUSES TO SERVE MULTIPLE CARDIS SYSTEMS ARE AN ALTERNATE POSSIBILITY.

3. CARDIS CONCEPT ALTERNATIVES
3.4 Message Transfer Option

TOPIC 1 POTENTIAL MESSAGE SWITCHING CAPABILITY

Both the Unified Data Base Concept and the Multiple CARDIS Concept have the potential to provide a message transfer service.

The Data Transfer Concept previously described considers CARDIS as basically a message switching network providing directory and routing capabilities. This allows shipment data maintained by users to be transferred as required without the system maintaining a data base of its own. The other two concepts accomplish the data interchange function by having users enter shipment information into one or more data bases where it is accessible to other users. In either of the data base oriented concept alternatives, a message transfer capability may be incorporated as an optional feature--optional because it may or may not be incorporated into individual CARDIS centers, and because even if available its use would be a matter of user choice.

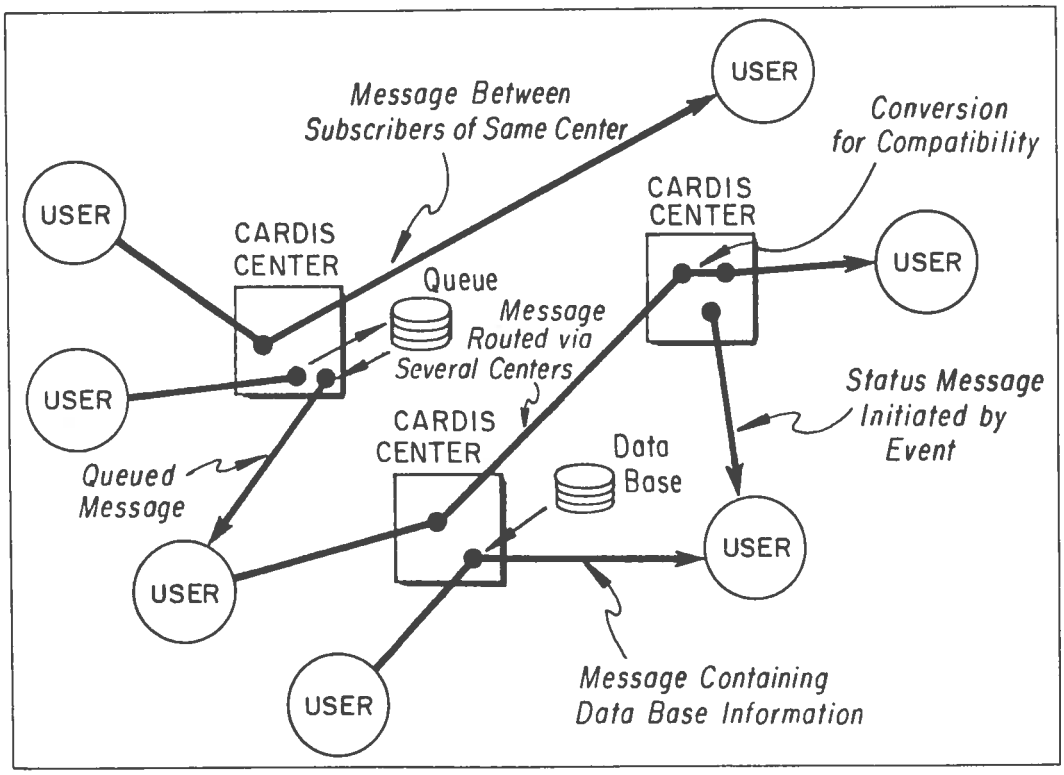
With the Message Transfer service a user could send shipment data (or any other information) via CARDIS without any editing, storage, or processing by the system. Since both addressor and addressee participate in CARDIS, the system has the required communications information such as terminal address, routing data, line speed, and protocol requirements, etc. Therefore CARDIS can also serve as an intelligent interface between users with dissimilar equipment or communications facilities by making the necessary conversions to achieve compatibility.

Several types of operation are possible with the message transfer capability, including:

- exchange of messages between subscribers of a single CARDIS center.
- routing of messages via several CARDIS centers when addressee is not a user of the same center as the originator.
- inclusion of selected data base information in messages.
- queuing of messages until addressee is ready to accept them.
- conversions necessary for communications compatibility.
- transmit status messages when specified conditions are met (e.g., shipment is received by carrier).

Tie in to the CARDIS system is possible using direct communications or through a value added network. The full store and forward capability of CARDIS augments the basic message forwarding capability to be offered by value added networks.

TYPICAL MESSAGE TRANSFER



4. INTERFACE CONSIDERATIONS

4.1 User Interface

TOPIC 1 USER SOPHISTICATION VARIES WIDELY

CARDIS will provide for interface with a wide spectrum of users which vary greatly in sophistication and requirements.

In addition to the seller and buyer of goods (the shipper/exporter and consignee) and the organizations that move the goods from one to the other (truckers, railroads, ocean carriers, airlines, etc.), CARDIS will serve parties who make various arrangements for shipments, provide insurance coverage and financing, or act as agents for the other parties involved. Government agencies involved in import/export control or reporting functions will also be users of CARDIS.

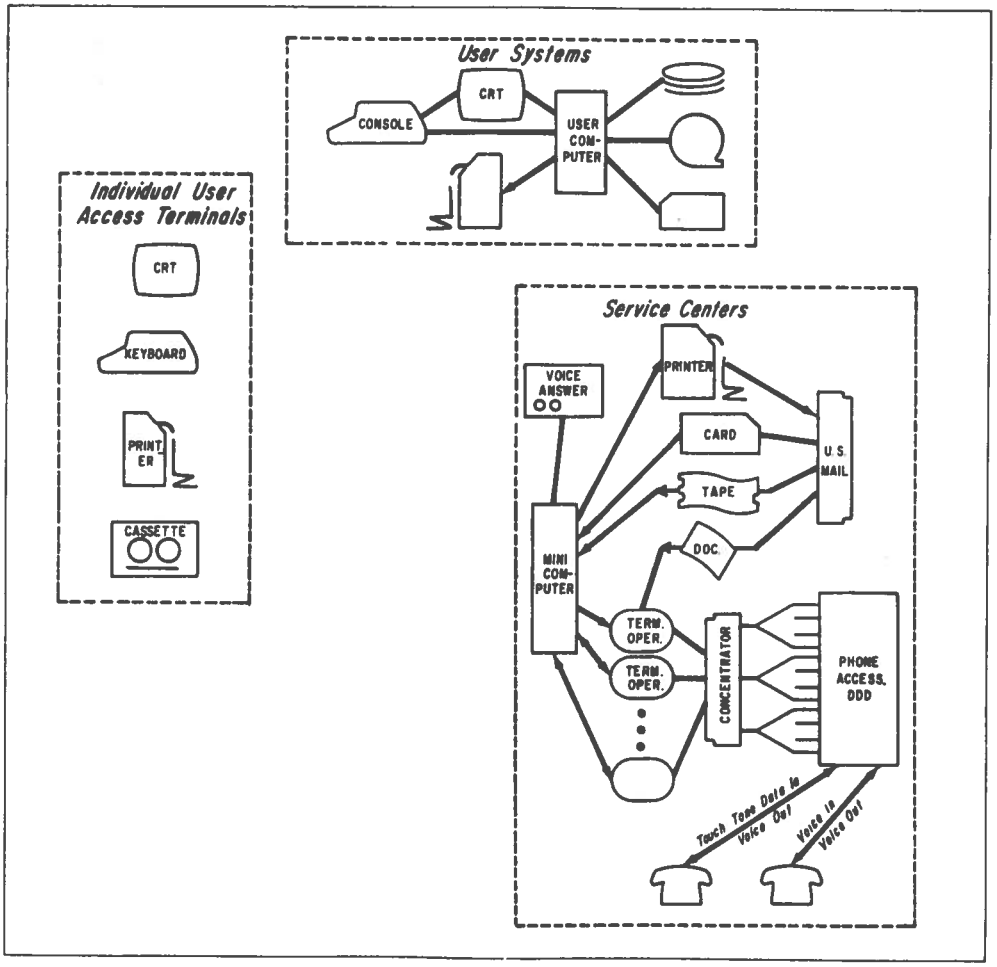
The wide variety and large number of potential CARDIS users represent needs and capabilities which vary greatly. This is due to their different roles, the size variation even among similar organizations, and the scope of functions performed which depends on shipment requirements and mutual agreements. Therefore, the requirements and methods used to interface with CARDIS will be dissimilar from user to user.

As a result CARDIS must be able to accept input data and retrieval requests from a wide range of equipment including keyboard/printers; CRTs; tape and disk oriented data entry systems; magnetic, paper, and cassette tape devices; and various size computer systems. This variety of user interface will accommodate the multiplicity of users and assure that presently installed user hardware will not be excluded by CARDIS. In this way, users will have sufficient latitude to select the appropriate interface equipment based on their specific requirements and cost considerations.

In addition it must be recognized that, especially in the early evolution of CARDIS, many participants in international trade cannot justify the cost of direct access to the system. CARDIS must include provisions for interchanging data with these parties so that users may continue to effectively transact business with them. This may be done by providing printed outputs in the form of messages and shipping documents which are useful to these parties. Similarly, inputs from such parties must be accommodated so that data on shipments in which they participate will be complete. One approach is for CARDIS users participating in a shipment to provide interface with other parties to the shipment without access capabilities. For example, freight forwarders may act on behalf of shippers in this regard as well as in their conventional capacity.

Another user interface that could be provided is a service center. This facility would contain terminal equipment for CARDIS interface installed and operated by center personnel. Shipment participants without equipment of their own interface with CARDIS by phoning a service center to have an operator make inquiries or inputs. The centers also accept mail inputs in the form of documents or automated media (i.e., cards, magnetic tape, etc.) and provide outputs in similar forms. They will also offer CARDIS users with limited interface equipment a means for handling workload peaks, and be a convenient facility for accepting bulk input data and producing printouts for documents and statistical reports. Such service centers could be operated as CARDIS facilities or developed and run by commercial establishments. Freight forwarding companies are the logical parties to provide this service to users.

CARDIS USERS



4. INTERFACE CONSIDERATIONS

4.1 User Interface

TOPIC 2 USER CRITERIA/RESPONSIBILITIES

To participate in CARDIS all users must comply with established standards, operational procedures, reporting requirements, and security provisions.

While CARDIS will accommodate many users and interface with a variety of equipment types, it is incumbent on those users to meet and maintain established criteria for effective use of the system. Just as the system will have responsibility to the user to maintain and provide access to data, the user has the responsibility to conform to the standards and procedures which will govern operations. Some of the basic areas in which such conformity is required are codes, communications, reporting and security.

The value of coding for identifying commodities, organizations, and geographical locations is well established. The benefits that codes offer include reduced storage requirements, improved communications efficiency, and standardization. To interface with CARDIS, users must conform with established coding systems selected for CARDIS. Similarly, conventions for identifying shipments and interacting with system processing functions must be followed.

In the area of communications there are many potential interface arrangements that could be adopted. A selected set will be included in the CARDIS design to accommodate a broad community of users. It will be the responsibility of individual users to conform to established protocols (e.g., half-duplex, full-duplex, signaling, transmission speeds, etc.), data transmission codes (e.g., ASCII, EBCDIC, etc.), and message formats to communicate with the system.

The usefulness of CARDIS is directly related to the completeness and timeliness of the data it makes available to users. Of course, the users are also the source of the data and therefore must accept responsibility for entering shipment data in a timely and accurate manner to assure that current shipment status is reflected in the system.

Security is another aspect of the system in which the user must meet certain standards. CARDIS will incorporate specific features to protect the data stored and transmitted in the system. The user in turn will have responsibility for control and utilization of his interface facilities in a manner consistent with system-wide security and privacy. For example, measures must be taken to prevent (as far as possible) intentional or accidental security violations on the part of user staff personnel with access to the system. This implies careful

control of user codes, passwords, access to terminals, hardcopy outputs and other elements attendant to using CARDIS. Both procedural and physical security measures will be necessary in this regard. CARDIS audits will be conducted to monitor system usage for protection against unauthorized access.

USER CRITERIA FOR CARDIS INTERFACE

- CODES
  - COMMODITY CODES
  - DUN'S NO. OR OTHER PARTY IDENTIFIER
  - LOCATION CODES
  - SHIPMENT NUMBERING CONVENTION
- COMM INTERFACE
  - ONE OF ACCEPTABLE INTERFACES
    - PROTOCOL
    - CODE
    - FORMAT
- REPORTING RESPONSIBILITY
  - TIMELY PROVISION OF SHIPMENT STATUS TO DATA BASE
- SECURITY PROVISIONS
  - ACCEPTABLE NOS. OF IMPROPER INQUIRIES
  - PHYSICAL SECURITY PROCEDURES

4. INTERFACE CONSIDERATIONS
4.2 Interface with other Systems

TOPIC 1 FOREIGN AND OTHER SYSTEM INTERFACES – OVERVIEW

CARDIS will communicate with other computer-based systems both domestically and in other countries.

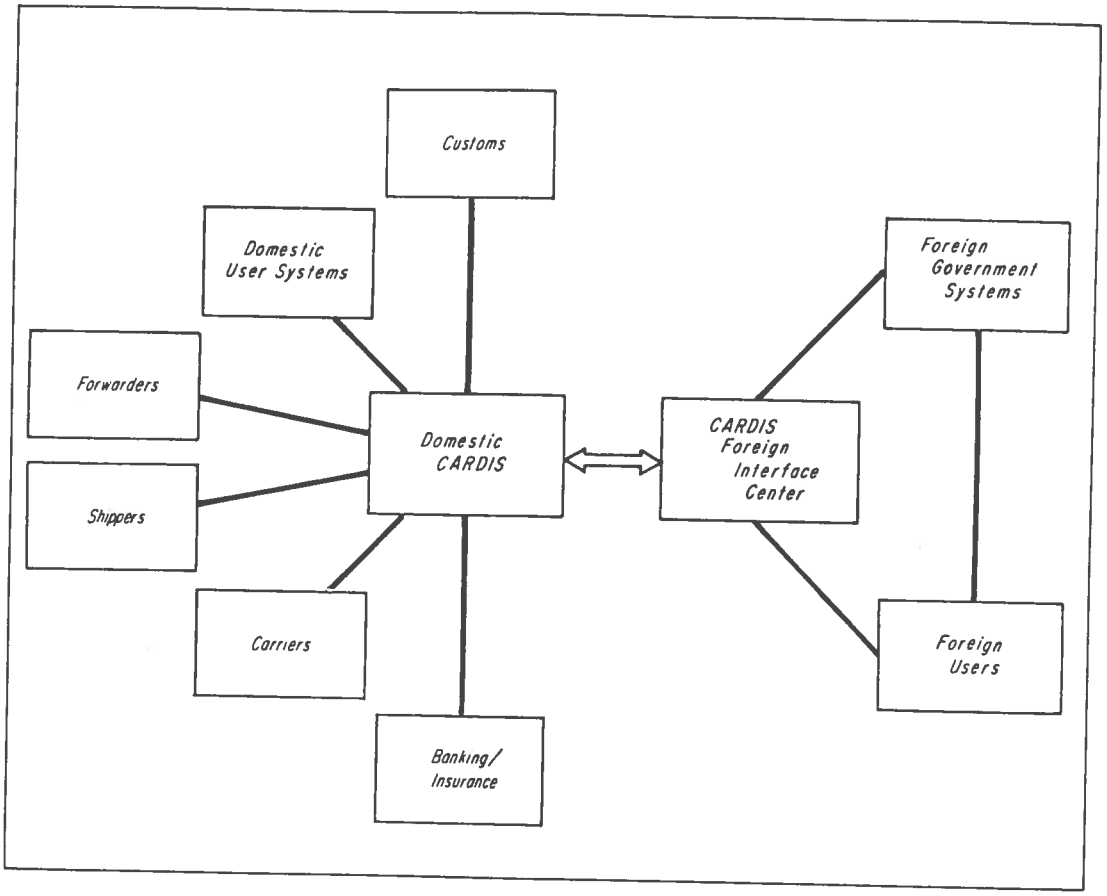
Within the potential CARDIS-user community are many companies with data processing systems to support their activities. These range from simple business systems performing conventional accounting and administrative functions to complex computer networks interconnecting various segments of corporations in support of both administrative and operational requirements. In some systems, information relating to shipment documentation is maintained in conjunction with other corporate information.

Where such systems exist or are being developed, significant advantages are possible by providing means for CARDIS interface. Manual preparation and entry of data will be reduced, accuracy and speed increased, and the timeliness of information available to both CARDIS and user systems improved. It is important to stress that the system interface contemplated is one which concentrates on each system complementing the other rather than one in which functions are shared or duplicated. User systems will continue to perform their application functions but will receive needed data from CARDIS and supply CARDIS inputs.

To achieve such interfaces, standards for coding, message formats, communications protocol, etc., will have to be established and implemented both in CARDIS and by user systems. This may require special conversion equipment and/or software on the part of the users, especially in view of the variety of hardware in these systems which may not be directly compatible with CARDIS equipment.

Similar considerations apply to interfaces with foreign systems, both user systems and government systems such as LACES, Clear/Inspect, etc. One approach establishes CARDIS Interface Centers in selected foreign countries to act as intermediaries between CARDIS and foreign elements. Such centers designed for conventional interface with domestic CARDIS would incorporate special provisions for interfacing with its foreign counterparts. These interfaces may be via direct connections (i.e., data communications) if circumstances warrant, or by producing hardcopy in appropriate formats and supplying it to user or government systems. These centers would also serve as a means of entering data from foreign sources into CARDIS either directly or via manual interface.

CARDIS SYSTEM INTERFACES



4. INTERFACE CONSIDERATIONS
4.2 Interface with other Systems

TOPIC 2 FOREIGN SYSTEM INTERFACE OPTIONS

The CARDIS capability established in the United States will be but one of a series of similar systems throughout the world with which interface is inevitable. Three possible approaches for establishing such interfaces have been identified.

The benefits of being able to interchange data on international shipments with foreign counterparts of CARDIS (such as those under consideration by SITPRO in the United Kingdom and COSTPRO in Canada) as well as with systems whose functions are related to CARDIS (such as IATA's CART and Heathrow Airport's LACES) are self-evident. The methods for accomplishing the interface are not as apparent because CARDIS and many of the foreign systems are at varying stages of planning and development. Generally, the technical aspects of system interfacing have been neglected although the value of such interfaces is recognized.

On the surface it would appear that the establishment of completely automated interfaces would offer the best means of interchange data with foreign systems. However, considering the unequal levels of development among the systems, the dissimilarities in the functions the systems are intended to fulfill, and the lack of comprehensive universal standards for coding, communications, procedures, etc., it is apparent that semiautomated interface arrangements will be necessary at least in the early operational stages. Therefore, the options under consideration provide for monitoring of the interface by an operator who will be able to intervene as required to make necessary inputs. The approach will permit communication with foreign systems even if all technical aspects are not sufficiently advanced to allow truly automated interchange.

The interface methods shown the the page opposite are:

Electronic Interface

In this arrangement a communications front-end processor would accept data transmitted from CARDIS via international communications and perform the necessary data and communications conversions to achieve compatibility with the foreign system. The front-end processor would then pass the information to the foreign system where an operator would add any necessary control parameters, authorization codes, and other inputs. The operator would also participate in correcting data errors detected by the system and reconciling other problems that may be encountered.

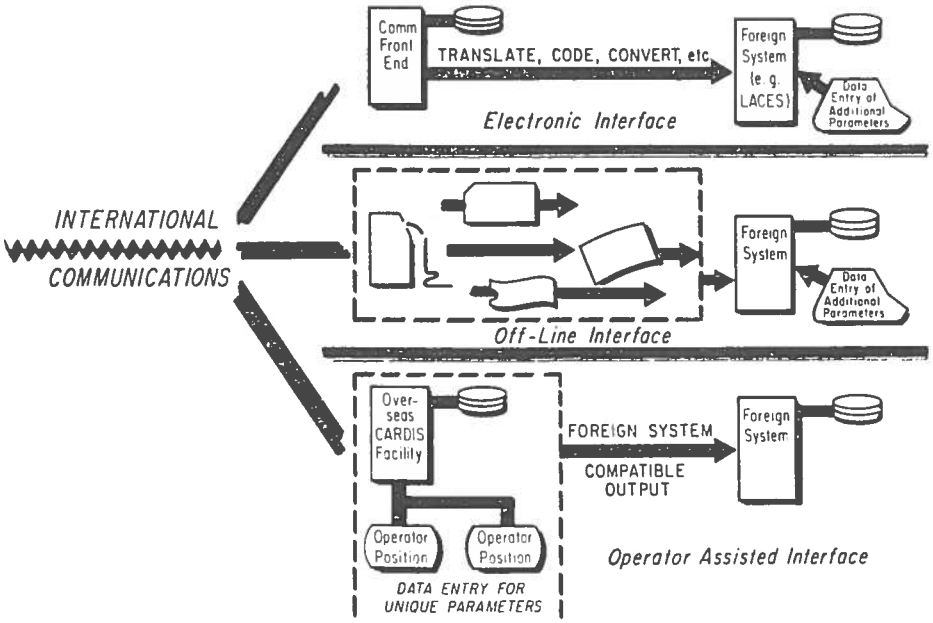
Off-Line Interface

In this interface option, data transmitted by CARDIS will be produced in ADP form such as punched cards, magnetic tape, paper tape, etc., or in hardcopy form. The appropriate means will then be used to enter the data into the foreign system with similar operator participation as outlined above. An essential difference is that there is no direct connection between the communications facilities and the foreign system. Instead the data is received off line, perhaps at a remote location, and entered into the system using peripheral devices such as tape readers, keyboards, or card readers rather than via communication lines. Therefore, communications compatibility with the foreign system is not required and data conversions may be performed off line.

Operator-Assisted Interface

This alternative employs an overseas CARDIS facility as the recipient of data intended for a foreign system. This facility will be compatible in all respects with CARDIS and would have the capability of performing necessary conversions to achieve compatibility with the foreign system. In this instance required operator intervention is performed at the CARDIS facility rather than at the foreign system. The overseas CARDIS facility functions in a similar manner as the communications front-end processor described above (in addition to providing conventional CARDIS functions) and effectively appears as a user to the foreign system.

CARDIS FOREIGN SYSTEM INTERFACE OPTIONS



4. INTERFACE CONSIDERATIONS
4.3 Interface with Foreign Parties

TOPIC 1 OVERSEAS USER INTERFACE OPTIONS

To accommodate the total information interchange requirement for international shipments, overseas parties must have access to CARDIS. Several options are presented for foreign parties to interface with CARDIS.

Just as the domestic elements of CARDIS will serve a wide variety of users, so the various overseas parties to shipments must be considered to achieve the full potential of the system. These may include shippers and consignees (for imports and exports, respectively), agents for any other party, overseas offices of U.S. companies (especially shippers and carriers), and others. Convenient means of interfacing with CARDIS will encourage fuller participation and increase the benefits to all concerned.

The illustration on the facing page presents four methods for providing the overseas user interface to CARDIS. International communications will consist of satellite links or oceanic cable between the domestic CARDIS network and the Post, Telephone and Telegraph (PTT) agencies which serve foreign users.

The methods depicted are:

Direct Communication

A foreign party may communicate directly with a domestic user of CARDIS who in turn provides access to the system via his terminal or computer installation. This is a practical arrangement when communications already exist between the domestic and overseas parties as in the case of branches of the same company. Another form of direct communications is for the foreign party to establish a direct connection with a domestic CARDIS facility using international telecommunications to access the system in much the same way as a domestic user would. The use of direct communications is cost-effective in cases of low demand and when existing communications facilities are able to support the added requirements with little or no cost increase.

Overseas CARDIS Facility

This approach is based on establishing dedicated CARDIS facilities overseas as counterparts of domestic CARDIS facilities. The overseas installations would offer standard CARDIS services to foreign users and also provide an interface with foreign systems. These facilities would be connected via telecommunications channels to domestic CARDIS, thereby providing access by foreign users to domestic elements of the system and offering a means for sharing international communications expenses.

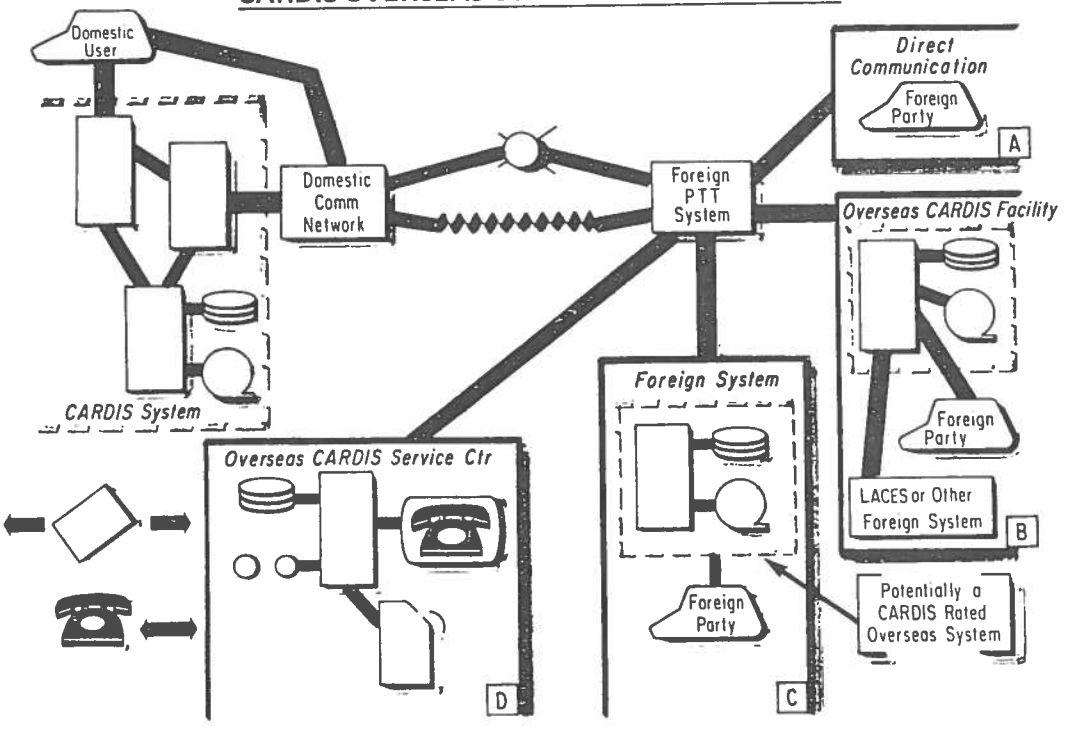
Foreign Systems

Government and industry systems to handle international cargo are becoming more and more prevalent overseas. Users of these systems need to exchange information with users of CARDIS and therefore are also potential CARDIS users. By establishing interfaces between these foreign systems and CARDIS, they can serve as the vehicle for foreign parties to be connected to CARDIS. Such systems, in addition to providing their regular services, would also handle the transfer of information to CARDIS according to established standards and would be analogous to "CARDIS Rated" systems previously described. This approach also eliminates the need for individual users to establish direct communications with domestic CARDIS.

Overseas CARDIS Service Centers

Centers with the appropriate terminals and other equipment operated by trained personnel offer another means for foreign parties to interface with CARDIS. Via phone or mail, these parties submit inputs and inquiries to center operators who make the necessary entries to CARDIS on their behalf. Outputs received at the center are relayed to the users in the same way. This approach is another means of sharing communications costs and also makes CARDIS accessible without requiring users to acquire terminal equipment.

CARDIS OVERSEAS USER INTERFACE OPTIONS



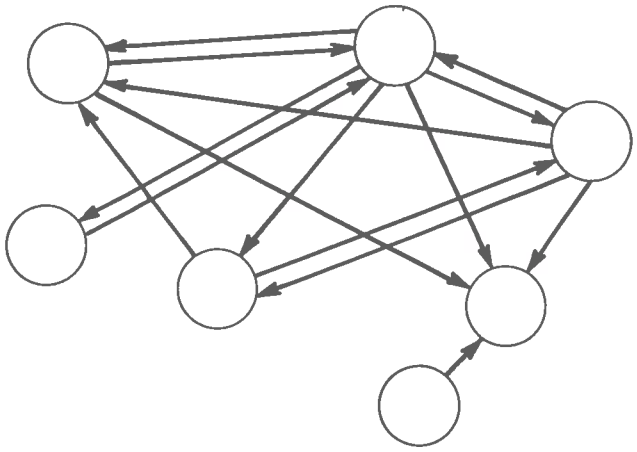
5. CARDIS INFORMATION FLOW

5.1 General System Flow

TOPIC 1 DATA FLOW BETWEEN USERS

The flow of shipment data in CARDIS is between users and the system rather than from one party to a shipment directly to another.

Conventionally, the interchange of shipment information is bilateral between the parties involved, often via phone calls and the transfer of elaborate, manually prepared documents. Direct contact is made on a one-to-one basis (via mail, phone, messenger, teletype, etc.) whenever shipment data must be conveyed. Thus, when the same information must be provided to more than one recipient, it is necessary to produce and transmit it separately to each.



CONVENTIONAL INFORMATION FLOWS

The CARDIS approach replaces this environment with a system for simplifying and improving data interchange. Each originator of data enters the required information into CARDIS and from this one entry all other parties may obtain access to it in whole or in part, when it is needed, in the form it is needed. Rather than having data flow from one party to each other party separately, the flow will be from the originator to CARDIS and from CARDIS selectively to each recipient. Needless redundancy is eliminated since the data is produced only once and only pertinent aspects of the data are provided to each receiving party. *

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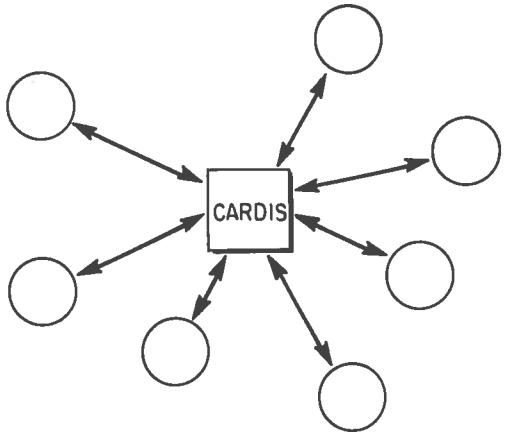
*For the data transfer approach to CARDIS implementation, users direct specific information rather than utilize data storage features. However, CARDIS acting as an intelligent message switch still provides a single point of entry and provides routing capability.



CARDIS DATA FLOW

CARDIS serves as an intermediary in the interchange of information between parties, acting not only as an interface point but also providing such services as:

- checking input data for correctness and completeness
- selectively limiting dissemination of data to those with a valid interest
- accepting data in a form convenient to the originator and providing it in a form convenient to the recipient
- providing for updating or correction of previously entered data
- responding to specific inquiries
- producing standardized documents

Typically, the shipper/exporter or a freight forwarder acting in his behalf will enter the basic data about a shipment. Other parties will access appropriate portions of this information which are needed to perform their functions. Each will enter additional data to complete the initial information, correct errors, and indicate status. The system will engage in a series of transactions with its users to provide these functions.

The general information flow between CARDIS and its users is outlined above. The flows involved within the system for the major user transactions are presented in the remainder of this section. The flow charts are intended to indicate, in a general way, how each transaction is conducted. The final specification of these and all other system functions will depend on the selected concept and subsequent detailed system design work. The logic presented, and the devices and files shown, merely illustrates a typical flow of information in the system. Many other possibilities exist and must be considered during system definition.

5. CARDIS INFORMATION FLOW
5.2 Typical Transaction Flows

TOPIC 1 SIGN ON

To conduct any interchange with CARDIS a user must first identify himself and the system must recognize him and determine if he is authorized for the data and functions requested. This is accomplished by the SIGN-ON transaction which is a basic system security element.

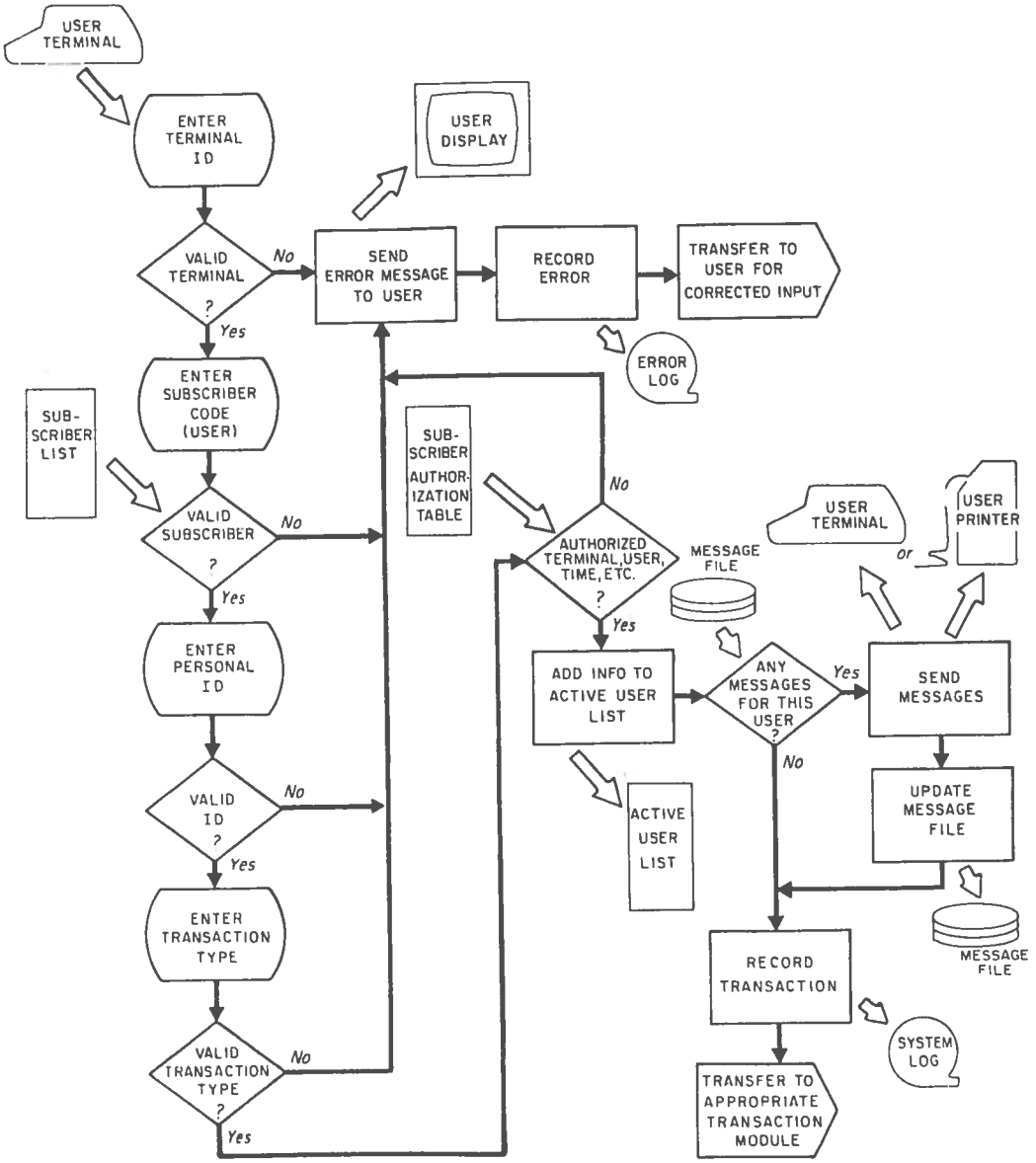
Each time a user establishes a communications connection with CARDIS his terminal must be identified (by a hardwired or keyed-in code), his subscriber code inserted (by key-in, magnetic card, etc.), and his personal identity entered. These are checked by the system and if any are not valid this is indicated to the user and no further transactions are permitted until valid identification information is supplied.

If accepted, the user indicates the type of transaction he wishes to conduct (such as data entry, report production, etc.) and the system determines if he is authorized to perform that function. When these initial checks are completed, the user is added to the "active" list. Assuming that the system has a message transfer capability, any messages stored for delivery to this user will be transmitted to him.

This completes the SIGN-ON procedure and the user may go on to other transactions. At the completion of each transaction the system will record the necessary control information in the System Log or in the Error Log if the user was rejected or the transaction was incomplete for any reason.

The flow shown is basic. Other features, such as timeouts to prevent inadvertently active terminals, are possible by suitable software in CARDIS communication processors. Sign-on and Sign-off disciplines are basic to accountability and must be carefully specified during system design.

SIGN–ON TRANSACTION FLOW



5. CARDIS INFORMATION FLOW
5.2 Typical Transaction Flows

TOPIC 2 DATA ENTRY

Usually the first CARDIS function for a shipment will be to input the basic shipment information. This will be accomplished by the DATA ENTRY transaction.

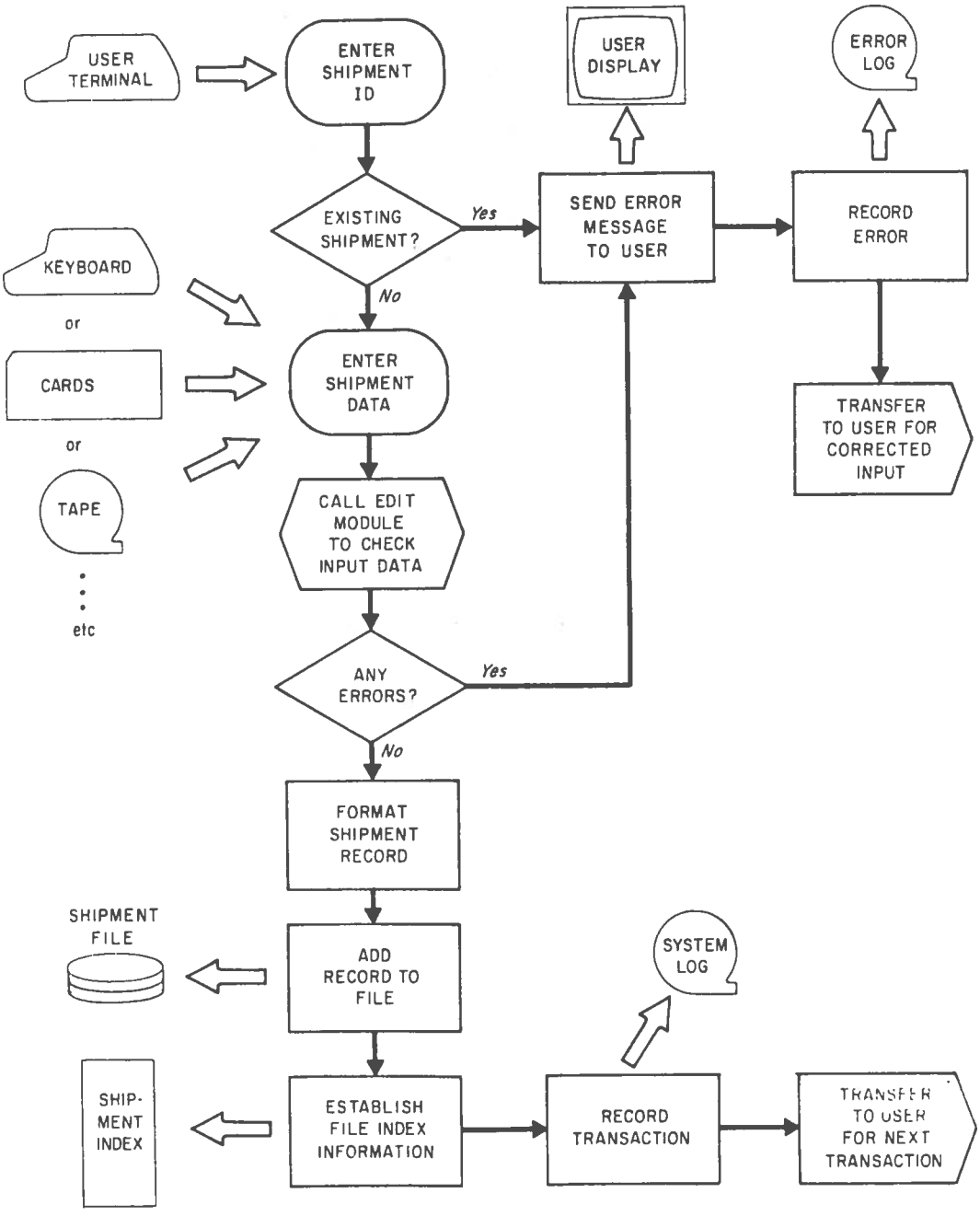
The shipper or freight forwarder will normally enter shipment data using a keyboard type terminal or other input media such as cards or tape. He will identify the shipment and supply the necessary data items which will be edited by the system. The data will be used to generate a shipment record which will be added to the file with appropriate entries made to the index for use in subsequent access to the data.

If errors are detected in the data, diagnostic messages will be sent to the user so that corrections can be made. Appropriate log entries are made at the conclusion of the transaction.

In the case of many (more sophisticated) users, the initial data entry will be performed off line, either by entry to user data management systems or by use of key-to-tape or miniprocessor-based systems. In this case entry can be batched with error indication provided as a return indication of all entry errors at once.

Where on-line data entry is used, the system will provide operator aids such as masks for data entry. Initial editing is performed by front-end processors for format integrity. The shipment record once completed can then undergo more sophisticated checks for consistency of content.

DATA ENTRY TRANSACTION FLOW



5. CARDIS INFORMATION FLOW
5.2 Typical Transaction Flows

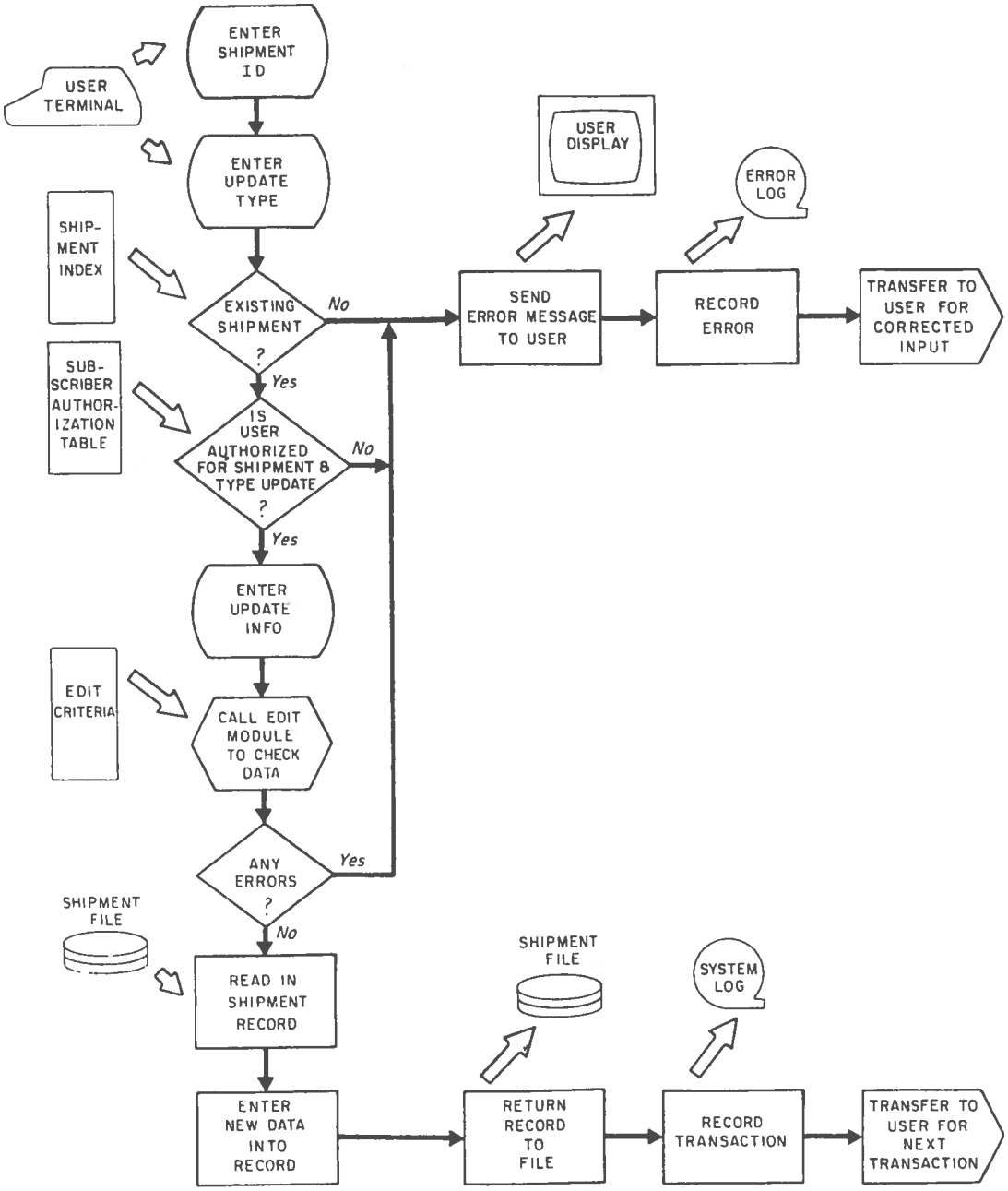
TOPIC 3 DATA UPDATE

During the life of a shipment it will be necessary to add new data, correct errors, enter status information, or delete previous entries. These functions will be performed by the DATA UPDATE transaction.

To update shipment data, a user must identify the shipment and the type update to be made. The system will determine if the user is authorized to make the requested changes to the shipment specified, edit any new data entered to assure that it is correct, and modify the system files accordingly.

If the user is not authorized for the shipment or function requested, or if there are errors in input data, the transaction will be rejected and the user given the opportunity to make necessary corrections.

DATA UPDATE TRANSACTION



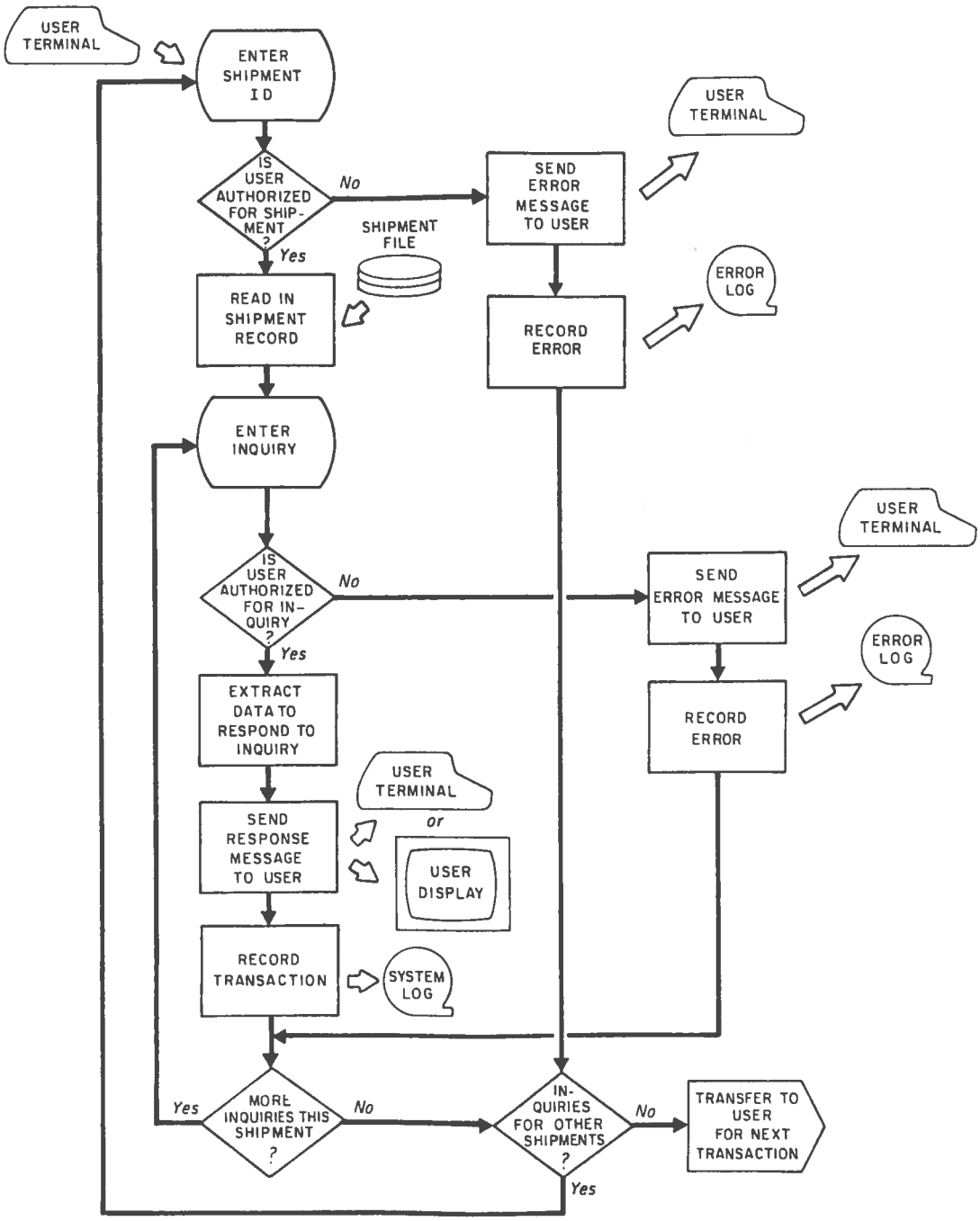
TOPIC 4 INQUIRY

This transaction provides the CARDIS user with a means for accessing shipment data interactively and selectively.

To obtain previously entered data about a shipment in which he has a valid interest, the user must first identify the shipment and then indicate the information required. The system will verify that he is entitled to access that shipment and authorized to obtain the specific data elements selected. If so, the required data is retrieved and transmitted to the appropriate user terminal printer or display. Using this transaction a series of inquiries may be made concerning a single shipment or additional shipments may be selected for further retrieval.

The interaction between user and system will be conversationally oriented with a dialogue conducted to assist the user in selection of the required information. This will be accomplished by the system posing a sequence of prompting type questions to guide the user in formulating his inquiry. Any errors made by the user will be brought to his attention and the system will assist him in making corrections by describing the error and suggesting alternative entries.

INQUIRY TRANSACTION FLOW



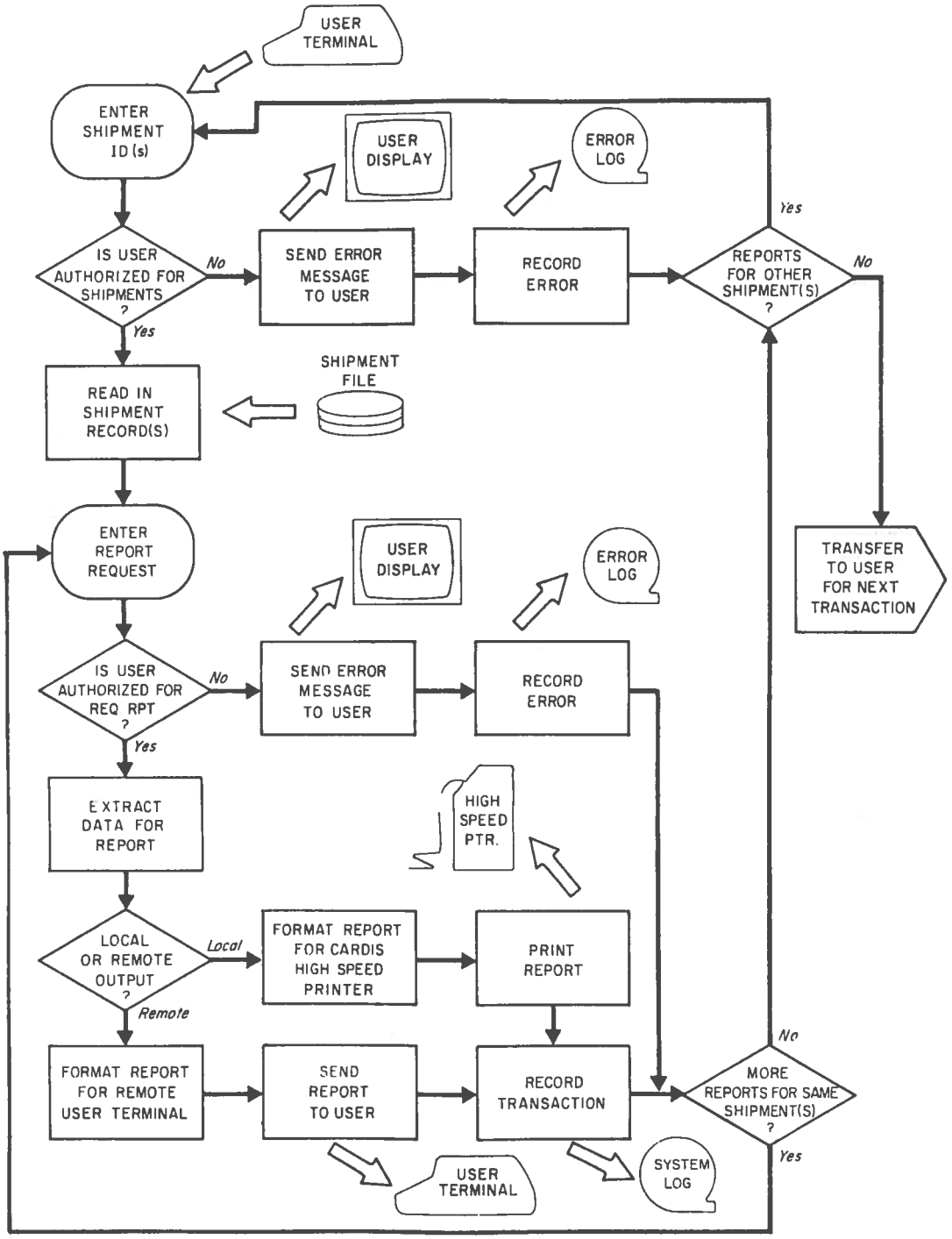
TOPIC 5 REPORT REQUEST

CARDIS users will be able to obtain standard shipping documents in addition to statistical reports and management summaries via the REPORT REQUEST transaction.

This transaction will control the production of hard copy documents and reports. By selecting an individual shipment or several shipments, and specifying the type of output to be produced, the user will have an automated means of generating required documentation. The production of the output may be accomplished at a CARDIS facility high speed printer, at a terminal or printer at the user's site, or may be directed to a third party. In this way shipping documents may be delivered as well as generated automatically.

The system will make the necessary authorization checks, retrieve the required data, and compose the appropriate format for the document requested. In some cases it may be preferable to generate the output in other than hard copy form such as for summary reports to customs which are often submitted on magnetic tape.

REPORT REQUEST TRANSACTION



TOPIC 6 MESSAGE TRANSFER

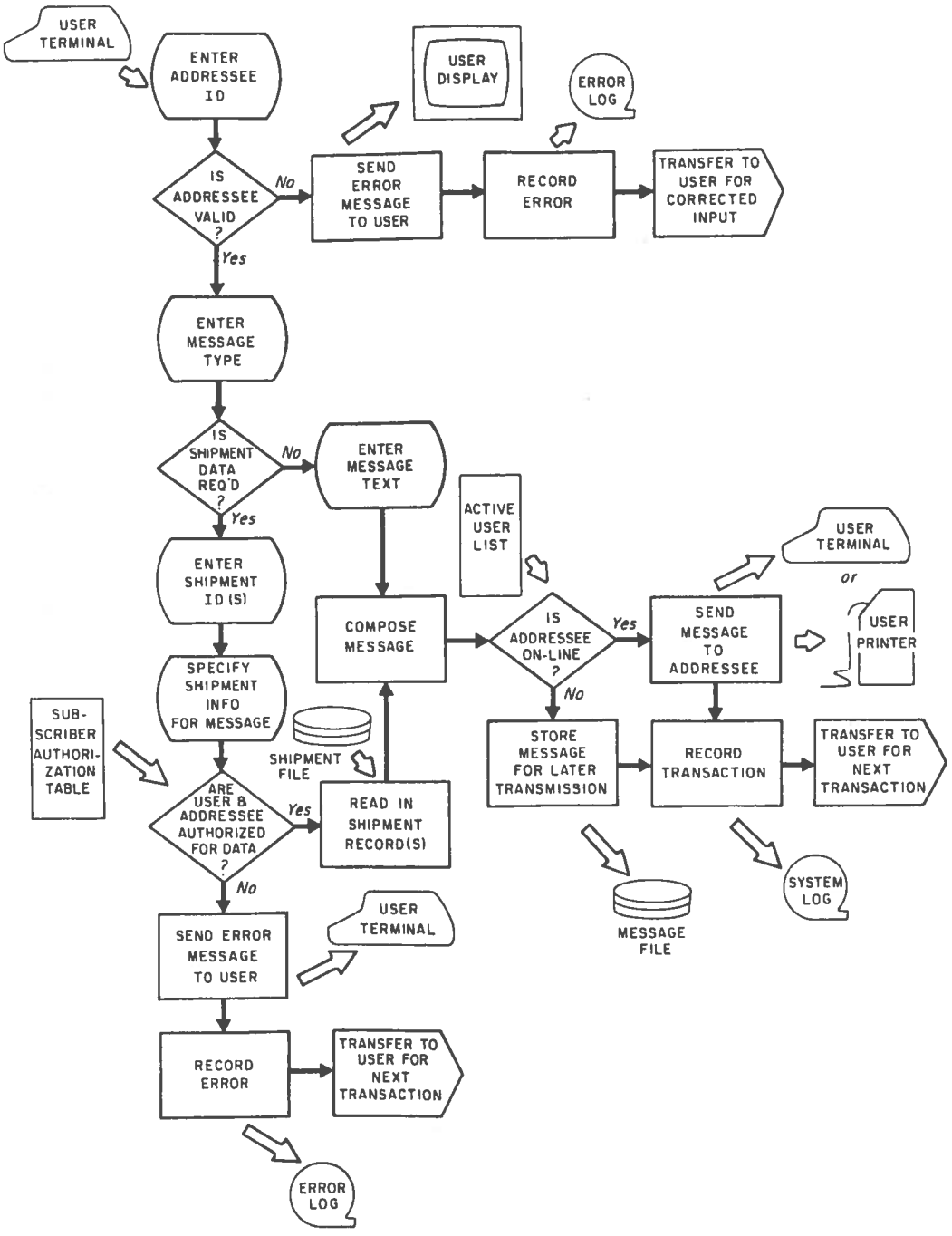
This transaction provides the capability to interchange messages between users by including a message switching feature in CARDIS.

A user of CARDIS who has a need to transmit a message to another user may do so by identifying the addressee and either supplying the information to be sent or specifying stored data to be included in the message. The system will retrieve the required data, format the message according to addressee equipment characteristics, and perform the necessary communication functions. In this way the system will act as a communication interface as well as a switch. It will be able to make the appropriate format and protocol conversions necessary to interface dissimilar users and, via appropriate directories, it will determine if the addressee can be directly connected or if the message must be sent to another CARDIS facility to reach him. Since the recipient may not be on line at the time the message is initiated, a storage capability will be required to serve as a message queue until the message can be delivered. When a user connects to the system (via the SIGN-ON transaction) the system will forward any queued messages and remove them from storage.

The provision of this option for CARDIS operation will require fairly detailed consideration to ascertain its exact form. For example, certain data regarding the shipment which is a matter of public record may be extracted for customs or statistical purposes despite the fact that no active shipment record is kept. This and other specific features require careful consideration by industry associates and users to provide a design which is universally acceptable.

The ultimate domestic use of CARDIS in particular will provide strong impetus for a simple message transfer capability.

MESSAGE TRANSFER TRANSACTION



TOPIC 7 SIGN OFF

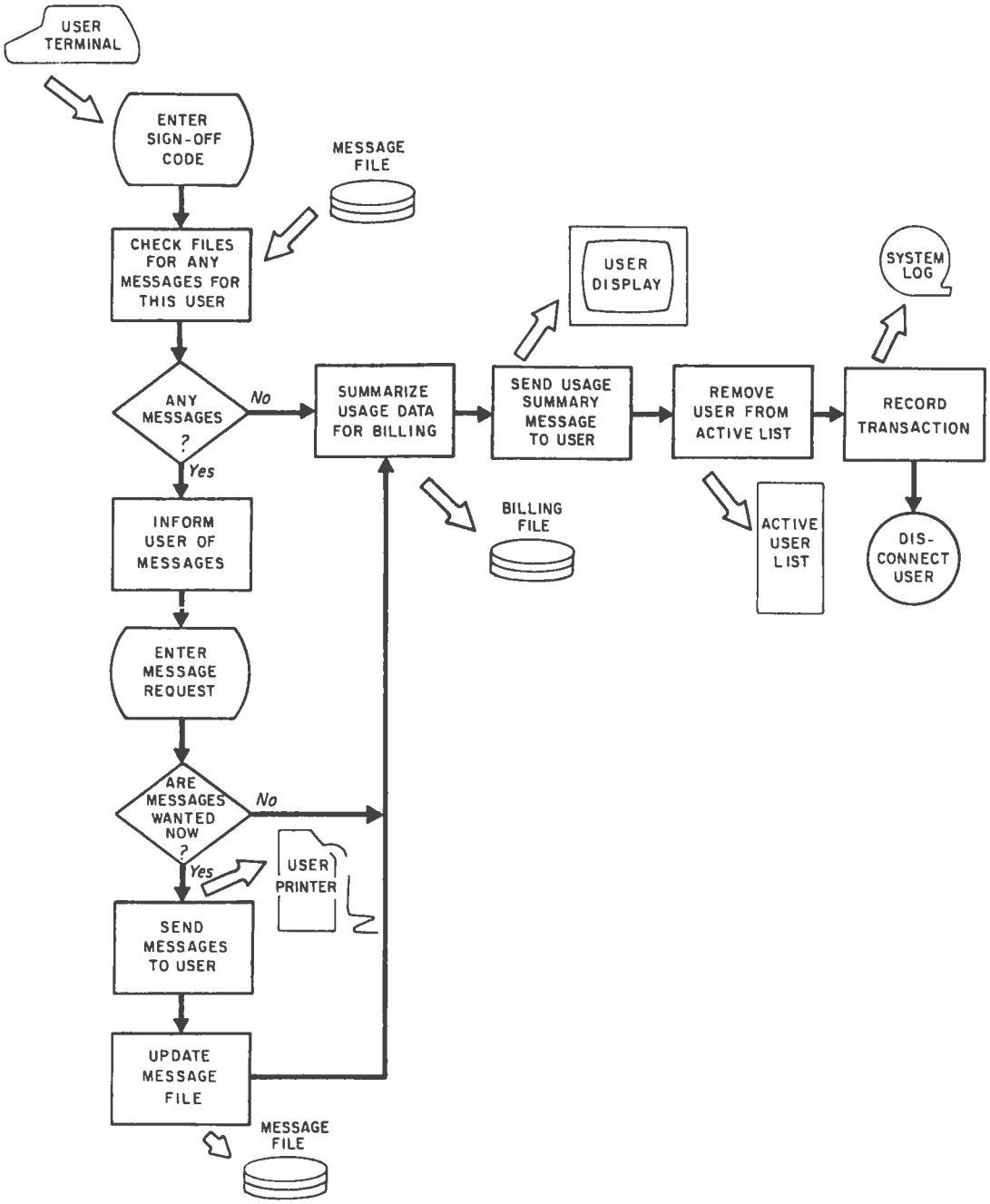
The orderly termination of a CARDIS user session is accomplished by the SIGN-OFF transaction.

When a system user completes his planned activities with CARDIS he will enter a SIGN-OFF code to inform the system that he wishes to be disconnected. At this point files will be checked to determine if any undelivered messages are on queue and transmit them if requested. The system will also record usage statistics to be used later for billing purposes and will send a summary of this information to the user. Next the user will be removed from active status and disconnected from the system until his next SIGN-ON transaction.

Should a user become disconnected because of a communications line failure or by a self-initiated termination (i.e., hang-up data phone, turn-off power on terminal or communications equipment, etc.), the system will perform similar functions except of course for transmitting messages and usage summary data to the user.

Good precedent for this type of procedure exists in the operation of existing time share computer systems. A blend of these features which have had extensive trial and unique CARDIS requirements should produce effective techniques for terminal control.

SIGN–OFF TRANSACTION



6. CONCLUSIONS AND RECOMMENDATIONS

TOPIC 1 TECHNICAL FEASIBILITY OF CARDIS

The study has shown several methods of CARDIS implementation, all within current technological capability.

The three CARDIS concepts developed (with their variants) are all technically feasible. The following observations reflect some of the work that has gone forth and provides a summary of observations made during the course of the project.

1. The concept of CARDIS finds favor with many industry elements. In particular, larger shippers and carriers currently undergoing in-house automation are aware of the benefits to be achieved by CARDIS. However, smaller concerns and some elements of the industry (forwarders and brokers particularly) must be shown to demonstrably reap benefits from the system. Great care is necessary to assure that those elements do in fact benefit from CARDIS and that these potential system users are informed of these benefits and brought into the picture at every stage of the process of system planning and development.

2. The technological problem is a relatively minor one compared with the major effort necessary to develop industry agreements and standards. Most problems with respect to serving CARDIS needs are manageable within the context of current and projected data processing system capability. This is true when one considers that the projected system requirements outlined in this report can all be handled by one major computer facility since:

   - Data base size is within current capabilities.
   - Projected transaction rates are less than those experienced with some of the larger airline reservation systems.
   - Communication needs are relatively modest.
   - Good, reliable operating system and file management software is already available and can be used as the basis for system development.

   When it is considered that the most likely evolution of CARDIS is through the use of multiple facilities, these requirements will be even less of a burden.

3. Identification of functions and Grade of Service parameters for "CARDIS Rated" systems will prove difficult in view of potential commercial opportunities which might result. For example, by the time CARDIS parameters have been negotiated, there will almost certainly be systems offering shipping data processing services to users. Depending on the adaptability of these systems, significant contention may be predicted when the question of implementing operational standards arises. Therefore, these criteria will have to be developed carefully to compromise between the demands of CARDIS and services already offered on other systems.

4. CARDIS success will depend on its offering to users. Thus, a "minimum" CARDIS may not take hold since there will be little demand for pure data base management functions. Accordingly, it will be necessary to provide sufficient "applications" features to make participation desirable from the user's viewpoint.

5. While government operation of CARDIS is anathema, government is probably the only consistent influence which can bring the system to fruition. The tie-in of Customs for international shipment of cargo and the regulatory agencies for domestic shipments can provide a major spur to system development. More work is needed to see where CARDIS can directly benefit government users. With government usage (and billing) as a base, it will become much easier to find sources of capital for development of CARDIS systems. More coordination with these bodies as well as with their foreign counterparts is necessary at the working level to define a method of interface and mutual support.

6. Privacy and security considerations are important system aspects to both industry and government interests. These issues must be included in requirements analysis, functional description, pilot testing and system design efforts.

A tentative plan is presented as part of this section which indicates steps necessary to determine the future course of CARDIS development. This attempts to reflect ongoing effort as well as other steps which are necessary to get to a point where implementation is to begin.

6. CONCLUSIONS AND RECOMMENDATIONS

TOPIC 2 ALTERNATIVE SYSTEMS COMPARED

A comparison of the three alternatives presented in the report indicates the need for an extremely flexible approach to CARDIS implementation. The Multiple CARDIS approach allows the greatest variation in implementation and therefore at this time seems particularly promising.

Since the thrust of this study was toward determining technical feasibility for various methods of CARDIS implementation, a determination of the most suitable approach is premature. Precise system configuration and comparative analysis must await the results of the requirements efforts now underway for CARDIS functions and communications.

In the accompanying chart, the three approaches and their variants have been ranked relatively with respect to a number of system characteristics derived from the study and from similar studies such as CART. A choice of system must take into account the relative desirability of each of these characteristics, e.g., the utility to the shipping community at large.

In addition to the basic CARDIS functions of data accessibility, documents and data generation, foreign system interface, data base maintenance and audit, CARDIS should have at least the potential for providing certain essential user functions. Aiding in shipment tracing is one instance which comes to mind as being desirable from the point of view of many users. Additional investigation must have as its goal the careful evaluation of alternatives based on CARDIS functions developed as validated requirements in conjunction with industry parties to both domestic and international shipments.

COMPARISON OF CONCEPT ALTERNATIVES

	DATA TRANSFER CONCEPT	UNIFIED DATA BASE CONCEPT		MULTIPLE CARDIS CONCEPT	
			With Msg Transfer Option		With Msg Transfer Option
UNIVERSAL APPLICABILITY (ALL TYPES OF USERS)	1	2	2	2	2
EXPANSION BY SHIPMENT QUANTITY	2	2	2	2	2
EXPANSION BY FUNCTION	0	2	2	1	1
VARIETY OF TERMINALS AND COMM. SYSTEMS	1	1	1	2	2
ACCEPTS DIFFERENT FORMATS OR MEDIA	1	2	2	2	2
ON–LINE AS WELL AS BATCH FUNCTIONS	0	2	2	2	2
AUDIT AND HISTORICAL REVIEW	1	2	1	2	1
MACHINE INDEPENDENCY	1	0	0	1	1
STANDARD CODES AND FORMATS	2	2	2	2	2
PRODUCTION OF SHIPPING DOCUMENTS AND DATA CORRECTION	0	2	2	2	2
DATA BASE MAINTENANCE CAPABILITY	0	2	2	1	1
COMMON FILES AND EQUIPMENT	0	2	2	1	1
REDUCED PAPER	1	2	1	2	1
POTENTIAL FOR ADDITIONAL USER APPLICATION	0	2	2	2	2
PERMITS PREPLANNING FOR SHIPMENT	0	2	2	2	2
COMPREHENSIVE INFORMATION AVAILABLE	0	2	2	2	2
SECURITY EASY TO ENSURE	2	1	2	1	2
PTT COMMON USER INTERFACE CAPABILITY	1	2	2	1	1
INTRA USER COMMUNICATIONS POTENTIAL	2	2	2	2	2
SHARED COMMUNICATION CIRCUITS	1	2	2	2	2
LOW INITIAL IMPLEMENTATION COST (CAPITAL OUTLAY)	2	0	0	1	1
OPERATING COSTS	2	1	1	2	2
USER INTERFACE/ACCESS CAPABILITY	1	2	2	2	2
SYSTEM DEPLOYMENT PROBLEM					
ALLOWS USE OF EXISTING SYSTEMS	1	1	1	1	1
ALLOWS FLEXIBLE IMPLEMENTATION	1	1	1	2	2
MINIMIZE SYSTEM MANAGEMENT DIFFICULTIES	0	2	2	1	1
EASY BILLING PROCEDURES IMPLEMENTATION	1	1	1	1	1
INCREMENTAL DEVELOPMENT POSSIBLE	1	0	0	2	2
RELATIVELY SHORT DEVELOPMENT CYCLE	1	0	0	2	2
EASE OF INTERFACE WITH OTHER SYSTEMS	1	2	2	1	1
COMPATIBILITY WITH MANUAL PROCEDURES	1	2	2	2	2
AVAILABILITY/BACKUP POTENTIAL	2	1	1	2	2
RELIES ON PROVEN TECHNOLOGY	2	2	2	2	2
RESPONSIVENESS TO USER NEEDS	1	1	2	2	2

LEGEND

0 – NO ADVANTAGES OFFERED BY SYSTEM

1 – LIMITED ADVANTAGES OFFERED BY SYSTEM

2 – GOOD ADVANTAGES OFFERED BY SYSTEM

6. CONCLUSIONS AND RECOMMENDATIONS

TOPIC 3 CARDIS PLAN

CARDIS development requires attention to many aspects of the international trading community.

Initial CARDIS studies outlined in the report have demonstrated the feasibility of implementation through a number of approaches. Efforts already under way toward industry standardization and in the implementation of intra-company systems assure that a significant base of facilities and procedures will be available upon which CARDIS can be built. Because of the complexity of the many tasks to be performed, precise timing and milestones should be flexible to accommodate the extensive coordination which will be required during all phases of the project.

The accompanying figure outlines some of the major tasks which must be performed prior to implementation. It should be pointed out at the outset that the implementation of CARDIS may take a number of forms--not all of which are mutually exclusive. It is entirely possible that with the establishment of adequate standards and procedures, only a very limited participation on the part of government and/or industry groups will be required during implementation. Instead, other systems designed to serve the individual needs of community members may be modified to become the hosts for domestic and perhaps international CARDIS functions.

Referring to the figure, current efforts have concentrated on feasibility investigation in conjunction with ongoing industry standardization efforts by NCITD and TDCC. At this juncture, efforts have been initiated into defining CARDIS functional and quantitative requirements through detailed coordination with segments of the shipping industry. At the same time the needs for data interchange between parties to the shipping process are being identified.

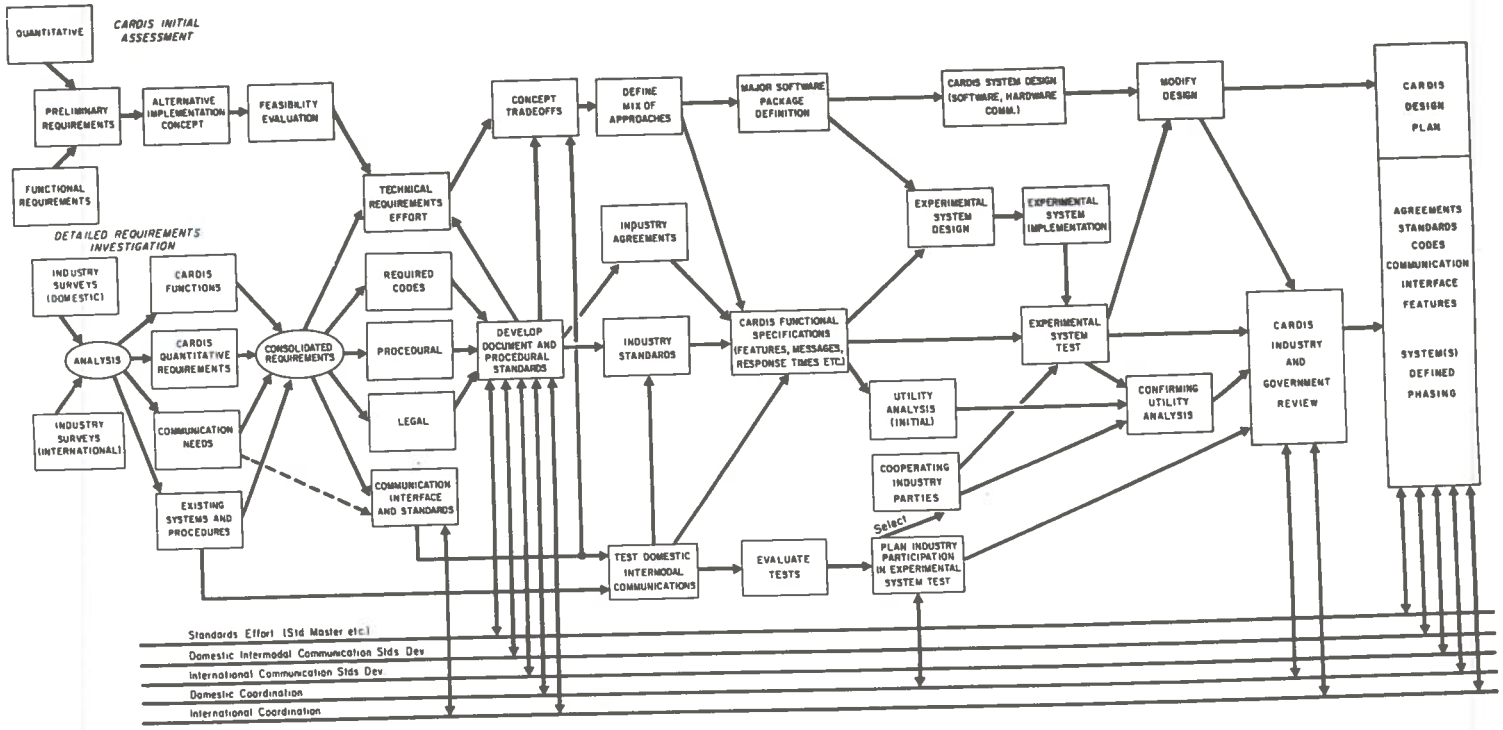
When these efforts start producing data, the requirements consolidation process can commence. From this point it will be possible to develop detailed technical requirements to better define the various alternative system concepts. The technical requirements phase will translate ongoing requirements efforts into technical parameters used for developing detailed system concepts.

Requirements consolidation will also provide essential input to the important process of standards development for documentation as well as intermodal communication. Current intermodal communication investigations will permit initial testing to verify the communications aspect of the concept.

With the performance of thorough requirements analysis, work can be started on industry agreements and standards necessary to the objectives of facilitating data transfer. This output of the CARDIS program will have significant impact on intermodal data transfer and interface with foreign systems irrespective of the actual implementation chosen for CARDIS.

Concept tradeoffs for CARDIS will be developed from the technical requirements derived. The concepts for CARDIS already investigated will be further refined to accommodate the specific functional requirements developed. It will then be possible to define the CARDIS complex as a series of interrelated entities building on existing and planned systems as well as new centers should these prove necessary. This will lead to the definition of major software modules as applicable.

Based on the functional specifications and major software module definition for the system, design of the experimental system can begin along with the basic CARDIS system design. An initial CARDIS utility analysis can commence using system functional specifications to see how procedures and data interchange under CARDIS will benefit various parties to shipments. Once the experimental system has been developed and tested in conjunction with participating industry elements, the final determination of utility may be made from a review of the concepts and plans. At this point an extensive government and industry review will be possible to determine the course of future CARDIS development. The result of this should be the plan for eventual CARDIS implementation as well as the publishing of draft standards and agreements derived from domestic as well as international coordination.



CARDIS Design and Test Phase

Appendix A Data Element Analysis

The Data Element Analysis charts presented in this appendix have been compiled by combining the data items included in each of the "References" indicated in order to identify the characteristics of the data to be handled by CARDIS. The data elements have been grouped by "Category" to facilitate identification of related and redundant items. Six reference sources were used and for each data element the source or sources in which it was included is indicated.

Estimates were made of the number of characters required for each element based on three premises: the minimum size needed using coding for only selected fields, the maximum size that would be required if no coding were used, and the size required assuming that coded fields were used to the fullest extent. Totals are included for the three estimates in each category. Topic 2 of Section 2.2 presents an overall summary of these charts.

Each of the participants in a shipment has been listed on the charts and the type of access for each data element indicated. In this area, an A has been used to indicate that the participant may add or change the associated element. An R means that the participant may retrieve the element but may not enter or change it. It is assumed that a participant who may add or change an element may also retrieve that element; that is, an A on the chart also implies the ability to retrieve (i.e., R). These access codes apply to international shipments including their domestic portions.

The data elements appropriate for totally domestic shipments have been identified on an ad hoc basis and are identified on the charts.

Several data elements in the Physical Description and Freight Charges categories (indicated by * in the charts) are required for each commodity in a shipment while others in the Commercial Invoice category are required for each item. The number of characters allocated in these cases is based on four commodities per shipment and 10 items per commodity. There is considerable uncertainty about these factors and additional study will be required to establish reliable estimates prior to system design (see footnote on page 10). Although adjustments in these factors may change the estimates of shipment record sizes and data base requirements, they will not have a significant impact on the alternative system concepts presented in this report.

Appendix A Data Element Analysis

TOPIC 1 PARTIES

In this category the various organizations participating in the shipment are identified. The amount of data for each element will be significantly reduced if standard codes are used in place of full name and address information.

CATEGORY PARTIES

Data Element	References						Number of Characters			Applies to Domestic Shipments	Access								
	NCITD	DART	CART	US-UK	DOT	SOIS	Min. Text	Max. Text	Coded		Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
SHIPPER/EXPORTER	✓	✓	✓	✓	✓	✓	104	180	10	✓	A	A	R	R	R	R	R	R	R
SELLER/CONSIGNEE					✓	✓	104	180	10	✓	A	A				R		R	R
CONSIGNEE	✓	✓	✓	✓	✓	✓	104	180	10	✓	A	A	R	R	R	R	R	R	R
Intermediate Consignee	✓			✓	✓	✓	104	180	10	✓	A	A	R	R	R	R	R	R	R
Notify Party	✓	✓	✓	✓	✓	✓	104	180	10	✓	A	A	R	R	R	R	R	R	R
Freight Forwarder	✓		✓	✓	✓	✓	104	180	10		A	A	R	R	R	R	R	R	R
Carrier	✓	✓	✓	✓	✓	✓	18	18	10		A	A	R	R	R	R	R	R	R
Export References	✓			✓			108	108	10		A	A	R	R	R	R	R	R	R
Inland Carrier		✓					18	18	10		A	A	R	R	R		R	R	R
Master (Vessel)					✓	✓	20	20	20		R	R		A	R				
Booking Agent					✓	✓	18	18	10		A	A		A					
Send Invoice To				✓	✓		104	104	10		A	A	R	R					
					TOTAL		910	1366	130										

Appendix A Data Element Analysis

TOPIC 2 PHYSICAL DESCRIPTION

The quantitative and descriptive characteristics of the shipment are included in this category. Coding has little effect here since most elements are numbers, types, quantities, etc. The typical shipment is estimated to have four commodities based on investigations made during the course of the study.

CATEGORY Physical Description

	Data Element	References: NCITD	DART	CART	US-UK	DOT	SOIS	Number of Characters: Min. Text	Max. Text	Coded	Applies to Domestic Shipments	Access: Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
*	Description of Goods	✓	✓	✓	✓	✓	✓	50	510	50	✓	A	A	R	R	R	R	R	R	R
*	Commodity Codes (Sched B)	✓		✓	✓	✓	✓	16	16	16		A	A	R	R	R	R	R	R	R
*	Net Quantity (Sched B)	✓				✓	✓	24	24	24		A	A	R	R	R	R	R	R	R
*	Gross Weight and Units	✓	✓		✓	✓	✓	4o	4o	4o	✓	A	A	R	R	R	R	R	R	R
*	Net Weight and Units			✓	✓	✓	✓	4o	4o	4o	✓	A	A	R	R		R	R	R	R
*	Chargeable Weight		✓		✓	✓		32	32	32	✓	A	A	A	A		R	R	R	R
*	Volume/Measurement	✓	✓	✓		✓	✓	32	32	32	✓	A	A	R	R	R	R	R	R	R
	No. And Kind of Packages	✓	✓	✓	✓	✓	✓	10	10	10	✓	A	A	R	R	R	R	R	R	R
	No. of Containers	✓		✓			✓	2	2	2		A	A	R	A	R	R	R	R	R
	Container Type			✓			✓	2	2	2		A	A	R	A	R	R	R	R	R
	Container Ids	✓	✓	✓			✓	10	10	10		A	A	R	A	R		R	R	R
	Marks and Numbers	✓	✓		✓	✓	✓	2o	2o	2o		A	A	R	R	R	R	R	R	R
	Size of Containers	✓	✓			✓	✓	2	2	2		A	A	R	A	R		R	R	R
	Seal Numbers	✓	✓			✓	✓	10	10	10		A	A	R	A			R	R	R
	Number of Pallets	✓				✓		2	2	2	✓	A	A	R	R			R	R	R
	Stowage Instructions	✓				✓	✓	10	10	10		A	A	R	R			R	R	R
	Special Handling	✓		✓				3	3	3	✓	A	A	R	R			R	R	R
	UN Technical Name	✓						20	20	20		A	A		R	R		R	R	R
	UN (Imco) Class	✓						2	2	2		A	A		R	R		R	R	R
	UN Cert. Clause	✓				✓		2	2	2		A	A		R	R		R	R	R
	UN Haz Label	✓				✓		2	2	2		A	A		R	R		R	R	R
	CG Haz Comm Desc	✓						20	20	20		A	A		R	R		R	R	R
	CG Haz. Class	✓						10	10	10		A	A		R	R		R	R	R
	CG Label	✓						2	2	2		A	A		R	R		R	R	R
	CG Chem. Name	✓						10	10	10		A	A		R	R		R	R	R
	CG Cert. Clause	✓						2	2	2		A	A		R	R		R	R	R
	Haz. Material Desc.					✓		10	10	10	✓	A	A	R	R	R		R	R	R
						TOTAL		373	833	373										

*Assumes 4 commodities per Shipment (International)

Appendix A Data Element Analysis

TOPIC 3 COMMERCIAL INVOICE

Detailed information about the items in the shipment are included in this category. Most of the space is allocated to identification and description of the items and their prices. Commodity codes will not generally provide sufficiently detailed information about items shipped so that the average shipment is assumed to consist of 40 items (10 items for each of four commodities).

CATEGORY Commercial Invoice

Data Element	References						Number of Characters			Applies to Domestic Shipments	Access								
	NCITD	DART	CART	US-UK	DOT	SOIS	Min. Text	Max. Text	Coded		Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
Commercial Invoice No	✓			✓	✓	✓	10	10	10	✓	A	A				R	R	R	R
Invoice Date	✓			✓	✓		6	6	6	✓	A	A				R	R	R	R
Customer's Order No.	✓			✓	✓		10	10	10	✓	A	A				R	R	R	R
Order No. Date	✓				✓		6	6	6	✓	A	A				R	R	R	R
Booking No. (B/L No.)	✓	✓			✓	✓	10	10	10	✓	A	A				R	R	R	R
Currency	✓			✓			3	3	3		A	A				R	R	R	R
Invoice Value	✓				✓	✓	6	6	6	✓	A	A				R	R	R	R
Payment Terms	✓			✓	✓		36	36	36	✓	A					R		R	R
Delivery Terms				✓	✓		36	36	36	✓	A							R	R
Discounts	✓			✓			6	6	6	✓	A	A				R		R	
Commission	✓						2	2	2	✓	A	A				R		R	
* Invoice Item	✓	✓		✓	✓		120	120	120	✓	A	A						R	R
* Invoice Units	✓			✓	✓		160	160	160	✓	A	A						R	R
* Unit Price	✓			✓	✓		400	400	400	✓	A	A						R	R
* Item Descriptor				✓			480	480	480	✓	A	A						R	R
					TOTAL		1291	1291	1291										

* Assumes 10 items per commodity and 4 commodities per shipment (International)

Appendix A Data Element Analysis

TOPIC 4 FREIGHT CHARGES

The cost of transporting the shipment is included in this category, both in terms of the total charge and its components. Since this data is mostly quantitative, coding has no effect in this category.

CATEGORY Freight Charges

	Data Element	References						Number of Characters			Applies to Domestic Shipments	Access								
		NCITD	DART	CART	US-UK	DOT	SOIS	Min. Text	Max. Text	Coded		Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
*	Rate Class/Freight Rates	✓	✓	✓	✓	✓	✓	40	40	40	✓	A	A	A	A		R	R	R	R
*	Rate Charge/Freight Charges	✓	✓	✓	✓	✓	✓	40	40	40	✓	A	A	A	A		R	R	R	R
*	Freight PP/Collect	✓	✓				✓	40	40	40	✓	A	A	R	R		R	R	R	R
	Freight Charges Payable At	✓				✓	✓	10	10	10	✓	R	R		A				R	R
	Weight Charge			✓	✓	✓	✓	10	10	10	✓	A	A		A				R	R
	Valuation Charge			✓	✓	✓		10	10	10	✓	A	A		A				R	R
	TOTAL Charge			✓				10	10	10	✓	R	R		A		R		R	R
	TOTAL Origin Charges			✓				10	10	10	✓	R	R		A				R	R
	TOTAL Collect At Arrival Charges			✓				10	10	10	✓	R	A		R				R	R
	Other Charges Due Agent			✓	✓	✓		10	10	10	✓	R	R		A		R		R	R
	Other Charges Due Carrier			✓	✓	✓		10	10	10	✓	R	R		A		R		R	R
						TOTAL		200	200	200										

* Assumes 4 commodities per Shipment (International)

Appendix A Data Element Analysis

TOPIC 5 GOVERNMENT DATA

The information needed for government control and licensing purposes, in addition to data used for preparation of trade summary report, is included here. Coding of country names offers some reduction is space requirements.

CATEGORY Government Data

Data Element	References						Number of Characters			Applies to Domestic Shipments	Access								
	NCITD	DART	CART	US-UK	DOT	SOIS	Min. Text	Max. Text	Coded		Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
Export License No.	✓		✓	✓	✓	✓	10	10	10		A	A			E	R	R	R	R
Expiration Date	✓		✓	✓	✓		6	6	6		A	A			E	R	R	E	R
General License Symbol	✓			✓	✓		5	5	5		A	A		R	E	R	R		
Import License No.	✓		✓				10	10	10		R	R			R	R	R	A	A
Date	✓		✓				6	6	6		R	R			R	R	R	A	A
Domestic or Foreign	✓		✓	✓	✓		1	1	1		A	A			R				
Country of Origin	✓		✓				18	18	3		A	A			R				
Country of Consignee	✓	✓	✓	✓			18	18	3		A	A			R				
Value at Point of Export				✓		✓	10	10	10		A	A			R				
Diversion Clause	✓				✓		1	1	1		A	A		R	R			R	R
						TOTAL	95	85	55										

Appendix A Data Element Analysis

TOPIC 6 ROUTING INFORMATION

The points and dates of departure and arrival of the shipment as well as the flight or voyage data are the subjects of this category. The use of location codes results in savings in fields identifying countries and ports.

CATEGORY Routing Information

Data Element	References						Number of Characters			Applies to Domestic Shipments	Access								
	NCITD	DART	CART	US-UK	DOT	SOIS	Min. Text	Max. Text	Coded		Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
Vessel	✓	✓			✓	✓	20	20	6		A	A	R	A	R	R	R	R	R
Flag	✓				✓	✓	3	3	3		A	A	R	A	R			R	R
Flight or Voyage		✓	✓	✓	✓	✓	3	9	4	✓	A	A		A	R		R	R	R
Origin Country	✓		✓	✓		✓	3	18	3		A	A			R				
Destination Country	✓	✓		✓		✓	3	18	3		A	A		R	R				
Trans Ship To...	✓					✓	3	18	3	✓	A	A		R				R	R
Port of Loading	✓	✓				✓	3	18	3	✓	A	A	R	A	R			R	R
Port of Departure			✓	✓	✓		3	18	3	✓	A	A		A	R			R	R
Pier of Departure	✓					✓	3	3	3	✓	A	A		R					
Departure Date	✓		✓	✓	✓	✓	6	6	6	✓	A	A		A	R			R	R
Port of Discharge	✓	✓			✓	✓	3	18	3	✓	A	A		A	R			R	R
Destination Airport			✓	✓	✓		3	18	3	✓	A	A		A	R			R	R
Arrival Date	✓		✓			✓	6	6	6	✓	A	A		A				R	R
Date of Delivery			✓			✓	6	6	6	✓	R	R	R	A				R	R
						TOTAL	68	179	55										

Appendix A Data Element Analysis

TOPIC 7 LETTER OF CREDIT

This category includes data relative to the financial arrangements made for the shipment as represented in the letter of credit.

CATEGORY Letter of Credit

Data Element	References						Number of Characters			Applies to Domestic Shipments	Access								
	NCITD	DART	CART	US-UK	DOT	SOIS	Min. Text	Max. Text	Coded		Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
Letter of Credit Data					✓		104	180	30		R	R				R		A	A
Terms	✓						2	2	2		R	R				R		A	A
Letter of Credit	✓						2	2	2		R	R				R		A	A
Expiration Date	✓						6	6	6		R	R				R		A	A
					TOTAL		114	190	40										

Appendix A Data Element Analysis

TOPIC 8 INSURANCE

The last category contains the amount, type and charges for insurance coverage of the shipment.

CATEGORY Insurance

Data Element	References						Number of Characters			Applies to Domestic Shipments	Access								
	NCITD	DART	CART	US-UK	DOT	SOIS	Min. Text	Max. Text	Coded		Shipper/Exporter	Freight Forwarder	Inland Carrier	Inter. Carrier	Government	Bank	Insurance	Consignee	Import Broker
Amount of Insurance	✓		✓	✓	✓		10	10	10	✓	A	A					R		
Amount of Ins-Shipper				✓			10	10	10		A	A					R		
Insurance Charges	✓			✓	✓		10	10	10	✓	A	A					R		
Shipper Ins. Charge				✓			10	10	10		A	A					R		
Origin Ins. Charge			✓				10	10	10		A	A					R		
Arrival Ins. Charge			✓				10	10	10		A	A					R		
Insured Rate				✓	✓		7	7	7	✓	A	A					R		
					TOTAL		67	67	67										

Appendix B Report of Inventions

After a diligent review of the work performed under this contract, no new innovation, discovery, improvement or invention was made.

Appendix C Bibliography

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